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EFFECT OF JIGSAW TEACHING MODEL ON SCIENCE CONCEPT MASTERY AMONG FEMALE STUDENTS IN COLLEGES OF EDUCATION, GHANA

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ABSTRACT

Teachers in general used varied pedagogies to communicate content-based concepts to students with varied cultural and educational backgrounds. However, most of these teachers over-looked jigsaw teaching model. The study focused on two important areas which are to investigate the female students' concept mastery and to identify students' intrinsic motivation in science concepts learning when the concept is taught using jigsaw teaching model. Ninety-four (94) randomly selected first year female students from the Presbyterian Women's Colleges of Education formed the study sample. Experimental data were collected using pre-test and post-test. Structured questionnaire was also administered to a sample of 40 conveniently selected female students from the experimental group. Observation and interview were also conducted to gather self-reported data on students' intrinsic motivation. The quantitative data was analyzed using descriptive, t-test and chi-square statistics. The qualitative data was analyzed using thematic content analysis. The results of the study indicate that greater number of students obtained better results as they learnt and remembered better through jigsaw model. Further, students' participation was generally higher and intrinsic motivation shown in the students when they learnt through jigsaw model. The study recommends that teachers in the colleges of education, particularly those in female colleges, should use the jigsaw model to encourage and motivate students to learn science. The study also recommends that the model should be extended to other colleges of education dealing with mixed students to further expand the efficacy of the model in science concepts mastery and building of intrinsic motivation.

Keywords: Jigsaw model, intrinsic motivation, science concept mastery, female students, Colleges of Education.

1. INTRODUCTION

The world is becoming scientific village and everything depends on the application of science. There is no doubt that Science have created and are still shaping the structure of our modern world. According to Seitz (1978), Science which started out primarily as an adventure of the mind is now becoming one of the principal pillars of life. Science has brought within the reach of multitudes benefits and advantages which only a short time ago were the privilege of the few. Science has shown how malnutrition, hunger and diseases could be overcome. Scientific truths have freed people from many false ideas and the practical application of scientific truths in industry as well as in the fields of communication and transportation, has freed people from unnecessary drudgery and, to a degree, from the limitations of time and distance. Scientific truths applied in preventive medicine and health care have helped free people from premature death or a morbid fear of disease.

It is therefore very important that all citizens should understand the basic scientific culture produced by modern civilization. Natural phenomena and their accompanying effects must be understood by all citizens so that misconceptions and superstitions and their associated fears are destroyed. The understanding of the phenomena is also an important weapon in the struggle to remove diseases, poverty and increase food production in order to raise the standard of living for all. Every individual needs to know more about how science works and the implications of science. With these, they would be in better position to have greater control over their environment. If these challenges are to be met, the inculcation of the scientific attitudes and popularization of science are important to all individuals, particularly, the girl child. With this increasing emphasis on science as a tool for life, many nations including Ghana are seriously responding to pressure to get every individual enrolled into the scientific community.

In Ghana, however, many students at the pre-university level often complain that science is difficult. This misconception has long been noted to be a universal problem and for that matter a national school problem in Ghana and particularly observed among many female students in the Junior High Students (JHS). This misconception continues to influence their choice of science courses at the Senior High level and even beyond. The study focused on two important areas which are to investigate the students' mastery of science concepts and to identify students' intrinsic motivation to learn science when the discipline is taught using jigsaw model.

There are several factors that have led the researchers to assess the effectiveness of Jigsaw Teaching model, among others in learning science. Jigsaw Model is an active students-centered-learning process whereby students are grouped and each group is assigned well defined concept to research into and become experts in that knowledge (Aronson & Patnoe, 1997). After the group task, students are regrouped by picking a member from each group (called expert group) to join another group and explain to them what they have discovered in their previous groups. Studies shows that this strategy encourages children to discover and develop new concepts or ideas followed by spurring children's mind to be critical and creative (Jones and Wyse, 2004; Wilson, 2008). As children independently think critically and work through a subject matter, they develop a sense of independence and autonomy which will 'enhance their desire and ability to be self-motivated' (Blandford and Knowles, 2009: 147). Many researchers have successfully proven that this method of learning develops the students' interest in learning Science (Norman, 2005; Johnson & Johnson, 1999).

