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ASSESSMENT OF SENIOR SECONDARY SCHOOL SCIENCE STUDENTS' MOTIVATION TO LEARN CHEMISTRY IN ILORIN, NIGERIA

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Abstract

Gradual decline in performance of senior secondary school students in chemistry over the years could be attributed to lack of motivation to learn chemistry. This study is a descriptive research that involved 250 respondents randomly selected from eight secondary schools in Ilorin Metropolis. The research instrument utilized for the study was a Chemistry Motivation Questionnaire. Findings revealed that students were highly motivated to learn chemistry. Female students were found to be more motivated to learn chemistry than the male students but the difference was not found to be significant. Also, SS I students were found to be more motivated to learn chemistry than the SS II students and the difference was significant. The study concluded that senior secondary students were highly motivated to learn chemistry. However, higher motivation was recorded in extrinsic motivation. It was recommended that teachers should utilize motivational strategies that would assist students to become intrinsically motivated.

Keywords: Science, chemistry, motivation, gender, class level

Introduction

Chemistry is a branch of science that is integral to the understanding of the natural world and deals with the study of the composition, properties, and the uses of matter as well as changes they undergo. Weisberg, Needham, and Hendry (2011) defined chemistry as a branch of science that investigates the structure and account for the transformations that matter undergoes. Chemistry is a central science whose basics are required in understanding other branches of science. Therefore, the study of chemistry at various levels of education and factors that may hinder its teaching and learning should be accorded adequate attention since the study of science is germane to the technological advancement of every nation across the globe.

Over the years students' performance in chemistry has been reported to be below satisfactory. Several factors have been identified to influence students' performance in science courses such factors include teachers' pedagogical content knowledge, time constraint, lack of teaching resources, class size, students' belief about science, motivation towards learning and peer coaching (Chen & Wei, 2015; Nordin & Huey, 2010). The motivation of students towards learning chemistry has been identified as one of the factors that influence students' performance in chemistry (Noordin, Azizi, Jamaludin, Shahrin, Zurihanmi, 2010). Therefore, this study sought to find out secondary school science students' motivational orientations towards learning chemistry.

Motivation is a virtue that energizes, directs, and sustains behavior; it gets the learner moving, points

them in a particular direction, and keeps them going (Ormrod, 2008). Motivation enhances the performance of students towards learning as it directs their behavior towards achieving particular goal. It increases the amount of effort and energy that they expend in activities directly related to their needs and goals; increases initiation of and persistence in activities and cognitive processing that learners pay attention to; and how effectively they process it, and the consequences of such. Students' motivation plays an important role in the processes of conceptual change, critical thinking, learning strategies and achievements in learning science (Tuan, Chin, & Shieh, 2005).

Motivation towards learning science is regarded as an internal condition that stimulates, directs and maintains an attitude of learning science (Glynn, Brickman, Armstrong, & Taasobshirazi, 2011). Learners conceptualize the content of science instruction in five dimensions; intrinsic & motivation and personal relevance, self-efficacy and assessment anxiety, self-determination, career motivation and grade motivation (Glynn, Taasobshirazi & Brickman, 2009). Motivation is therefore a factor that influences students' performance in science. Students' motivation towards science is considered important for the decisions that students make during their school life, ranging from the courses that they attend to the profession that they choose (Koul, Lerdpornkulrat, & Chantara, 2011). Therefore, the applications of motivational strategies in teaching and learning of chemistry will create life-long learning process in students (Noordin, et. al., 2010).

Motivation can be in two dimensions; intrinsic and extrinsic motivation. Intrinsic motivation refers to the

performance of a task rewarded by completing the task itself, whereas extrinsic motivation refers to the performance of a task in order to receive an external reward (Ryan & Deci, 2000). Better performance is usually experienced in students when they are intrinsically motivated. However, extrinsic motivation can be promoted in students when teachers take into consideration of the extrinsic factors that influence their students' performance (Noordin, et. al., 2010). This assertion is corroborated by Bryan, Glynn & Kittleson (2011); Aschbacher, Lee & Roth (2010) that opined that students are motivated when they find career interest and relevance of science education to their immediate and future lives. Extrinsic and intrinsic motivation towards science can vary among male and students due to social and cultural roles that are ascribed to them in their immediate society.

