Academic Leadership: The Online Journal

Volume 8
Issue 4 *Fall 2010*

Article 19

1-1-2010

Effect Of Instruction In Metacognitive Self-assessment Strategy On Chemistry Self-efficacy And Achievement Of Senior Secondary School Students In Rivers State, Nigeria

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Academic Leadership Journal

Introduction

Chemistry is one of the major brnaches of science. There are various applications of Chemistry in home or industry. There is an increasing impact of growing knowledge in the subject of chemistry on our social and economic life. A poor chemistry foundation at the secondary school will jeopardize any future effort to enhance achievement in the subject.

The study of chemistry at the secondary school level helps students in developing basic skills, knowledge and competence required for problem solving in their environment. According to Ohodo (2005) chemistry contributes generating to the attainment of the aims of education and specifically helps individuals to develop effective process skills, critical thinking and competences required for dealing with observation, classification, measurement, counting numbers, recording, communication, prediction, hypothesis, inference, experimentation, interpretation of data, research, controlling variable and generalization etc. At the secondary level, the foundation of chemistry education is laid as they are taught the underlying principles.

The poor achievement of learners in chemistry has been variously explained. According to Usman and Memeh (2007), the factors that negatively affect chemistry achievement include students' background problems; students lack of interest and/or negative attitude towards chemistry; teacher related factors like poor teacher preparation; inadequate qualified chemistry teachers, inadequate instructional materials and application of poor teaching methods.

In Nigeria efforts are being made by researchers, government and nongovernmental organization to improve both cognitive, affective and psychomotor outcomes in chemistry. For instance, a good number of research efforts have been made to diagnose the problems associated with the teaching and learning of chemistry in order to proffer solution that lead to better achievement. Recommendations have been made regarding the teaching methods, instructional materials, home and school related environmental factors that could enhance achievement in chemistry. However, as evidence available indicates, achievement in chemistry at the secondary school remains low and unimpressive. The federal government of Nigeria is not left out in this effort to revamp interest in the study of science, especially chemistry and improve achievement in the subject.

Chemistry teachers mainly adopt instructional strategies that arc mainly teacher directed and do not encourage deeper students involvement and self-regulation (Zimmerman, 1990). Self-regulated learners are self-propelled and independent learners, who possess relevant skills which enhance their ability to construct knowledge, assume responsibility for their own learning and realises that learning is a personal experience that requires active and dedicated participation (Peters, 2000, and Kuiper, 2002).This perception of the role of the learners in the learning process is changing the views of educational researchers on the role of the teacher in the learning process. Instead of viewing teaching as teacher exposition followed by students practice, effective teaching may be achieved by integrating

a self-regulating strategy such as metacognitive self-assessment in the process. The constructivists approach to learning locates understanding within the learners, not with the teachers. It is the learners who must learn and therefore must take the responsibility for learning. According to Kuiper, (2002), learning is based on an appropriate self-reflection which leads to meaningful knowledge construction.

Trends in research in some western Countries tend to suggest that metacognitive self-assessment strategy enhances learners' self-regulated behaviour and academic achievement. Metacognitive self-assessment is a self- monitoring approach in which learners get involved in the assessment of their own progress and deficiencies in the process of learning (Rivers, 2001). As learners monitor their own learning, they learn to check their own responses and become conscious of errors or answer that do not make sense. Schunk (1996a)) opined that metacognitive self-assessment is simply judging the quality of one's work. It is a process of assessing the quality of work done based on evidence and explicit criteria. This suggests that self-assessment is goal oriented. To achieve the desired goal will require the active involvement of the learners in the process and the development of skills.

Research findings have suggested that learners who possess relevant skills in metacognitive self-assessment and are aware of these skills arc more strategic in pursuing learning and achieve better in their academic endeavour (Kuiper, 2002: Rivers 2001). When learners are exposed to the skills of self-assessment of their progress, they achieve more. As Bandura (1997 and Schunk (1996a) observed positive self-assessment encourages students to set higher goals and commit more personal resources to learning the task. However, negative self-assessment arises when learners embrace goals that conflicts with learning or select goals that are unrealistic or adopt strategies that are ineffective or exert low effort. Rivers (2001) observed that when skills in metacognitive strategies are acquired, they become potentially powerful stimulants to higher achievement.