2. LITERATURE REVIEW

Studies indicate that most commonly adopted strategies for science classroom instruction in Ghana is in line with what can be called "traditional teacher-centered approach. This is the approach where teachers monopolize communication, dominate classroom discussion, and maintain structures that heavily rely on teacher-centered approach (Abanihe et.al., 2010; Azuka: 2006; Bature & Jibrin, 2015; Kaka, 2007; Odilli: 2006). Abanihe, *et al*, (2010) went further to assert that, this approach permits teachers to dominate classroom talk and control classroom activities with little or no opportunity for students' contribution. From this view, students' responsibility is to listen carefully and copy notes given by the teacher (Bature et al., 2015; & Emaikwu, 2012).

However, in reality very few science concepts are taught using student-centered approaches such as 'Jigsaw model'. Most lessons are conducted based on teacher-centered approach. One of the reasons is because of the teachers' beliefs and experiences in school which have influenced them in a way to practice this approach (Jones and Wyse, 2004). According to Woolnough (1997), although, it is satisfying to see the high achievements of students when the

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teacher-centered approach is used in schools, nevertheless, students' emotional interest in learning should also be taken into account as it is fundamental to boost their intrinsic motivation, their commitment, their enjoyment and creativity in science. As a result, the researchers explore the effectiveness (impact) of Jigsaw model in mastery of science concepts.

The jigsaw model is a teaching strategy in which the instructor prepares several different, related tasks for the class. The instructor designs specific number of tasks, one for each of specific number of groups. Each group then prepares on one of the tasks. Once each group is prepared, the class is divided according to the number of the designed tasks. Each group will have one group member from each of the groups. Each member of the group is responsible for teaching the rest of the group what he/she has learned from his/her previous group task. The group then puts all of the pieces together and completes a group task that can only be answered once all of the team pieces are together (hence the name "jigsaw"). One critical assumption (unavoidable condition) that the instructors using the Jigsaw model framework must take into consideration is that the individuals in each group must know and masters **their own task better than any of the ones presented by their peers in other groups.** This is true partly because students must know their own tasks well enough to explain them and partly because their peers are typically not skilled presenters. The jigsaw technique is a cooperative teaching strategy specifically designed to provide students the opportunity to become "experts" in a particular concepts, and share that knowledge with their peers (Cooperative Learning Institute, n.d. para.5).

According to Barbara (1995) describes the jigsaw teaching model as "a method in which teams of students are assigned to investigate different aspects of the same problem or issue. Each team analyzes a different but related data set on the same concept. Once each team member thoroughly understands his/her team's aspect of the problem, new groups are formed, with at least one representative from each original team. Each individual then explains his/her team's aspect of the problem to the new group. In this way, every student learns every aspect of the problem. Each group then uses the combined information to evaluate a summary issue" (Barbara, 1995, p. 322). As a form of cooperative learning, the jigsaw method is a teaching strategy that helps students to develop skills for working effectively in teams, an important competency for socio-environmental synthesis (Johnson & Johnson, 2009).

Grounded in social interdependence theory (Johnson & Johnson, 2005), the jigsaw model is an established educational approach robustly supported by plethora studies (Johnson & Johnson, 2009). The central principle of the jigsaw model framework is that learning is rather than competing with each other or being indifferent to each other, students engaged in cooperative learning "work together to maximize their own and each other's learning" (Cooperative Learning Institute, n.d. para.5). The jigsaw method is an effective way to increase student engagement through group work that facilitates peer to-peer learning (Barbara, 1995). According to Carin and Bass (2001), there are three major ways for people to learn about the world. These included discover things about the world from personal observations and experiences with the environment; acquire knowledge transmitted directly from other people or construct personal knowledge by transforming discovered and acquired knowledge in meaningful ways.

Studies on teaching strategies emphasizes that all students irrespective of needs and background are to be provided with intellectually challenging classrooms work (Blackhall 2002; Boaler, 1997; Hayes et al., 2006) and that if such students are engaged with intellectually challenging work during their classroom instruction, there is the probability of having their

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learning outcomes improved (Ramsey, 2000; Sorin & Klein, 2002). Similarly, giving students intellectually challenging classroom task could also help forester students' collaboration and interaction during classroom instruction (Bature, 2014).