Gender is a contemporary issue in science education. Researches have shown superiority of one gender over the other in science lessons and students' motivation to learn science related subjects (Noordin, Azizi, Jamaludin, Shahrin, Zurihanmi, 2010; Chow & Yong, 2013; Tella, 2007). Noordin, et. al. (2010) observed a significant difference in students' motivation based on gender when extrinsic motivation factors are considered. Tella (2007) also asserted that a significant difference exists between male and females students, motivation to learning when the impact of motivation was measured on their achievement. However, Chow and Yong (2013) revealed no significant difference in male and female students' motivational orientations except in the area of assessment anxiety where the difference was found to be significant. It was also noted that as students' age increases, they show a decrease in their motivation (Hegearty, 2010). Therefore, it can be inferred that an increase in class level could depict a decrease in motivation. It is on this premise that the study intends to investigate students' motivation to learn chemistry considering variables of gender and class level. The following research questions guided the study;

1. What are the motivational orientations exhibited by senior secondary school science students towards learning chemistry?
2. What is the difference in the motivational orientations exhibited by male and female senior secondary school science students' to learning chemistry?
3. What is the difference in the motivational orientation to learning chemistry by SS1 and SS2 science students?

Review of related literature

Motivation is regarded as one of the several factors that influence students' performance. Students that are intrinsically motivated devote more time to study than students that are extrinsically motivated. Olakanmi, Gambari, Gbodi, and Abalaka (2016) in a study on promoting intrinsic and extrinsic motivation among SS1 chemistry students' in Minna, Nigeria adopted the quasi experimental design to find the effect of computer assisted instruction on students' motivation in chemistry. The instruments utilized in the study are a computer simulation instructional package (CSIP), chemistry tutorial instructional package (CTIP), and a chemistry motivation questionnaire. Chemistry achievement test, interview, and classroom observation were utilized in the data gathering process. Data were analyzed using mean, standard deviation and ANOVA. Findings from the study revealed that significant difference exists in students' intrinsic and extrinsic motivation in favor of the CSIP, CTIP and the control group respectively.

Okafor and Raphael (2015) investigated the influence of motivation, self-esteem and reasoning level of female students' on their interest in chemistry in Lagos, Nigeria. The sample for the study involved 400 secondary school students and motivation and self-esteem inventory, cognitive development test and interest in chemistry questionnaire were used to gather data for the study. Pearson Product Moment Correlation (PPMC), multiple regression and ANOVA were used to analyze data. Findings from the study revealed that there was a significant mean difference among, motivation, self esteem and reasoning levels of the students. Also, a significant relationship exists among motivation, self-esteem and levels of reasoning in relation to students' interest in chemistry. A significant composite contribution of motivation, self-esteem and level of reasoning on students' interest in chemistry was also observed. However, among the three factors considered much contributions was not noted for motivation.

In another study by Tella (2007) on the impact of motivation on students' achievement in mathematics, the study involved 450 students from 101 secondary schools in Ibadan, Nigeria. The research instruments utilized include; motivation for academic preference questionnaire that was adapted from Motivation for Occupational Preference Scale (Bakare, 1977) and Motivation for Academic Scale by Osiki (2001). Data were analyzed using t-test and ANOVA and findings revealed that significant difference exist between male and female students motivation in mathematics in favor of the male students. Also, a significant

difference existed in students' achievement based on motivation levels in favor of highly motivated students. It can be deduced from earlier studies of Olakanmi, Gambani, Gbodi, and Abalaka (2016); Okafor and Raphael (2015) and Tella (2007) that motivation is a factor that influences students' achievement. Although, these studies investigated the influence of motivation on students' achievement in science it did not find out the motivational orientation that influenced the performance of the students. Therefore, the present study investigated the motivational orientations that senior secondary school students exhibit towards learning chemistry in Ilorin, Nigeria.

Studies have been conducted on the assessment students' motivational orientations toward learning science and mathematics (Chow & Yong, 2013; Noordin, Azizi, Jamaludin, Shahrin & Zurihanmi, 2010). Chow and Yong (2013) carried out a study involving year II students' motivation towards learning combined science in Brunei Darussalam. The study involved 324 students (141 males and 183 females). The study adopted the science motivation questionnaire (SMQ) adopted from Glynn, Taasobshirazi, and Brickman (2009). The study assessed students' motivation based on six motivational orientations which are intrinsic motivation, self-determination, self-efficacy, personal relevance, extrinsic motivation, and assessment anxiety.

The data gathered were analyzed using descriptive statistics of the mean and standard deviation and inferential statistics of the t-test. Findings from the study revealed that students exhibit a moderate level of intrinsic motivation, self-determination, self-efficacy, personal relevance and high level of extrinsic motivation and assessment anxiety were observed. Findings also revealed that male and female possess high extrinsic motivation and assessment anxiety. However, female students were found to be more anxious than their male counterparts. Also, moderate level of intrinsic motivation, personal relevance, self-determination and self-efficacy were observed among the respondents.

