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GENDER DIFFERENTIAL EFFECT OF BRAINSTORMING ON SENIOR SECONDARY SCHOOL STUDENTS' CREATIVITY IN DATA PROCESSING IN ANAMBRA STATE, NIGERIA

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Abstract
This study determined the effect of gender on senior secondary school students' creativity in data processing in Anambra State, Nigeria. Two research questions guided the study and two null hypotheses were tested. Quasi-experimental research design specifically, pre-test post-test non-equivalent control group design was adopted for the study. Population was 3,182 senior secondary two (SS2) Data Processing students in 2022/2023 academic session in Anambra State. A multi-stage random sampling technique was used to select a sample size of 60 intact class SS2 students for the study. Rating Scale for Creativity Skills in Data Processing was used for data collection. The face and content validity of the instruments were established using three experts. The reliability of the instrument was established through pilot testing method and data collected calculated using Cronbach's alpha which yielded coefficient values of .91. Mean was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. Findings of the study revealed that there was no significant difference in the mean creativity score of male and female students taught data processing using brainstorming teaching strategy. Furthermore, there was no significant interaction effect between the teaching methods and gender on students' creativity in data processing. The researcher therefore, recommended that, gender differences should not be introduced in brainstorming classrooms.
Keywords. Gender, Senior Secondary School, Creativity, Data Processing

Introduction

Education is a crucial instrument for sustainability as it offers the framework for development of nations. One major desire of every nation in the world is economic development. The focus has recently changed from mere development to sustainable development. This suggests that countries around the world are realizing that development alone may not be enough, particularly when it cannot stand the test of time. Therefore, there is an urgent need for sustainable development that will last from one generation to the next.

To achieve the Sustainable Development Goals by 2030, citizens must have unlimited access to not only education, but qualitative education (Uleanya & Gamede, 2017). Qualitative education according to Agommuoh and Joseph-Kalu (2020) enables senior secondary school students in Nigerian to acquire entrepreneurial skills for self-reliant and financially independent upon graduation to reduce youth unemployment. Secondary school education, according to the Federal Republic of Nigeria (FRN) (2013) is the education children receive after primary education and before the tertiary stage. The secondary education curriculum is designed to meet the national objective of preparing individuals for useful living within the society and higher education. Secondary school education is

provided in two stages - the upper basic secondary and post basic secondary. At the junior secondary level, typewriting, shorthand, book keeping, office practice and commerce are integrated as business studies. Senior Secondary School (SSS) is the higher level of secondary education. At the SSS level, business subjects such as financial accounting, keyboarding, data processing, economics, commerce, insurance, marketing, trademanship, and office practice among others are offered. It is expected that these subjects when offered, will expose the students to a plethora of business skills, as well as offer them good knowledge on how to become future entrepreneur. It is in recognition of this, that the Federal Government of Nigeria through its National Policy on Education, (FRN, 2013) adds entrepreneurship studies in the new curriculum of senior secondary schools in Nigeria.

Entrepreneurship education means a meticulously developed programme of instruction in schools intended to help students develop entrepreneurial skills needed to start, and manage business enterprises (Olaniyi, 2016). The aim of entrepreneurship education according to Omoniyi, Gamede and Olaniran (2022) is to equip students with knowledge and skills to support studies in entrepreneurship. In order to foster an entrepreneurial mindset and creativity among senior secondary school students in Nigeria, entrepreneurship subjects were broadened to 35 trade subjects, and included in the new secondary school curriculum, which was presented in 2008 and completely implemented in 2011. Out of 35 subjects, every student regardless of the field of study is expected to study five core subjects: English language, General Mathematics, Civic Education, a Science subject, and one trade/entrepreneurship subject. In addition to auto body repair and spray painting, trade/entrepreneurship subjects also cover auto electrical work; auto mechanical work; air conditioner/refrigeration; electrical installation and maintenance work; radio, TV and electrical work; block laying, brick laying and concrete work; painting and decoration; carpentry and joinery; upholstery; garment making; cosmetology; keyboarding; leather goods manufacturing and repair; animal husbandry; marketing; tourism; GSM maintenance, data processing, and others.