Alsharif & Atweh, (2012) & Atweh, (2007) were of the view that providing students from diverse background a supportive classroom environment possesses the possibilities of creating classrooms where students are given the opportunity to 'take risks' without being ridiculed or pull down by their classmates and or their teachers. Finally, the recognition of different social groups in a science classroom suggests the need to recognize and value the cultural backgrounds existed among students with the aimed of developing the learning experiences of different students in a classroom (Hayes *et al.*, 2006). The desire, therefore, to introduce the jigsaw model framework into the Ghana's science classroom with the view to reforming its instruction is not out of place. In view of these, this study attempts to use jigsaw model as a framework to reforming the teaching and learning of science in Ghanaian science classroom with the view of achieving quality classroom instruction and students motivation to science learning. This study seeks to investigate the effect of jigsaw-based learning method on students' concepts mastery and development of intrinsic motivation towards learning. The study critically investigate the effective of jigsaw teaching model in science concepts learning among randomly selected first year female students in the colleges of education.

3. MATERIALS AND METHODS

3.1 Study Design

The study was a college-based cross-sectional survey and the design used were both quantitative and qualitative. The quantitative desgn was employed because it offers rich descriptive reports of participants' perceptions, attitudes, beliefs, views and feelings as well as the meanings and interpretations of the issue under investigation (Creswell, 2012). The qualitative design was also used because it focuses on interpreting and understanding a social constructionof meaning in a natural settings (Creswell, 2015). The qualitative phase followed the quantitative phase to further explain the results obtained during the quantitative stage (Creswell, 2015).

3.2 Study Sample and Sampling

A study sample of 94 students with mean age of 21 years was selected from first year class of 232 female students in the colleges of education using simple random sampling method. The sample was then divided into two groups, resulting in 47 female students in the experimental group and 47 female students in the control group (94 female students). Data collection instruments employed were questionnaire, interviews, observations and tests. The used tests were pre-test and post-test.

3.3 Data Collection Procedures

The researchers taught a science lesson using the Jigsaw teaching model framework in the experimental group and used the conventional lecture method in the control group. The science concepts taught were specifically based on the characteristics of Hibiscus flower (*Hibiscus rosa-sinensis*), Pride of Barbados flower (*Caesalpinia pulcherrima*) and Flamboyant flowers (*Delonix regia*). Five tasks were designed based on these three thememematic concept areas. They included the following:

1. *Observe the Hibiscus flower and identify its characteristics features.*
2. *Observe the Pride of Barbados flower and identify its characteristics features.*
3. *Observe the Flamboyant flower and identify its characteristics features.*

4. *Observe the three flowers and identify the differences among their characteristic features.*
5. *Observe the three flowers and identify the characteristic features common to them.*

Prior to the lesson, the researchers conducted pre-test based on the five tasks to determine students' "entry mastery performances" in both the experimental and control groups. The test involved ten (10) multiple choice items. The test administration follows normal classroom test procedures and lasted for 25 mininutes. All the ninety-four (94) female students responded to the pre-test. Test items reliability and internal consistency were determined using Cronbach's alpha statistics (Pallant, 2013). The accepted standard for Cronbach's a coefficient should be 0.7 and above (Cuieford, 1965). The calculated coefficient value (0.9) was greater than 0.7 indicating that items on the instruments have sufficient internal consistency (Pallant, 2013), suggesting that the factors are reliable.

In-depth interviews were also conducted with a cross-section of the students (10) from experimental group after the lesson to elicit their performance, mastery and interest expectancy levels in the lesson. The interview sessions were recorded using digital recorders and latter transcribed by three of the authors for consistency and analysis. Ethical issues and the necessary permissions were obtained earlier before the research commenced. In oder to ascertain the performance, mastery, and motivation expentancy levels generated by the jigsaw model during the teaching, 40 randomly selected students from the study sample responded to a 5-point Likert scale type questionnaire comprising: (i) strongly disagree, (ii) disagree, (iii) no idea, (iv) agree, to (v) strongly agree. The performance expectancy level was assessed by means of 2 items providing choices; mastery expectancy level was assessed with 5 items providing choices; and motivation expectancy level was also assessed using 6 items providing choices. Again, all the items were responded to on a 5-point Likert type questionnaire ranging from 1 = strongly disagree to 5 = strongly agree.