Noordin, et. al. (2010) investigated the influence extrinsic motivational factors in learning mathematics among secondary school students. The study utilized a researcher designed questionnaire that was developed based on seven factors which are the teacher, family, peer group, environment, facility, parent-teacher-association (PTA) and language. Data were analyzed using mean, standard deviation and the differences in students' responses to these factors were analyzed using t-test statistics. The study

concluded that all extrinsic motivation factors considered in the study were at a moderate level for all the respondents. It was reported that there was no statistically significant difference between these factors and students' gender. However, male students shows a higher mean in factors such as the teacher, PTA, family, and facility while females shows higher means in factors such as peer group, environment and language as they influence their performance.

It can be deduced from studies of Chow and Yong, (2013) and Noordin, et. al. (2010) that students are extrinsically motivated. Also, extrinsic motivation factor (peer group) influences their motivation to learning. However, the present study differs from earlier studies as it examined students' motivational orientations specifically on intrinsic motivation, self-efficacy, self-determination, career motivation and grade motivation considering gender and class level as moderator variables.

Methodology

The study is a descriptive research of the survey type. The survey type was considered appropriate for the study because there was no manipulation of variables. The population for the study consisted of all senior secondary school students in Ilorin metropolis. The target population consists of all senior secondary school science students in Ilorin South Local Government area. A sample of 250 respondents (126 males and 124 females) which consisted of (130) SSI and (120) SSII students that were randomly selected from eight secondary schools in Ilorin South Local Government area.

The research instrument utilized for the study was a Chemistry Motivation Questionnaire (CMQ-II) adopted from Glynn, Brickman, Armstrong, and Taasobshirazi (2011). The CMQ-II consisted of 25 items in five categories (intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation) which were measured using five likert scales ranging from always, usually, sometimes, rarely and never. The reliability of the instrument was determined using Pearson Product Moment Correlation statistics and a reliability coefficient of 0.81 was obtained.

The students' responses were coded from 0 for never to 4 for always. Each motivational orientation had five items and each motivational orientation was attached to a maximum score of 20. Therefore, the score ranges between 0-20 for each motivational orientation. Respondents' motivation was classified into low, moderate and high while the mean score for each

motivational orientation ranges between 0- 6.67 (low), 6.68- 13.35 (moderate) and 13.36- 20.00 (high).

Data analysis and results

Data gathered were analyzed using descriptive and inferential statistics. Descriptive statistics of mean and standard deviation and inferential statistics of t-test was used to test hypotheses one and two at 0.05 alpha level of significance.

Research Question 1

What are motivational orientations of secondary school students' to learn chemistry?

Table 1: Mean and standard deviation of motivational orientation for the respondents

Scale	Mean	SD	Rank
Intrinsic Motivation	15.82	3.98	5
Self- Efficacy	16.71	4.19	2
Self-Determination	16.18	3.87	4
Grade Motivation	17.22	4.62	1
Career Motivation	16.38	4.18	3
Average	16.38	4.17	

Research Question 2

What is the difference in the motivational orientations exhibited by male and female senior secondary school science students' to learn chemistry?

Table 2 presents the mean and standard deviation of motivational orientation for male and female respondents. It can be deduced that both male and female students are highly motivated in all the

Table 1 shows the mean and standard deviation for the motivational orientations exhibited by the respondents. The mean score of the respondents for the motivational orientations ranges from 15.82 to 17.22 with an average mean of 16.38 (SD= 4.17). This is an indication that the respondents were highly motivated towards learning chemistry because 16.38 fall in the range of 13.36 to 20.00 thresholds for high motivation. However, higher motivation was recorded in terms of grade motivation having a mean of 17.22 (SD= 4.62) and least intrinsically motivated.

motivational orientations. However, female students are more motivated towards learning chemistry than the male students in all the motivational orientations. Female students are highly motivated to learn chemistry in terms of grade motivation with a mean of 17.79 (SD= 4.89) than the males with a mean of 16.67 (SD= 4.28). The mean difference for male and female students' motivational orientations was highest for grade motivation and lowest to self- determination.

Table 2: Independent t-test for Motivational Orientations for Male and Female Students

Scale	Male		Female		t-cal	P
	Mean	SD	Mean	SD		
Intrinsic Motivation	15.35	3.98	16.31	3.98	-1.91	0.06
Self- Efficacy	16.42	4.50	17.01	3.85	-1.11	0.27
Self- Determination	15.93	4.11	16.44	3.61	-1.05	0.29
Grade Motivation	16.67	4.28	17.79	4.89	-1.93	0.05*
Career Motivation	16.05	4.50	16.73	3.83	-1.28	0.20

P≤0.05

Hypothesis One: There is no significant difference in the motivational orientations of male and female secondary school students towards learning chemistry.