Data processing (DP) is the process of organizing, categorizing, and manipulating data in order to extract information (Huang, 2019). In the Nigerian Senior Secondary School curriculum, it is designed to test basic knowledge and skills in data processing (Education Research and Development Council (NERDC, 2013). The main objective of teaching data processing in the Nigerian senior secondary schools according to NERDC is to help students acquire a level of competence in ICT applications that will promote the acquisition of entrepreneurial skills for everyday living in the global world. Data processing is seen as a subject that can create employment opportunities for youths in Nigeria especially Anambra State. In view of this, Anambra State government in the year 2014 equipped all public secondary schools with computers, generators and other ICT facilities. However, a new emphasis on teaching strategies is necessary for the development of creativity in students in Anambra State secondary schools.

Creativity can be referred to as a quality held by people who create goods that are both original and adaptable. Juliana, Hui, Clement, Solomon, and Elvis (2021) defined creativity as the use of skills and imagination to create something new. It is an individual's ability to solve issues in creative ways and create works that are novel, suitable, and socially valued. Creativity can be cultivated, strengthened, or even hampered by institutional and environmental circumstances (Vejian, Kamarudin, & Kadir, 2016). Therefore, it is the responsibility of teachers to foster creativity at the classroom level. Every student has an inherent capacity for creativity, which is a fundamental ability for entrepreneurs. However, it would need to be developed before it could flourish in the student. It should be remembered that each student's rate of development is unique. While some students have a

high rate of creativity, others may have a very slow rate. This disparity in development rates may be caused by students' level of intelligence, teachers' competence, and teaching methods.

Innovative teaching strategies are necessary for creativity development. One of the most well-liked strategies for generating ideas is brainstorming, which involves teaching students how to solve problems in creative ways to prepare them for future real-world challenges. Brainstorming is a process of generating new ideas and solutions through intensive freewheeling group discussions. Hidayanti, Rochintaniawati and Agustin (2018) defined it as the use of brain to engage in active problem solving. Hidayanti, et al. noted that brainstorming involves thinking in numerous ways to dissect previous concepts, create new connections, extend the boundaries of knowledge, and come up with brilliant ideas. The authors posited that brainstorming encourages critical thinking, student interaction, and serves to inspire and stimulate students' acquisition of entrepreneurship skills. Mona (2019) asserted that brainstorming gives teachers the chance to introduce a problem and encourage students to come up with as many potential answers as they can in a short amount of time.

In view of the fact that gender of senior secondary school students may have impact on their creativity, this study used gender as moderator variable. The importance of examining instructional strategy in relation to gender is based primarily on the socio-cultural differences between males and females (Dania, 2014). Gender differences in creativity performance of students have been examined for some time resulting in inconsistent outcomes. For example, a study by Yuin, Tung and Sei (2021) found out that females are more creative than males. In contrary, other researchers reported that the males are more creative than the females (Piaw, 2013). According to Wang's (2011) research, female students scored higher than male students in terms of creativity. Additionally, Kamonjo (2016) discovered that men outperformed women in terms of adaptability, relationship awareness, sensitivity, planning, and overall scientific originality. Similar to this, Steidtmann, Kleickmann and Steffensky (2022) observed in their study that female students scored lower on creativity tests than male students when brainstorming teaching strategy was used. In contrast, Obi (2018) concluded that the level of creativity between males and females is much the same.

These findings showed that studies related to gender differences in creativity have not produced clear or consistent results. It is against this background that the study determined the effect of gender on senior secondary school students' creativity in data processing when exposed to brainstorming teaching strategy Anambra State, Nigeria.

Statement of the Problem

Since independence, Nigerians have been concerned and vocal about how to improve secondary education so as to produce graduates who can contribute to society by living a meaningful life. Due to these concerns from stakeholders, entrepreneurship was introduced and included into the secondary school entrepreneurship curriculum. The New Senior Secondary School Entrepreneurship Curriculum (NSSSEC) is designed to help secondary schools produce well-rounded graduates who have the necessary creative and other skills for both further education and the workforce. The NSSSEC have been in place for almost ten years, yet secondary school graduates' ongoing lack of creativeness raises concerns about the curriculum's capacity to improve students' creative performance.

Because graduates from Nigerian secondary schools seem not to have learned or possess the requisite skills, the majority of them are unsuitable for self-employment. These students can only be innovative and independent when teachers use the proper strategy while instructing students in

entrepreneurship. Unfortunately, the teaching methods used by secondary school teachers do not seem to give students the chance they need to participate in activities that foster creativity. This indicates that entrepreneurial education in secondary schools does not foster students' capacity for creative thought. It would seem that teachers' lecture-based teaching methods discourage students' creativity. Also, there have been inconsistent results about the effect of gender on secondary school students' creativity in entrepreneurship subjects. However, in Anambra State, there are very scanty empirical researches covering this area of the study. Therefore, in order to fill this gap in knowledge, This study specifically determined the: (1) differences in the mean creativity scores of male and female students taught data processing using brainstorming teaching strategy, (2) interaction effects of teaching strategies and gender on students' creativity in data processing.