4. ANALYSIS

Data collected were analyzed using both qualitative and quantitative statistics. The qualitative analysis approaches (Corbin & Strauss, 2008; Strauss & Corbin, 1998) were conducted to find patterns in the students' performances, matery and motivation expectancies when the Jigsaw teaching model framework was used. Transcripts of the observational notes during the lessons, as well as transcripts from interviews with a cross-section of the students, were the main qualitative data sources for analysis. Field notes taken by the researchers were secondary documents that provided additional and multidimensional points of view on the science classroom instruction using the Jigsaw model framework. The analysis in these study was not limited to anticipated themes that are those issues the researcher thinks are important, but, emergent themes from the students were also considered by the researchers to establish the credibility of the data collected. The transcripts of data generated were ordered, coded and analyzed using thematic content procedures. The researchers selected quotes that are most representative of the students' interest, performances and matery expectancies and weaved them together to discussed and interpreted with the view of production meaning before drawing conclusions from them.

Quantitative data collected using the tests, Likert scale type questionnaire were analysis by means of SPSS version 21.0. Data collected were collated, cross-checked against the items on the instruments used, coded, entered into SPSS and analyzed using descriptive and t-test statistics to determine the mean differences in variable scores. The students responses to the Likert scale type questionnaire were analysed using chi-square test of association to determine the relationship between the jigsaw teaching model and students performance, mastery and motivation expectancies. The analysis of the test scores was conducted at 0.05 significance level (95% CI). Cronbach's alpha statistics was also conducted to determine scale and test item reliability of the items used. The test result shows the scale reliability for all the 13 items as: alpha value= .87. George and Mallery (2003) provide the following rules of thumb for interpreting the alpha value: [“_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and _ < .5 – Unacceptable” (p. 231)]. Hence the alpha value obtained in this study for all the 13 items used was good. Again, all the items were responded to on a 5-point Likert type questionnaire ranging from 1 = strongly disagree to 5 = strongly agree. Graphs were generated using SPSS software version 21.0.IBM.

5. Results

5.1 The demographic profile of study participants is presented in Table 1 below.

Table 1: Demographic Profile of Questionnaire Respondents

Table 1 results show that all the participants were female with average age of 2.4 and majority of them belonged to age group of 21-26 (48%) and were christians (80%) with the rest (20.%) constituting Islamic religion. All the participants were level 100 female students.

5.2 Students Performance Expectancy

The results of students' performance expectancies in both the experimental and control groups obtained through the provision of pre-test and post-test with 10 multiple-choice items were presented in Table 2 below.

Demographics	Response Distribution in Sample	Percentage Distributions
Sex		
Female	40	100
Age (Year)		
15-20	5	12.5
21-26	19	47.5
27-32	10	25.0
33-38	6	15.0
Mean Age (Year)	2.4	---
Standard Deviation	0.90	---
Religions		
Christianity	32	80
Islamic	8	20
Traditional	—	—
Education		
Level 100	40	100

Table 2: Students Performance in the Pre-Test and Post Test (Scale 0 – 100)

Students ID	Experimental Group/Class		Students ID	Control Group/Class	
	Pre-Test (%)	Post Test (%)		Pre-Test (%)	Post Test (%)
1	34	75	1	33	70
2	20	66	2	26	62
3	30	80	3	32	68
4	34	77	4	31	70
5	34	86	5	35	70
6	32	84	6	36	74
7	28	76	7	25	70
8	21	80	8	24	48
9	34	85	9	31	70
10	21	80	10	24	48
11	24	78	11	26	64
12	28	76	12	23	70
13	32	86	13	33	74
14	20	75	14	27	62
15	24	78	15	26	64
16	24	78	16	21	64
17	24	79	17	24	64
18	24	68	18	25	64
19	28	78	19	25	70
20	21	84	20	32	48
21	28	76	21	34	70
22	32	84	22	28	74
23	32	84	23	29	74
24	30	80	24	36	68
25	24	78	25	34	64
26	32	84	26	37	74
27	28	72	27	32	70
28	28	74	28	35	70
29	30	80	29	36	68
30	21	81	30	29	48
31	28	75	31	27	62
32	30	77	32	34	68
33	31	87	33	29	62
34	31	82	34	37	62
35	31	76	35	28	62
36	32	84	36	33	74
37	34	78	37	31	70
38	30	83	38	27	68
39	20	74	39	25	62
40	20	77	40	34	62
41	30	80	41	29	68
42	31	86	42	37	62
43	30	82	43	35	68
44	31	83	44	37	62
45	20	69	45	29	62
46	21	80	46	33	48
47	20	76	47	35	62
		Mean mark=47.73			Mean mark =53.26

[N= 94; Mean age: 2.4; SD=0.79]

The two standard deviations should also be calculated and as a rule of thumb, one should be no more than twice the other. From the results, the standard deviation of the experimental and control groups were 26.26 (N=47) and 18.42 (N=47), respectively. This suggests that the data from the two population groups have similar standard deviations, hence the data in both groups are statistically independent and Normally distributed. The t-test fits the analysis of the data.