Literatures reviewed indicate that most of the studies that investigated the efficacy of self assessment are foreign to Nigerian culture and most of them were in English comprehension, prose and reading. This created the need to design a study to determine the extent instruction in metacognitive self assessment strategy would enhance the Chemistry achievement of senior secondary school students.

Self-assessment has been associated with individual learners' perceived self-efficacy. Learners who arc exposed to metacognitive self-assessment skills have been suggested to persist more on difficult tasks, be more confident about their ability and take greater responsibility for their learning tasks (Daley. 2002:

Kuiper. 2002). Self-efficacy has been described as a set of belief an individual has about his/her abilities or capabilities in specific performance domain (Bandura, 1994). Individuals' self-efficacy belief influences choice of task, the amount of effort expended and level of persistence in the selected task. Thus learners who possess a repertoire of earning skills are more likely to be efficient learners with high self-efficacy. Successful learners seem to control and direct their thinking process, ask themselves questions and try to organize their thought. They have learnt how to go about their learning and possess relevant cognitive strategies they can apply as necessary. On the contrary, low self- efficacy belief is associated with conditions of learned helplessness, a severely debilitating belief that one has no control over ones learning (Pajares and Miller, 1994).

In spite of efforts by educational researchers to improve school achievement especially Chemistry, less attention has been paid to the affective component of the learner such as their perceived self- efficacy.

This study therefore sought to determine the extent the acquisition of metacognitive self assessment skills could affect the Chemistry self-efficacy of senior secondary school students in Delta North education zone of Delta state.

Studies on gender differences in Chemistry achievement have continued to yield inconsistent results (Usman and Memeh. 2007). The results of some studies indicate that male students achieve significantly better than girls (Kador, 2001: Usman and Ubah, 2O07 whereas some other studies reveal no significant difference in the achievement of the two genders (Loofa, 2001). Where these differences exist between boys and girls, it has usually been attributed to unequal exposure of males and females to experiences relevant to Chemistry learning. This is occasioned by the traditional cultural attitude towards the female gender which restricts them from activities considered masculine (Okeke, 1990). This difference in cultural attitude towards males and females in access to environmental stimulations has been reported to influence their self- efficacy in favour of the boys (Eze and Agboma, 2008). This study therefore sought to examine the extent exposure to metacognitive self assessment strategy interact with gender to affect senior secondary students' Chemistry self-efficacy and achievement. The findings of this study will be beneficial to educators in designing instructional strategies that will help lay a solid foundation for Chemistry at the secondary level of education.

This study was guided by the following research questions and hypotheses:

Research Questions

1. To what extent does the acquisition of skills in metacognitive self assessment strategy depend on instruction in the strategy?

2. What is the difference in the Chemistry achievement of those exposed to metacognitive self assessment strategy and those not exposed as measured by their mean scores on Chemistry achievement test (CAT)?

3. To what extent do the Chemistry achievement of males and females differ as a result of instruction in metacognitive self assessment strategy?

4. What is the difference in the Chemistry self-efficacy of students exposed to instruction in metacognitive self assessment strategy and those not exposed as measured by their mean scores on the Chemistry self-efficacy scale?

5. To what extent do the Chemistry self-efficacy of males and females differ as a result of instruction in metacognitive self-assessment strategy?

Hypotheses: The following hypotheses that guided the study were tested at 0.05 levels of significance.

1. There is no significant difference in the mean Chemistry achievement scores of students exposed to metacognitive self assessment strategy and those not exposed as measured by their mean scores on CAT

2. There is no significant interaction effect of instruction in metacognitive self assessment strategy and gender on students' achievement in Chemistry

3. There is no significant difference in the mean self-efficacy scores of students exposed to metacognitive self assessment strategy and those not exposed as measured by their mean scores on Self- efficacy scale (SES)

4. There is no significant interaction effect of instruction in metacognitive self assessment strategy and gender on students' Chemistry self-efficacy.

Methods

The design adopted for this study was quasi-experimental. Specifically, the study was a pre-test and posttest non-equivalent control group design involving one treatment and one control group. In fact classes were used for the study in order not to disrupt administrative arrangement of the school. This became necessary as the study lasted for eight weeks.