Research Questions

The following research questions guided the study:

1. What is the difference in mean creativity scores of male and female students taught data processing using brainstorming strategy?
2. What is the difference in the mean creativity scores of male and female students taught data processing using brainstorming strategy and lecture method?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the mean creativity score of male and female students taught data processing using brainstorming teaching strategy.
2. There is no significant interaction effect between the teaching methods and gender on students' creativity in data processing.

Method

The design for the study was a quasi-experimental design; specifically pre-test post-test non-equivalent control group design was adopted. The study was carried out in Anambra State, Nigeria using the population of 3,182 (444 male and 1,738 female) SS2 students from 256 public secondary schools in the six (6) Education Zones in Anambra State offering data processing in 2022/2023 academic session (Source; Post Primary School Service Commission (PPSSC) Awka, Anambra State as at April 2022). The sample size of 62 SS2 data processing students from two co-educational secondary schools in two different education zones in Anambra State was drawn using multi-stage random sampling technique (simple random sampling and purposive random sampling techniques). The experimental group (E) comprised 32 students (20 females and 12 male) and control group (C) had 30 students (15 male and 25 female).

Instrument for Data collection was a self-developed questionnaire Titled "Rating Scale for Creativity Skills in Data Processing (RSCSDP) ". The instrument is divided into two sections, A and B. Section A dealt with personal data of the students such as gender and name of school while Section B dealt with RSCSDP containing 30 items designed based on the SS2 data processing curriculum. The RSCSDP was structured on a five point rating scale of: Very High Extent (VHE) 5 points, High Extent (HE) = 4 points, Moderate Extent (ME) = 3 points, Low Extent (LE) = 2 points and Very Low Extent (VLE) =1 point. Face and content validity of RSCSDP was ascertained using the opinions of three experts; one expert from the Department of Educational Foundations and two experts from the Department of Technology and Vocational Education Nnamdi Azikiwe University Awka. The reliability of the instrument was established using pilot-testing method, and Cronbach Alpha was used

to establish the internal consistency of the instrument which yielded a reliability coefficient value of 0.91.

Four (4) research assistants (data processing teachers in the school) and the computer laboratory attendant rated the students on creativity skills in data processing in both experimental and control group (pre-test) and (post text) at the end of the exercise. The research questions were answered using mean while the null hypotheses were tested using the Analysis of Covariance (ANCOVA). The decision on hypotheses is that where the p-value is less than or equal to the level of significance (0.05), the null hypothesis was rejected and where the p-value is greater than the level of significance, the null hypothesis was accepted. The calculation of the mean and ANCOVA were carried out using SPSS version 23.

Result

Research Question 1. What is the difference in mean creativity scores of male and female students taught data processing using brainstorming strategy?

Table 1.

Pre-test and Post-test Mean Creativity Scores in Data Processing of Male and Female Students Taught with Brainstorming Teaching Strategy

Source of Variation	N	Pretest Mean	Post-test Mean	Mean Gain	Mean Difference
Male	14	42.93	90.43	47.50	0.75
Femle	16	42.94	91.19	48.25	

Data in Table 1 shows that the male students taught data processing with brainstorming teaching strategy had pre-test mean creativity score of 42.93 and post-test mean creativity score of 90.43 with gained mean 47.50, while the female students taught data processing with brainstorming teaching strategy had pre-test mean creativity score of 42.94 and post-test mean score of 91.19 with gained mean 48.25. With gained mean difference of 0.78 (48.28 - 47.50) in favour of female students, brainstorming teaching strategy is more effective in enhancing female students' creativity in data processing.

Hypothesis 1. There will be no significant difference in the mean creativity score of male and female students taught data processing using brainstorming teaching strategy.

Table 2.