5.3 Descriptive Statistics of Students Performance Expectancies

The data presented in Tables 2 and 3 below show descriptive statistics of students performance expectancies in the control and experimental groups.

Table 2: Descriptive Statistics of students performance expectancies in the control and experimental groups.

	N	Mean		Standard. Deviation	Variance
	Statistic	Statistic	Std. Error	Statistic	Statistic
Experimental Group	94	53.26	2.71	26.26	689.396
Control Group	94	47.73	1.90	18.42	339.251

Table 3: T-Test results of students performance expectancies in the control and experimental groups.

	Test Statistics					
	t	df	Sig	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Experimental Group	19.67	93	.000	53.26	47.88	58.63
Control Group	25.13	93	.000	47.73	43.96	51.51

The data presented in Table 2 above shows that the mean scores of students in the control and experimental groups were 47.73 (N=47), and 53.26 (N=47), respectively. The standard deviation of the experimental and control groups were also 26.26 (N=47) and 18.42 (N=47), respectively. These clearly suggersts that performance in experimental group was better than that of the control group. The variance of the experimental and control groups were 689.40 and 339.25, respectively. Again, these results confirmed that the experimental group performed better than the control group. In Table 3, the t-statistics also indicates that significant difference exists in performances between the experimental and control groups: experimental group: t (93) = 19.67, mean difference= 53.26, p-value=0.000; Control group: t (93) = 25.126, mean difference= 47.73, p= 0.000). The magnitude of the difference in the mean (mean difference =5.53, 95% CI: 3.93 to 7.12) was larger, supporting the practical significance of the these results.

5.4 Graph of Percentage Responses of Influence of Jigsaw Teaching Model on Students Performances, Mastery, and Motivation Expectancies

The results presented in Figures 1—8 below described students percentage responses to relative levels of influence of jigsaw teaching model on their performance, mastery, and motivation expectancies regarding science learning. On the x-axis scale column of each graphs, the abbreviations DS, D, N, A and SA, respectively, represent 'strongly disagree', 'disagree', 'no idea', 'agree', and 'strongly agree'.

Figures 1—8: Graph of Percentage Responses of Influence of Jigsaw Teaching Model on Students Performances, Mastery, and Motivation Expectancies in Science Learning

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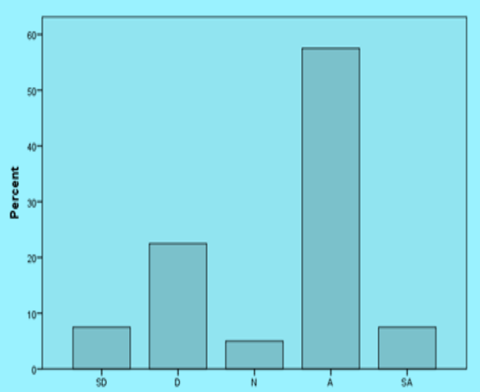

Fig. 1 Using jigsaw model increases my understanding of concepts in the science classroom

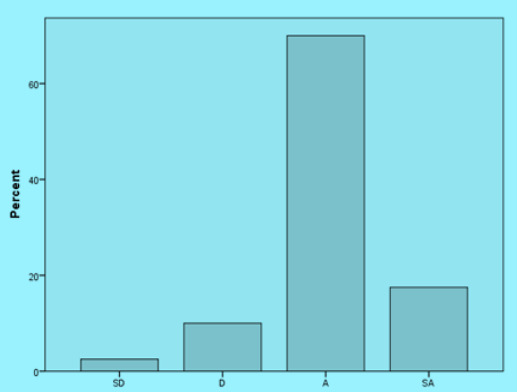

Fig. 2 would find jigsaw teaching model useful in my teaching career in future.