The population of the study comprised of all the senior secondary school (SS II) students in Port Harcourt education zone. The participants in this study comprised of 192 SS II students drawn from the area of study. This is made up of 91 boys and 101 girls. Their average age is [0.4 years. To compose the sample for the study, the researcher adopted a multi-stage sampling technique. First, two local government areas were randomly sampled through a toss of the coin. In each local government area, two secondary schools with at least two streams of SS II students were randomly selected. The secondary schools in each of the local government areas were then randomly assigned as treatment and control schools. In each school, one intact class was randomly sampled to participate in the study. Treatment was implemented only in the treatment schools where the students were instructed in the skills for using metacognitive self assessment strategy in solving mathematical problems.

This was independent of the normal Chemistry classes by the regular classroom teachers. The students in the control group had their normal Chemistry classes with their regular class teachers who were only requested to encourage the students to be serious in studying Chemistry for better achievement.

Instrument for the study

Three researchers' developed instruments were used for the study. They are:

1. Chemistry Achievement Test (CAT)

2. Self-Assessment Scale (SAS)

3. Chemistry Self-efficacy Scale (CSS)

1. **Chemistry Achievement Test**: This is a teacher made achievement test constructed by a panel of qualified and experienced teachers and under the supervision of two specialists each in Chemistry education and measurement and evaluation. Ten questions were generated based on the selected Chemistry contents the students were taught in the second term of 2008/09 session. The test was not a multiple choice type since the emphasis was on the process of working out the answer and not just the test is 50.

The test items were generated based on the test blue print developed and face validated by 'the two

specialists in Chemistry education and two others in measurement and valuation. This was done to ensure the content validity of the achievement test. The test items generated were again given to the same specialists to ensure their suitability in terms of appropriateness of language and clarity, and the level of the students. Each test item has a maximum score of 5 marks. The highest score obtainable from the test is 50.

The CAT 'as trial tested on 18 SS 2 students in Obio/Akpor Local Government Area. The score obtained from the test was used to determine the reliability of the test. Since the test was nor dichotomously scored, the internal consistency reliability estimate was determined using cronbach Alpha method. The obtained reliability estimate is 0.92. An inter-rater reliability was determined using Kendall's co-efficient of concordance procedure. This was done using the scores of three different scorers who used a validated marking scheme as a guide. The obtained Kendall's co-efficient of concordance estimate is 0.94. This shows a high positive relationship among the scores given by the different scorers. Since the same MAT was used as pretest and posttest, the test was re-administered after two weeks and a test retest analysis conducted to determine the stability of CAT over time. Pearson correlation method was adopted and a test retest reliability estimate of .93 was obtained.

2. **The Self-Assessment Scale (SAS)**. This instrument was designed to assess the extent students possess the self-assessment skills relevant for Chemistry problem solving. It is a five point likert rating scale which ranges from very high extent (VHE= 5), High extent (HE =4), Moderate extent (ME = 3), low extent (LE= 2) to Not at all (NAA = 1). The items of the scale were generated based on review of literature and the researchers' personal experiences. The scale has two parts. Part A relates to the personal data of the subjects whereas part B sought for information on the self-assessment skills the students possess and apply in learning Chemistry. The instrument required the subjects to self-report on the extent they use the skills in the process of solving Chemistry task. The SAS was face validated by subjecting it to peers review. Two educational psychologists and one measurement expert reviewed the items to ensure appropriateness and clarity. It was thereafter trial tested to further determine its appropriateness and suitability and to test the reliability. The cronbach alpha method was adopted to determine the internal consistency of the items. The internal consistency reliability estimate of 0.86 was obtained. In order to determine the stability of SAS over time the instrument was re-administered after two weeks and the data obtained were correlated with the earlier data using Pearson product moment correlation method. The test retest reliability estimate of 0.79 was obtained.

