ENHANCING WOMEN EMPOWERMENT THROUGH CHEMISTRY ENTREPRENEURSHIP EDUCATION USING METACOGNITIVE PROBLEM SOLVING STRATEGY

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ABSTRACT
This study investigated Enhancing Women Empowerment through Chemistry Entrepreneurship Education using metacognitive problem solving strategy. This method is geared towards equipping women in the society with knowledge and skills to convert innovations from researches in chemistry into marketable products for commercial gain. One objective, a research question and a null hypothesis were generated to guide the study. The design of the study was a quasi-experimental pretest-posttest non-equivalent-control-group design, involving one experimental group and one control group. The experimental group was exposed to metacognitive problem solving strategy while the control group was taught using lecture method. A sample size of 74 Senior Secondary One (SS 1) Chemistry students selected from two single sex secondary schools in Zaria was used; drawn from population of 724 students out of 5 single sex girl schools. The instrument used for the study was a twenty-five-item multiple choice Chemistry Entrepreneurship Performance Test (CEPT) which was validated by experts and used for data collection. Means, standard deviation and t-test was used to answer the research question and test the null hypothesis. The result showed that; students exposed to metacognitive problem solving strategy performed significantly better in the Chemistry Entrepreneurship Performance Test (CEPT) than those taught with lecture method. Based on the findings, conclusions were drawn and the educational and economic implications were discussed. Among the recommendations made was that Chemistry teachers especially those in single sex girls schools, at all levels of education should employ the use of Metacognitive problem solving strategy to teach chemistry and hence it has the potential that encourages women to become creative thinkers in chemistry entrepreneurship education. By doing this the women (girl-child) are being empowered to become wealth creators since many of the household materials used domestically are the products of innovations from chemistry.

KEYWORDS: Metacognitive problem solving strategy, Academic performance, Women empowerment and Chemistry entrepreneurship education.

INTRODUCTION
Women empowerment is the development of women in terms of politics, social and economic strength in nation development. It is also a way of reducing women vulnerability and
dependency in all sphere of life. Women empowerment is a useful tool in development because it emphasizes the idea of women as active agents in development strategies, rather than passive recipients of development strategies. Ighodalo in Fapohunda (2011) therefore, views women empowerment as a process of enabling women to develop the capacity to actualize their potentials. Ighodalo in Fapohunda further adds that women should be looked at as individuals that possess some hidden potentials for greatness and so should be encouraged to develop their potentials to the fullest. The process of empowerment must necessarily also include the expansion of women’s access to educational opportunities, facilities for skills acquisition and positions of authority. Anugwom in Ajuzie, Okoye and Mohammed (2012) opined that education is the main tool for imparting skills and attitudes relevant to the contribution of an individual to the development of the society. Education is seen as the chief agent for training the young for competent adult role performance and for socialization. Any nation in the 21st century that aspires to prosper must have means of imparting technological occupational skills in her students. On this basis, science and technology education becomes a necessity to be pursued. Science, Technology and Mathematics (STM) are powerful tools for social economic and political development of any nation. If Nigeria must stay competitive as a nation, then we need to build a scientifically literate citizenry and a bank of highly skilled STM literate. It is important to make it clear the various levels of occupation in science and technology for which requisite man-power must be produced by the educational system (Olayiwola & Emmanuel, 2009). This is because the current educational programme lacks the major ingredient that is necessary for adequate self-reliance of its recipient because it is theoretically based with little or no practical critical thinking and skills acquisition foundations. One of the major goals of National Policy on Education (FRN, 2013) is to equip every individual with skills and job competences for gainful employment; this is meant to help cement the partnership between education and labour and one of such skills includes creative thinking skills.

The term metacognition refers to a learners’ knowledge about his/her processes of cognition and the ability to control and monitor these processes as a function of the feedback received through outcomes of learning. Metacognitive activity can be specified in terms of its components namely planning, monitoring and evaluation (Van Hout- Wolters, Simons & Volet in Shareeja & Gafoor, 2014). According to Flavell (1979), they are the main components at the highest hierarchical level of metacognitive activities before commencing a task, during execution of the task, and upon completion of the task, respectively. Metacognition involves planning, evaluating and monitoring problem-solving activities are the executive processes of the brain. Recent studies on enhancing domain specific problem-solving recommend the use of metacognitive strategies. They argue that students may not know how to use the instruction
effectively, thus they might benefit from metacognitive instruction on how to learn (Roll, Aleven, McLaren, Ryu, Baker & Koedinger in Shareeja and Gafoor, 2014). When new information and domain specific knowledge are held constant, reflective thinking processes that encourage elaboration on a problem are instrumental in providing the most efficient problem solving. This is because high metacognitive skills can compensate for deficit in overall ability by providing knowledge about their own cognition.