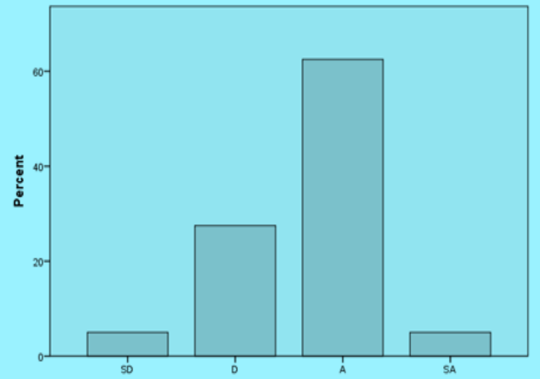

Fig. 3 Learning using jigsaw model makes it easy for me to understand concepts in the science classroom

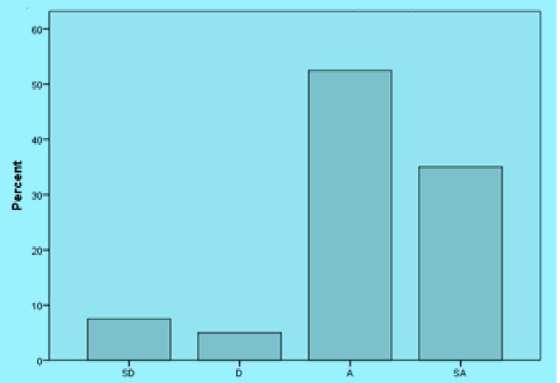

Fig. 4 My confidence level increases when I explain concepts to my peers/classmates.

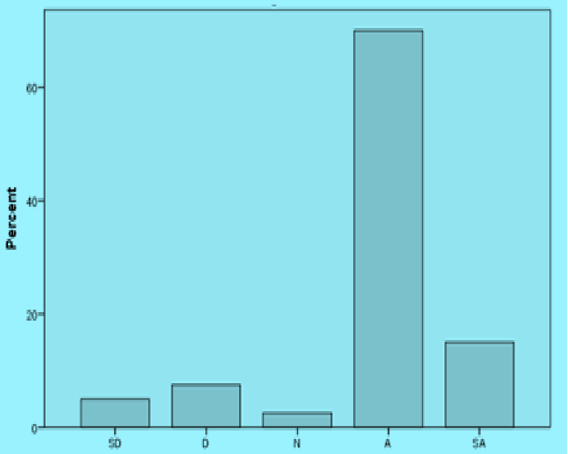

Fig. 5 .I develop interest in the science classroom when the teacher uses jigsaw teaching model.

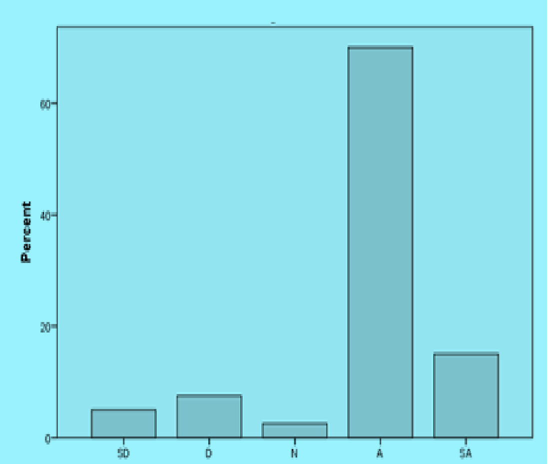

Fig. 6 .I develop interest in the science classroom when the teacher uses jigsaw teaching model.

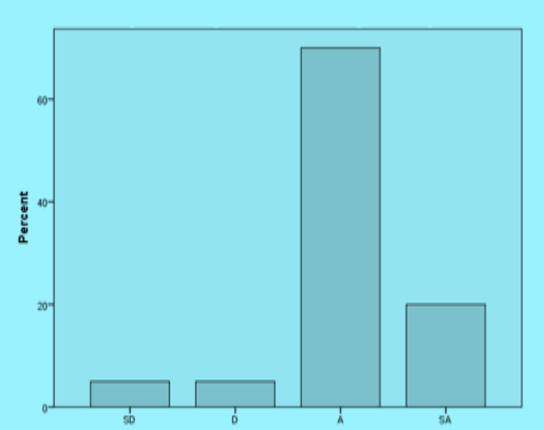

Fig. 7 Jigsaw teaching model makes learning interesting

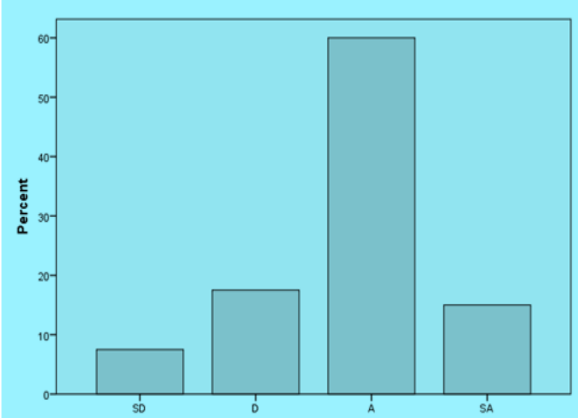

Fig. 8 Jigsaw teaching model used by my teacher made me develop interest in science.