3. **Chemistry Self-Efficacy Scale (CSS).** This instrument was developed by the researchers and used in measuring the perceived Chemistry self-efficacy of the students. It is a four point rating scale with the responses option ranging from strongly Agree (SA= 4), Agree (A 3), Disagree (D= 2) to strongly disagree (SD[). Negative items statements were reverse scored. The instrument has two parts. Part A sought for personal information of the respondents whereas part B sought for information relating to the self-efficacy belief of the respondents on Chemistry teaming and problem solving. This instrument was peer reviewed by presenting it to two educational psychologists and one in measurement and evaluation. It was trial tested and the data obtained used in testing the internal consistency reliability estimate. This was done using cronhach alpha procedure and the reliability estimate obtained is 0.84. The instrument was also tested for stability as it was used for pretest and posttest. The data obtained through a re administration of the instrument after two week were correlated with the data obtained earlier using Pearson product moment correlation method and the stability estimate of 0.82 obtained.

Treatment Procedure

Before the commencement of treatment, the SAS, CSS and CAT were administered in this order after a lesson period interval. These were administered by the regular classroom teachers in both the treatment and control schools. In the treatment schools, one of the researchers who had good background in secondary Chemistry posed as a guidance counselor and implemented the treatment using a validated self-assessment instructional programme (SAIP). The treatment was independent of the normal Chemistry classes though illustrations were drawn from Chemistry content that were not part of the scheme of work for the second term of 2008/2009 session. The researchers made use of available free periods on the time table for instruction in the self-assessment strategy. The treatment was designed to last for eight weeks with one session per week. Each session lasted for 35 minutes. Those in the control group had their normal Chemistry classes, however, their teachers were requested to encourage them to be working hard in Chemistry.

The SAIP emphasized skills that will enable the students to set learning goals and to assess every step they take as they work towards the goal. Using SAIP, the instructor guided that students to use the metacognitive self-assessment strategy as they work through a Chemistry problem. The instructor models the process and engages the students in the practice of the skills. Elaborative feedbacks were given and the instructor evaluated every stage in the process.

At the end of treatment the class teachers administered the SAS, the CSS and the CAT to the students in both treatment and control group to obtain the post treatment data. This was done two weeks after treatment.

Method of Data Analysis

The data generated were collated, organized and analyzed using mean and standard deviation in order to answer the research questions and a two way analysis of covariance for testing the hypotheses. The homogeneity of regression assumption that underlies the use of ANCOVA was tested for in this study. It was assumed in this study that the difference between the population regression coefficient of the treatment and control group is not significant ($P<.05$). This was confirmed as the observed f value for the population regression coefficient for the treatment and control groups are 1.94 an4 1.65 for MAT and SAS respectively. These were significant at .18 and .27 respectively and therefore not significant at .05 levels, In order to determine the extent of students' metacognitive self assessment acquisition and self-efficacy before and after treatment, the following decision rules were applied. Mean rating between the ranges of 0.50-1.49, 1.50-2.49, 2.50-3.49, 3.5-4.49 and 4.50-5.00 were interpreted as not at all, low extent, moderate extent, high extent and very high extent respectively. Also, Mean rating within the ranges of 20- 29.9, 30-49.9, 50-69.9 70-80 were interpreted as strongly disagree, disagree, agree and strongly agree respectively.

Results

The results of the study are presented in the Tables as shown below:

Research Question One: To what extent is the secondary students' meracognitive self assessment skills acquisition dependent on instruction in metacognitive self assessment?

Table 1: Mean Pretest and Posttest scores of treatment and control groups on SAS

Groups	Pretest	Posttest	Mean gain score
Treatment Mean	1.46	4.42	2.96
N	97	.85	
Std. Deviation	.48		
Control Mean	1.07	1.38	0.31
N	97	.78	
Std. Deviation	.68		

Results in Table I show the pretest posttest mean ratings on the extent of metacognitive self assessment skills acquisition of the secondary students in the treatment and control groups. The students in the treatment group had pretest mean rating of 1.46 with a standard deviation of .48 and a posttest mean rating of 4.42 with a standard deviation of .85. The posttest mean rating indicate that the extent of acquisition of the skills was high. This is also shown by the pretest posttest mean gain of 2.96. Students in the control group had a pretest mean rating of 1.07 with a standard deviation of.68 and a posttest mean rating of 1.38 with a standard deviation of .78. The pretest posttest mean gain was 0.31. These data show that the extent of acquisition of metacognitive self assessment skills was low for the control group. The low standard deviations for the treatment group and control group show that their ratings clustered closely around the mean.