This is in accordance with Ozsoy (2009), that metacognitive strategy has a positive impact on students in improving problem-solving skills. Through metacognitive learning strategy, problem solving on students can be directed to develop students’ skills, among others, to build new mathematical knowledge, solve problems in various contexts related to chemistry, apply various strategies as needed, and reflect on chemistry problem-solving process. Surya (2015) stated that problem solving is the cognitive strategies necessary to carry out the life tasks that must be faced in everyday life with a range of difficulties ranging from the simplest to the most complex. All these abilities can be obtained when students are accustomed to carrying out problem-solving according to appropriate procedures, so the scope of benefits gained is not only tied to one solved problem, but also touched on many other issues and includes a broader aspect of chemistry entrepreneurship knowledge. Metacognitive strategy in which there is a process of thinking in problem solving is important and gets the attention of educators specially to help students to develop their ability to solve problems. This is in line with the main purpose of teaching problem solving in chemistry; it is not only to equip students with a set of skills or processes, but rather to enable students to think about what they think. Problem solving on students have goals ranging from remediation to critical thinking to the development of creativity. Chemistry is used in most fields of human Endeavour: sciences, engineering and medicine. It is closely related to physics and biology (Helmenstine, 2010). Qualitative functional chemical knowledge is practical and useful that is if chemistry is taught in such a way that it reflects on our immediate environment and developmental needs (Suleiman, 2010). Due to the abstract nature of chemistry, learners tend to shy away or perform low.

Chemistry is the science of matter and the changes it undergoes. It attempts to explain chemical phenomena of everyday life. Chemistry shows up as a scientific discipline with many overlaps and interfaces to other fields and applications for myriad of areas of day-to-day life. For instance, the chemical industry exhibits co-evolutions with many other industries such as textiles, paper, automotive, oil, food, electricity and electronics and water energy. Chemistry cuts across almost all fields of human endeavours and could therefore be utilized to meet the needs and aspirations of the teeming unemployed graduates in the area of job creation, since
there are abundant opportunities (Dahiru, 2010). Based upon these, chemists are supposed to be job creators rather than job seekers. The missing gap in the chemistry curriculum is entrepreneurship. The new chemistry curriculum for senior secondary schools revised by the Federal Ministry of Education (FME) by 2009, stated as one of the objective among other is to show chemistry and its link with industry, everyday life benefits and hazards; The aim of this reform is to ensure that the programmes is relevant to the nation’s aspirations and meeting current technological development. The big question is; are the teachers implementing?

Chemistry entrepreneurship is not only suitable to tackle the problem of unemployment, it is also appropriate for growing natural economy. This being as it is, there is need for inclusion of chemistry entrepreneurship in the chemistry curriculum from secondary level to the higher level of education. Chemistry entrepreneurship being offered as a course will equip the students with the knowledge and skills to convert innovations from researches in chemistry into marketable products for commercial gain. Many of the household materials being used on daily basis are the products of innovations from chemistry researches. Such household materials as soap, candle, cream, toothpaste, slippers, shoe polish, insecticides, and herbicides among others are enough, if invested in, to make a chemistry graduate a wealth creator instead of a job seeker. In view of the issues discussed, this study therefore, aimed at enhancing performance for women empowerment through Chemistry entrepreneurship education using metacognitive problem solving strategy.

STATEMENT OF THE PROBLEM

The panacea of poverty, family disorganization and societal true development has suffered several sets backs over the years due to socio-cultural and economic factors. Unfortunately, gender gaps in education still exist. The national literacy rate for females is only 48%, compared to 73% for males (National Population Commission Nigeria, 2010). From the statistic, the gap within the girl-child and male-child literacy is 25% which is on a high side. Girls’ access to basic education, especially in the northern states, has remained low.

There are some limitations for women to progress in education and to be considered outside their family roles, expectations and responsibilities in the society. The girl-child is seen as more conforming, suggestible and dependent on the opinions of others. The traditional system of education often dictates that the place of the girl or woman in the society is in the home. Mohammed (2009) opined that most girl-children are engaged in either hawking goods on the street for their parents, and at some other times, the girls are engaged in early marriages and as a result of parental poverty and financial problems some parent prefer to educate the male and live the female. In some families, parents who have many children select the male and educate them, thus leaving the female untrained and uneducated. Not only that, the girl-
child has suffered enough discrimination among siblings and parents, and even the society and this has affected her education negatively. Forgetting the saying “if you educate a woman you educate a nation”. In order to build the girl-child confidence and self-reliance right from secondary school level to empower her for the future, teacher should be encouraged to use teaching strategies that enhance critical thinking and creativity. When a girl-child can think critically and make viable decisions on her own that will bring about problem solving in the society, then she will be able to stand firm and be highly useful in the society. Based on this affirmation, the objectives of this study is aimed at finding out the impact of metacognitive problem solving strategy on performance among the female SS 1 students in chemistry entrepreneurship education for women empowerment.