ANCOVA on the differences in the post-test mean creativity scores of male and female students taught data processing using brainstorming teaching strategy

Source	SS	df	Mean Square	F	P-value	Decision
Corrected Model	10.266[a]	2	5.133	.084	.920	
Intercept	1918.086	1	1918.086	31.351	.000	
Pretest	5.966	1	5.966	.098	.057	
Gender	4.289	1	4.289	.070	.093	Not Significant
Error	1651.900	27	61.181			
Total	249183.000	30				
Corrected Total	1662.167	29				

Data in Table 2 show that there was no significant main effect due to gender on the achievement scores of the students, F (1, 29) =.070, P (.093) > 0.05. Since the p-value is greater than the level of significance, the null hypothesis is therefore accepted. Thus, there is no significant difference in the mean creativity score of male and female students taught data processing using brainstorming teaching strategy.

Hypothesis 2. There is no significant interaction effect between the teaching methods and gender on students' creativity in data processing.

Table 3.
ANCOVA on the interaction effect in the post-test mean creativity scores of students based on their gender and teaching methods

Source	SS	df	Mean Square	F	P-value	Decision
Corrected Model	27608.916[a]	4	6902.229	164.518	.000	
Intercept	3352.092	1	3352.092	79.899	.000	
Pretest	17.049	1	17.049	.406	.526	
Group	5751.429	1	5751.429	137.088	.000	
Gender	2.810	1	2.810	.067	.797	
Group * Gender	21.141	1	21.141	.504	.481	Not Significant
Error	2307.484	55	41.954			
Total	318898.000	60				
Corrected Total	29916.400	59				

In table 3, it is observed that at 0.05 level of significance, 1 df numerator and 59 df denominator, the calculated F is.504 with P-value of.48 which is greater than 0.05. Therefore, the fourth null hypothesis is accepted. So, there is no significant interaction effect between the teaching methods and gender on students' creativity in data.

Discussion of Findings

Findings of this study disclosed that female students performed better than their male counterparts when taught data processing using brainstorming teaching strategy. However, this difference in creativity of male and female students is not significant. Perhaps, the difference between male and female students was a chance occurrence. The findings of the study support that of Yuin, Tung and Sei (2021) which revealed that female secondary students scored higher in mean creativity scores than the males. In contrast, Obi (2018) and Steidtmann, Kleickmann and Steffensky (2022) both revealed that male students scored high in creativity tests than females. Similarly, the finding of the study that revealed that the difference in mean creativity score due to gender was not significant supports that of Wagbara (2020) who reported no gender disparity in the use of brainstorming teaching strategy on students' creativity. Collaborating, Filgona, Sababa and Iyasco (2016) found no significant effect of gender on the creativity of students taught using brainstorming teaching strategy. The researchers suggest that the no gender difference in mean creativity scores among students could be as a result of ample opportunities created by brainstorming classroom for every student irrespective of gender to partake in classroom discussions and activities leading to findings solutions to problems in the classroom.

Findings of the study showed that there was no significant interaction effect between the teaching methods and gender on students' creativity in data processing. This indicates that while the effect of the treatment was significant, the interaction effect with gender was not significant. It then means that the treatment does not depend on gender to be effective. Hence, the observed difference in the mean creativity scores of male and female students among teaching methods was merely due to chance. The findings of this study align with that of Piaw (2013) who reported no significant interaction effect between teaching methods and gender on overall students' creative thinking ability. Rampersad and Patel (2014) asserted that the extent of success was not totally based on gender or the responsibilities laid on a particular gender but rather on the creative level of students and their ability to manage their creativity to enable them achieve academic goals. However, XiaojuanWeiping, Fengchun, Haihong, Jing, Mark and Yinghe (2017) observed a significant interactive effect between teaching methods and gender in students' creativity. The findings of this study has no doubt contributed to the on-going debate or discourse regarding the interactive effect of teaching methods and gender on students' creativity in entrepreneurship education.

Conclusion

The results in this study provide empirical evidence that students creativity in senior secondary school Data processing depend on the method of instruction adopted and are not influenced by gender. The study has shown that gender (male/female) had no significant effect on students' creativity in Data processing. It can therefore be concluded that gender of students whether male or female, does not have any influence on the effectiveness of brainstorming teaching strategy employed in this study. This is an indication that if the brainstorming teaching study is used effectively for male and female students, they are likely to produce the same result.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Data Processing teachers should use more of brainstorming in teaching the subject so as to enable male and female senior secondary school students to actively participate in classroom instructional processes to enhance their creativity.
2. Gender differences should not be introduced in brainstorming classrooms in order to enhance students' creativity in data processing. Data Processing teachers in secondary schools should not bring into the instructional process, learning experiences and resources that could encourage gender bias.

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