Research question two: What is the difference in the Chemistry achievement of those exposed to self assessment strategy and those not exposed as measured by their mean scores on the Chemistry achievement scores?

Table 1.2: Pretest, Posttest means Chemistry scores of treatment and control groups

Groups	Pretest	Posttest	Mean gain score
Treatment Mean	14.96	43.43	28.57
N	97	97	
Std. Deviation	2.80	3.48	
Control Mean	15.60	24.22	8.62
N	95	95	
Std. Deviation	3.58	3.10	

Total Mean	15.14	33.93	17.79
N	192	192	
Std. Deviation	3.18	8.46	

Data on Table 2 indicate that the students in the treatment groups had a pretest mean score of 14.96 with a standard deviation of 2.80 and posttest mean score of 43.43 with a standard deviation of 3.48. Their pretest posttest mean gain score is 28.57. The students in the control group had a pretest mean score of 15.60 with a standard deviation of 3.58 and a posttest mean score of 24.22with standard deviation of 3.10. Their pretest posttest mean gain score is 8.62. These results indicate that the students in the treatment group benefited from the self assessment skills instruction as can be observed from their higher posttest achievement scores in the Chemistry achievement test.

Research Question Three: To what extent do the Chemistry achievement of males and females differ as a result of instruction in metacognitive self assessment strategy?

Table 1.3: Posttest means and standard deviations of students on MAT (Treatment x Gender Levels)

Groups	Gender	Pretest	Posttest	Mean gain score
Treatment	Male	43	43.44	3.94
	Female	54	43.42	3.10
Control	Male	48	24.98	3.52
	Female	47	23.45	2.38

Results on Table 4 indicate the posttest Chemistry mean scores of male and female students. Males in the treatment group had a posttest mean score of 43.44 wish a standard deviation of 3.94, whereas the females in the group had a mean score 43.42 with a standard deviation of 3.10. The males in the control group had a posttest mean score of 24.98 with a standard deviation of 3.52 whereas the females in the group had a mean of 23.45 with a standard deviation of 2.38. The results show that both males and females in the treatment group outperformed the males and females in the control group in the Chemistry achievement test.

Research Question Four: What is the difference in the self-efficacy of students exposed to metacognitive self assessment strategy and those not exposed as measured by their mean scores on the Chemistry self-efficacy scale?

Table 5: Pretest Posttest means scores and standard deviations of students on CSS

Groups	Pretest	Posttest	Mean gain score
Treatment Mean	52.01	76.89	24.88
N	97	97	
Std. Deviation	11.05	12.96	
Control Mean	48.38	47.81	-.57
N	95	95	
Std. Deviation	3.78	4.02	
Total Mean	50.22	62.51	12.29
N	192	192	
Std. Deviation	8.47	17.46	

Result on Table 4 show that the students in the treatment group had pretest mean self- efficacy score of 52.01 with a standard deviation of 11.05 and posttest mean self- efficacy score of 76.89 with a standard deviation of 12.96. For those in the control group, they had a pretest mean self-efficacy score of 48.38 with standard deviation of 3.78 and a posttest mean score of 47.81 with standard deviation of 4.02. The students in the treatment group had a pretest and posttest mean gain score of 24.88 indicating enhanced self-efficacy probably due to the treatment received whereas those in the control group had pretest- posttest mean loss of -.57 suggesting a slight deterioration in their self-efficacy.

Research Question five: To what extent does the Chemistry self-efficacy of male and female students differ as a result of instruction in metacognitive self assessment strategy?

Table 5: Posttest mean scores of male and female students in MSS (Treatment x Gender)

Groups	Gender	Pretest	Posttest	Mean gain score
Treatment	Male	43	77.33	13.17
Female		54	76.56	12.91
Control	Male	48	47.06	3.50
Female		47	48.58	4.40

Results on Table 5 show the posttest self- efficacy mean ratings of males and females in the treatment and control groups. Males in the treatment group had the mean ratings of 77.33 with standard deviation

of 13.17 whereas males in the control group had a mean of 47.06 with standard deviation of 3.50. Females in the treatment group had a mean of 76.56 with standard deviation of 12.91 whereas the females in the control group had a mean of 48.58 with standard deviation of 4.40.These results imply that both males and females in the treatment group experienced high self- efficacy at posttest stage whereas both males and females in the control group experienced lower self-efficacy at the posttest stage.