Table 4: Results From Chi-Square Test of Association

Independent Variable	R'-ship	Dependent Variables	χ^2 Value	df	p-value	Association Decision
Jigsaw Teaching Model	→	Be useful in my teaching career in future.	45.0	3	***	Supported
Jigsaw Teaching Model	→	Enable me to perform task more quickly.	18.2	2	***	Supported
Jigsaw Teaching Model	→	Increase my understanding of concepts in the science classroom.	39.0	4	***	Supported
Jigsaw Teaching Model	→	Can Increase my competency in science teaching in future.	39.0	3	***	Supported
Jigsaw Teaching Model	→	Make it easier for me to understand concepts in the science classroom.	35.4	3	***	Supported
Jigsaw Teaching Model	→	Increase my confidence level in explaining concepts to my peers/classmates.	25.0	3	***	Supported
Jigsaw Teaching Model	→	Improve my communication skills in the science classroom.	30.7	2	***	Supported
Jigsaw Teaching Model	→	Develop my interest in the science classroom	64.3	4	***	Supported
Jigsaw Teaching Model	→	Develop my self-confidence when teaching my peers in science classroom.	30.7	2	***	Supported
Jigsaw Teaching Model	→	Makes science learning fun.	39.8	2	***	Supported
Jigsaw Teaching Model	→	I like learning with jigsaw teaching model.	48.2	3	***	Supported

Jigsaw Teaching Model	➡	Makes learning interesting	45.6	3	***	Supported
Jigsaw Teaching Model	➡	Develop my interest in science.	27.0	3	***	Supported
*** p<0.05 : *Items 1-2 measured students' performance expectancy; items 3-7 measured students' mastery expectancy, Item 8-13 measured students' motivation expetance.*						

The results presented in Table 4 above indicate that the dependent variables have association with the independent variable (Jigsaw Teaching Model). All the p-values at 95% CI were less than 0.05. This means all the associations have been supported and have significant positive relationship. These findings provide strong positive support for the influence of jigsaw teaching model on female students performance, mastery and motivation expectancies in the science classroom.

DISCUSSIONS

The study focused on two important areas which are to investigate the students' performance and mastery of scientific concepts and to identify the level of students' intrinsic motivation to learn science when the subject is taught using jigsaw teaching model. This section report on the results of the group randomized intervention study that examined the effects of jigsaw teaching model versus control conventional lecture teaching model in supporting the performance and mastery of scientific concepts and level of students' intrinsic motivation to learn science in colleges of education level 100. The results provide convincing evidence of positive effect of jigsaw teaching model on female students performance, mastery and motivation in the science classroom.

Role of Jigsaw Model in Understanding of Science Concepts by Students

The results of present study showed that the jigsaw model framework had a positive influence on mastery of concepts by female students in the experimental group compared to students in the control group who received teaching using the conventional lecture method. The results of the pre-test prior to the use of the jigsaw model and post-test after the use of the jigsaw model prove this (Table 1 above).

The implication of the findings suggest that science tutors' change in pedagogy has a positive influence on their students' understanding of concepts and interest towards learning. Studies (Alsharif & Atweh, (2012) and Atweh (2007) show that tutors using jigsaw model stimulate students' interest and creates helpfulness, openness, and friendliness which could be seen as ingredients for effective teaching. Alsharif & Atweh, (2012) and Atweh, (2007) also demonstrated that providing students from diverse background a supportive classroom environment possesses the possibilities of creating learning environment where students are given the opportunity to 'take risks' without being ridiculed by their classmates and or their teachers. They further found that the recognition of different social groups in a classroom suggests the need to recognize and value the cultural backgrounds existed among students with the aimed of developing the learning experiences of different students in a science classroom (Hayes et al., 2006).