It can be inferred from table 2 that there is no significant difference between male and female students' motivational orientations to learning chemistry. The P-value calculated were greater than 0.05 for intrinsic motivation, self-efficacy, self-determination and career motivational orientations.

Therefore, the hypothesis was not rejected. However, a significant difference exists in the students' grade motivation between male and female students ($p=0.05$).

Research Question 3

What is the difference in the motivational orientation to learn chemistry by SS I and SS II science students?

Table 3 shows the mean and standard deviation of the motivational orientations exhibited by SS I and SS II

students to learn chemistry. It can be inferred that SS I students have a higher mean score in the various motivational orientations than the SS II students. The highest mean score for both class levels was recorded for grade motivation with a mean score of 18.06 ($SD=5.17$) for SS I and a mean score of 16.32 ($SD=3.76$) for SS II. Also, intrinsic motivation had the least mean score for both groups with a mean score of 16.65 ($SD=3.73$) for SS I and a mean score of 14.93 ($SD=4.05$) for SS II students.

Table 3: Independent t-test for Motivational Orientations for SS I and SS II Students

Scale	SS I		SS II		t-cal	P
	Mean	SD	Mean	SD		
Intrinsic Motivation	16.65	3.73	14.93	4.05	3.50	0.00
Self- Efficacy	17.16	3.52	15.36	4.45	5.16	0.00
Self- Determination	17.10	3.66	15.19	3.86	4.02	0.00
Grade Motivation	18.06	5.17	16.32	3.76	3.03	0.00
Career Motivation	17.08	4.04	15.65	4.23	2.76	0.01

$P \leq 0.05$

Hypothesis Two: There is no significant difference in the motivational orientations of SS I and SS II secondary school students towards learning chemistry.

From table 3, it can be deduced that significant difference exists between SS I and SS II students for intrinsic motivation, self-efficacy, self-determination, grade motivation and career motivation orientations with calculated t-value of 3.50, 5.16, 4.02, 3.03 and 2.76 respectively. Since the calculated P-value for all the motivational orientations were less than 0.05, the null hypothesis was rejected.

Discussion

Based on the findings of this study, it can be inferred that senior secondary school sciences students are highly motivated to learn chemistry. It was found that the least motivational orientation that students exhibited was the intrinsic motivation therefore students were more extrinsically motivated in the grade motivation scale. The reason for a high level of grade motivation could be attributed to the students' desire to pass examinations in order to promote into the next class. The finding of this study is contrary to the findings of Chon and Yong (2013) that stated students are moderately motivated to learn combined science.

Findings also revealed that female students have a higher motivation when compared with the male students. Four of the five motivational orientations measured, revealed that there is no significant difference in male and female motivational orientations. However, a significant difference exists in the grade motivational orientation for male and female students. Also, in contrary to the findings of this study, Glynn et. al. (2011) inferred that male students had high self-efficacy than the female while a lower self-determination was recorded for male against their female counterparts.

It was also revealed from the findings of this study that SS I students are highly motivated than SS II students towards learning chemistry. This decrease in the motivational orientations of SS II students could be due to the more abstract nature of chemistry and a more tasking activity required in learning complex chemistry topics as they move to higher classes.

Conclusion

It was therefore concluded in this study that senior secondary school science students are highly motivated to learning chemistry. Female students appear to be more motivated than their male counterparts although the difference is not found to be statistically significant. However, a significant

difference was observed in the grade motivational orientation in favor of the female students. Finally, it was concluded that the SS I students were found to be highly motivated than the SS II students and the difference was found to be significant.

Recommendations

The following recommendations were made based on the findings of this study.

1. Intrinsic motivation of students should be improved upon by using appropriate instructional strategies and organizing symposium by the teachers. Such that students will find learning chemistry as a pleasure rather than for attaining higher grades.
2. Motivational strategies that will enhance students' motivation and stimulate learning should be adopted by chemistry teachers. Also, engaging students in motivational and career talks can improve students' intrinsic motivation towards learning chemistry irrespective of their gender.
3. Teachers should utilize motivational strategies and incorporate pedagogical teaching strategies that could reduce the abstract nature of chemistry. Such that students' interest would improve as they move to higher classes to study more complex chemical concepts.

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