Hypothesis One: There is no significant difference in the mean Chemistry achievement scores of students exposed to metacognitive self assessment strategy and those not exposed.

Table 6: Analysis of Covariance (ANCOVA) on students posttest achievement scores on CAT (treatment and gender)

Source	Type lll sum of squares	Df	Mean square	F	Sig
Correct Model	17779.578a	4	4444.894	415.722	.000
Intercept	8109.797	1	8109.797	756.493	.000
Pretest	9.003	1	9.003	.842	.360
Experimental	17340.873	1	17340.873	1621.857	.000*
Gender	24.797	1	24.797	2.319	.129**
Experimental x Gender	20.7313.043	1	20.731	1.939	.165**
Error	1999.401	187	10.692		
Total	240780.000	192			
Corrected Total	19778.979	191			

*Significant at 0.05 levels ** Not Significant at 0.005 level of significant.

Data on Table 6 indicate that treatment as main factor has a significant effect on the students' Chemistry achievement. This is shown by the obtained f-value of 1621.857 which is significant at .000 and also significant at 0.05 levels. The null hypothesis of no significant difference in the mean achievement scores of the students in the treatment and control group is therefore rejected. In other

words, there is significant difference in the mean scores the students in the two experimental groups as a result of instruction in self assessment skills.

Hypothesis Two: There is no significant effect of instruction in metacognitive self assessment strategy and gender on students' achievement in Chemistry.

Results on Table 6 also indicate that the interaction effect of instruction in metacognitive self assessment skills and no significant. This is shown by calculated f-value of 1 .939 which is significant at .165 levels and therefore not significant at 0.05 levels. The null hypothesis of no significant interaction effect of instruction in self assessment skills and gender on students' Chemistry achievement is upheld. This suggests that the effect of treatment on the students' achievement did not depend significantly on the gender of the students.

Hypothesis three: There is no significant difference in the mean self-efficacy scores of students exposed to instruction in metacognitive self assessment skills and those who were not exposed.

Table 7: Analysis Covariance (ANCOVA) on students posttest Chemistry self-efficacy (Treatment x Gender)

Source	Type lll sum of squares	Df	Mean square	F	Sig
Correct Model	48605.196a	4	12151.299	235.299	.000
Intercept	51705.328	1	51705.328	1002.328	.000
Pretest	7932.279	1	7932.279	153.733	.000
Experimental	46553.556	1	46553.556	902.238	.000*
Gender	27.208	1	27.208	.527	.469**
Experimental x Gender	73.201	1	73.201	1.419	.235**
Error	9648.799	187	51.598		
Total	710250.000	192			
Corrected Total	58253.995	191			

Results on Table 7 reveal that treatment as main factor produced a significant effect on the students'

Chemistry self-efficacy. This is indicated by the calculated f-value of 902.238 which is significant at .000 and also significant at 0.05 levels. This implies that instruction in self assessment skills significantly enhanced the Chemistry self-efficacy of the students. Consequently, the null hypothesis of no significant difference in the Chemistry self-efficacy of those in the treatment and control group is rejected. An alternate hypothesis of a significant difference in the Chemistry self-efficacy of the two groups is therefore, accepted.

Hypothesis Four: There is no significant interaction effect of instruction in metacognitive self assessment strategy and gender on students' Chemistry self- efficacy.

Results presented on Table 7 further show that there is no significant interaction effect of treatment and gender on the students' Chemistry self-efficacy. This is because the calculated f-value of 1.419 which is significant at .235 levels is not significant at 0.05 levels. The null hypothesis of no significant interaction effect of treatment and gender on the students' Chemistry self-efficacy is therefore accepted. This suggests that the effect of the treatment did not significantly depend on the gender of the students.