**RESEARCH QUESTION**
To achieve this objective, one research question was raised;

What is the impact of metacognitive problem solving strategy on female chemistry students’ performance compared with those taught with lecture method?

**Null Hypothesis**
One null hypothesis was formulated to be tested at 0.05 level of significance.

\[ \text{Ho1: There is no significant difference in the mean performance score of female Chemistry Students exposed to metacognitive problem solving strategy compared with those taught with lecture method.} \]

**METHODOLOGY**
The design of this study was a quasi-experimental design involving pre-test, post-test, with one experimental group and one control group. The population of the students comprised all SS 1 female secondary schools in Zaria Educational Zone. The use of SS 1 chemistry students was because it is a foundational stage for science subjects (Biology, Chemistry and Physics) and need to be treated with uppermost interest as it forms the base for developing their problem solving skill which will be needed in SS 2 and SS 3. There are 5 single sex girls’ public secondary schools in the zone, with a population size of 724 female students offering chemistry. Two schools were randomly selected from the population as the sample school with a sample size of 74 SS 1 female Chemistry students. Intact classes were used with 36 students in the experimental group and 38 students in the control group. The selected schools were grouped into experimental and control respectively using random sampling technique by balloting. Experimental group was treated using metacognitive problem solving strategy while the control group was taught using the lecture method. The instruments used for the study were a twenty-five-item multiple choice Chemistry Entrepreneurship Performance Test (CEPT) developed by the researcher, which was dully pilot tested and validated by 3 experts in the field.
of Chemistry Education. The reliability coefficient of the CEPT was determined using test-retest method within the interval of two weeks. Pearson Product Moment Correlation (PPMc) was used to determine the reliability and was found to be 0.74 which is viable for the study. The CEPT was used for data collection. Mean, standard deviation and t-test was used for data analysis.

RESULTS

**H01:** There is no significant difference in the mean performance score of female Chemistry students exposed to metacognitive problem solving strategy compared with those taught with lecture method. The result of t-test analysis is as shown in Table 1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Mdf.</th>
<th>SD</th>
<th>SE</th>
<th>df</th>
<th>t-value</th>
<th>p-value</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>36</td>
<td>36.15</td>
<td>7.04</td>
<td>0.33</td>
<td></td>
<td>17.88</td>
<td>10.29</td>
<td>0.001</td>
<td>S</td>
</tr>
<tr>
<td>Control</td>
<td>38</td>
<td>18.27</td>
<td>3.61</td>
<td>0.29</td>
<td></td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at P ≤ 0.05

Table 1, been a summary of the inferential statistic and t-test analysis of the mean performance scores of experimental and control groups. It has shown that a mean difference of 17.88 exists between the two groups in favour of the experimental group due to the treatment with metacognitive problem solving strategy. And the calculated p-value of 0.001 is less than 0.05 level of significant. This implies that exposure to metacognitive problem-solving strategy significantly enhanced the performance of the female students in the experimental group compared to their counter-part in the control group. Therefore, the null hypothesis of no significant difference is thereby rejected.

DISCUSSION

The findings of this study showed the effectiveness of metacognitive problem solving strategy over the lecture method used by most teachers in teaching chemistry in our school enhances students’ performance. The result revealed that there was a significant difference in the scores of students taught using the metacognitive problem solving strategy and those taught using the conventional approach. This finding therefore suggests that students having good metacognition are likely to achieve academic success in chemistry and thus depicting metacognition as a good predictor of performance. Metacognitive approach to teaching regulates the students’ learning process and problem solving and enhances the learners’ problem solving ability through strengthening their efforts to solve the problem (Mokos & Kafoussi, 2013). This shows that metacognition has a dual role: it forms a representation of cognition based on monitoring processes; and exerts control on cognition based on the
representation of cognition. In this context, it can be say that metacognitive problem solving strategy is effective in enhancing performance for women empowerment through chemistry entrepreneurship.

CONCLUSION

The finding of this study revealed that metacognitive problem solving instruction has an effect on female students’ problem solving skills and thus encourages women to become creative thinker in chemistry entrepreneurship education. By doing this the women are being empowered to become wealth creators since many of the household materials being used on daily basis are the products of innovations from chemistry.

RECOMMENDATIONS

Hence, an educational course is recommended to be designed in order to strengthen metacognitive strategies and consequently to enhance problem solving skills in students. Further, metacognitive training workshops are suggested to be held for teachers to develop their understanding of the important component of learning-teaching process.

REFERENCES