Role of Jigsaw Teaching Model in Development of Students Intrinsic Motivation

Intrinsic motivation as an important and powerful source of behavioural drive that affects learning, adaptation, and competencies has been documented in several studies (Deci, & Ryan, 2004; Black & Deci, 2000; Deci et al., 1989; Williams et al., 1996). The results of this study showed that students develop interests in the science classroom due to the use of the jigsaw teaching model. This positive effect was mediated by intrinsic motivation. In the context of classroom teaching and learning, intrinsic motivation leads to better persistence, performance, and satisfaction in a variety of tasks in various domains (Baard, Deci, & Ryan, 2004; Black & Deci, 2000). The findings of this study fully support previous research by identifying a direct relationship between intrinsic motivation and students matery of concepts.

Also, from the interview it was evident that students interest was developed in the lesson when the jigsaw teaching model was used. Studies show that the desire of students to perform in terms of standard of excellence, to do something better or more efficiently, to solve problems, to master complex tasks or to be successful in competitive situations generates interest (Rosenshire (1980). According to Brophy (2010), as students enjoy learning and build their interest in the learning, it leads them to be active participants in the activity they engage in.

Equally important factor which affects how much individuals strive to succeed in learning is their desire to maintain a positive self-evaluation (PSE). The PSE proposes that self-evaluation may sometimes be raised or lowered through a comparison process (Masters and Kiel, 1987). To them, this happens when a personal performance is compared with the performance of a close friend on a skill or task that is important to one's self-definition. These views on the need for achievement suggest that when students are engaged in learning experiences in which they have an effect, curiosity motivation is developed in them for continual strive for attainment of perfection for good work and for high educational achievement. Wigfield *et al.* (1998) have demonstrated that when students are intrinsically motivated, they willingly engage and actively participate for their own sake and out of interest in an activity. This observation was further emphasized by Stronge *et al*. (2004) that each student's learning style are met as they undergo the cycle of experiential learning in jigsaw model, resulting in the development of students' confidence, enthusiasm, motivation and achievements. Closely linked to achievement motivation is curiosity motivation theory. During the lesson, it was evident that students interest was high as they were very curious to present their findings to their peers. Consistent with the findings above, Fennel (1992) concluded from his study that most of the students enjoyed being in the lesson with the jigsaw method and found it beneficial.

According to Bruner (1983) every individual has a "built-in-will" to learn; and it is only through intrinsic motivation that the will to pursue is sustained. He demonstrated that the best example of intrinsic motivation is curiosity. This theory suggests that curiosity initiates self-reinforcement. This implies that students become motivated when they are made to discover their own knowledge and skills. This was observed as students were given the opportunity to become experts in their own self and explain concepts they discovered to their peers, they showed much interests in their self-confidence and autonomy. Several studies have shown that autonomy-supportive (in contrast to controlling) teachers catalyze in their students greater intrinsic motivation, curiosity, and the desire for challenge (Deci, Nezlek, & Sheinman, 1981; Ryan & Grolnick, 1986). They further concluded that students who are overly controlled not only lose initiative but also learn less well (Benware & Deci, 1984; Grolnick & Ryan, 1987).

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CONCLUSION

In conclusion, the study has shown that the use of jigsaw teaching model in presenting scientific concepts to female students' promotes effective performance expectancy, mastery of concepts and builds on their intrinsic motivation. Development of intrinsic motivation by female students is critical to the successful science learning and concepts mastery in the science classroom. This indicates that if scientific concepts are presented to female students in colleges of education using the right approach a healthy peer relationships is largely developed and promote easy comprehension of concepts. This result has two significant implications for science tutors. First, tutors methodology ought to generate a certain level of learning motivation in the students while teaching science. Second, as students enjoy learning and build their interest and confidence in learning, it leads them to be active participants in the science classroom. Furthermore, the productions and reactions of students in this study proved that when appropriate strategies and activities are employed, students understand concepts better and develop interest in their learning. Finally, the general feedback received through the questionnaire given to the experimental group at the end of the study also shows that female students like to see themselves discovering scientific concepts and presenting their findings to their peers with confidence.

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Conflict of Interest
The authors declare no conflict of interest in this study.

Authors Contribution
The first author conceicved the idea. The second and third authors transcribed the interviews, incorporated field notes and translated conversation from Twi to English. The fourth and the fifth authors checked all transcriptions against original voice record. Discrepancies were discussed, and a final decision was made after mutual agreement of all the authors. All participants examined transcripts for precision and accuracy of words, ideas and jargons. Corrections were made accordingly by all the authors. All participants endorsed signatures on the original manuscripts as proof of authenticity. Data are coded and analyzed by the first author and are checked and clarified for data analysis and representation by the second author.

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