Discussion

The results of this study have shown that instruction in metacognitive self assessment strategy enhanced the achievements of the students in Chemistry. Data on Table 6 indicate that the students exposed to instruction in self assessment skills performed significantly better in the Chemistry achievement test than those in the control group. The non significant effect of the interaction of the instruction in self assessment strategy and gender further shows that acquisition of the skills in self assessment skills accounted for the better achievement of those in the treatment group. The findings of this study support the findings of related earlier studies by Kuiper (2002), Rolheiser and Ross (2002) and Rivers (2001). Their findings suggest that good learners engage in the process of assessing the quality of their work based on evidence and set criteria. They get involved in active self- appraisals and management of their thoughts. As they monitor their own learning, they learn to check their own responses and become aware of errors or answers that do not fit. Acquisition of the self assessment skills could have permitted the students to gain control of their learning activities and were therefore able to learn the processes in Chemistry problem solving.

Result in Table 6 also shows that gender is not a significant factor in the students' Chemistry achievement. This finding contradicts some earlier studies. For instance, Jahun and Momoh, (2001), and Usman and Uba,(2007) observed a significant difference in Chemistry achievement based on gender. However, the findings of the study by Olagunju (2001) support the non significant difference in Chemistry achievement reported in this study. The acquisition of self assessment strategy by both males and females in the treatment group could have removed gender related disadvantage in Chemistry learning. These skills in self assessment encourage sell-regulated learning and could have motivated both genders to actively participate in the Chemistry learning process.

The findings of the study showed that the interaction effect of instruction in self assessment skills and gender on students' mean achievement scores in Chemistry was not significant. The findings supported the results of a similar study by Eze (2003). In the study, Eze found no significant interaction effect between instruction in elaborative interrogation strategy and gender. In this study, the findings indicate that both gender benefited almost equally from the self assessment instruction. This implies that the contribution of gender to the effect of treatment on the dependent measures was not significant.

Results on Table 7 show that instruction in metacognitive self assessment strategy has a significant effect on the Chemistry self-efficacy of the secondary school students involved in the study. The students in the treatment group who received instruction in self assessment strategy had a significantly higher Chemistry self-efficacy than those in the control group. The findings of this study may be explained in line with the study of Zimmernam (1990, 2000), and Pajeres and Miller, (1994) which observed that learning skills acquisition enhances self-regulated learning behaviour which in turn ensures motivation and confidence as a learner engages in learning tasks. The confidence to approach learning in an independent manner which promotes the belief in one's ability to execute a given task may invariably lead to enhanced self-efficacy. It has been noted that learners who posses a repertoire of effective learning skills are more likely to be efficient learners who develop high self-efficacy. The instruction in self assessment could have been the reason for the higher self-efficacy demonstrated by those in the treatment condition.

Data on Table 7 also show that gender had no significant influence on the Chemistry self-efficacy of the secondary school students. The non significant different on the Chemistry self-efficacy of the males and females especially in the treatment group would be attributed to the effectiveness of instruction in self assessment strategy which possibly equipped them with relevant learning skills that makes learning Chemistry appealing. When the relevant skills were mastered, it is possible that the male and female students saw Chemistry as a subject that can be learnt through systematic and sustained effort.

The interaction effect of instruction in self assessment and gender on the Chemistry self-efficacy of the students was not significant. This supported the results of a similar study by Eze (2003) which found no significant interaction effect between learning strategy instruction and gender on perceived self-efficacy. The findings of this study showed that both males and females benefited from the strategy instruction. In this study, evidence on Table 7 show that the contribution of the two genders on the effect of the self assessment instruction on the students Chemistry self efficacy was not significant.

Conclusion

The results of this study show that instruction in metacognitive self assessment strategy significantly improved the Chemistry achievement of secondary school students and also significantly enhanced their self-efficacy. This suggests the need for teachers to equip senior secondary school students with relevant self assessment skills effective for Chemistry learning. Such skills which have been observed to enhance confidence in task execution also improve their self-efficacy and keep them focused and concentrated on a given mathematical task. The result of the study further indicated that the difference in the mean Chemistry achievement scores and the mean Chemistry self-efficacy scores of male and female students exposed to the self assessment skills instruction were not significant. These indicate that both male and female students benefited from the self assessment instruction and as such both genders can explore the skills in .self assessment to enhance their Chemistry achievement and self-efficacy.

Recommendations

Classroom teachers should therefore be equipped with self assessment strategy so that in the teaching learning process, they would be able to transfer these skills to the students who need them to pursue their own learning purposefully and independently. This will help the students who are deficient in some

areas of Chemistry to acquire the necessary skills needed for efficient and effective learning of the subject.

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