Innovations

Performance and Situation-interest of Physics Students Exposed to Collaborative and Reciprocal Peer-Tutoring Strategies

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Abstract: *The research investigated the performance and situation-interest of Physics students exposed to collaborative and reciprocal peer-tutoring strategies in secondary schools. This was with a view to ascertaining the need to compliment the long aged conventional strategy with students' interactive strategies that could sustain the goal of learning Physics at the secondary schools. The study adopted quasi-experimental design of non-equivalent pretest posttest control group. The target population for the study comprised 3425 secondary Physics students in senior secondary two in Osun State of Nigeria. The sample of the study consisted of 148 senior secondary school two (SSS II) Physics students in their intact class selected using multi-stage sampling procedures. Physics Performance Test (PPT) and Situation-interest Questionnaires (SiT) used for data collection were scrutinised by experts for their contents validity. The PPT and SiT were found reliable at 0.78 and 0.80 using Kuder-Richardson 21(KR-21) and cronbanch alpha respectively on 35 Physics students outside the study area. Collaborative, reciprocal peer-tutoring and conventional groups were taught with the same contents but each with peculiar strategy that charaterised the group. Mean, standard deviation, Analysis of Variance, Post-Hoc analysis and t- test statistics were used for the analyses. The result of findings showed that there were statistical significant differences in the performance and situation-interest in the three groups. Reciprocal peer tutoring group performed better followed by collaborative and the conventional groups in that order, so likewise with the situation-interest. The research concluded that with using reciprocal peer tutoring and collaborative strategies, students' performance and their situation-interest in the class can be sustained over a period of time which is ultimate desirable end a teacher would be expected in the course of study.*

Keywords:*1. Performance, 2. Teaching, 3. Situation-interest, 4. Physics Students, 5. Collaborative strategy, 6. Reciprocal Peer-Tutoring Strategy*

Introduction

Teaching is a dynamic process involving series of events in overlapping phases to achieve education goals at all levels. Teaching is said to be done if it succeeded to produce change in the behavior of the learners with reference to cognitive, affective and psychomotor expectations in the curriculum or the implied. In recent times, much fact has gone into teaching to stripe it off from all forms of initiation or indoctrination as experienced in the informal settings. According to Adebisi and Dania (2018) teaching is an action packed processes involving impartation of skills, knowledge or giving of instructions to the learners based on some pre-determined aims and objectives in a formal setting. They further submit that teaching is concerned with social, emotional, psychomotor and cognitive development of learners. With enormous expectations from the scope of teaching, it calls for effectiveness in a formal setting to make it purpose-driven. Effective teaching cannot be achieved in one directional rigid teaching strategy. This implies that the teachers are the sole factor to coordinate and use their initiative to bring about effective teaching. It is important for teachers to be conversant with the use of varieties of teaching strategies to disengage the mind of students from distraction in this global age of many activities of encumbrances. That is, teachers should be active and be stereotyped free with array of strategies to compliment conventional mode of disseminating instructions to students.

Particularly, science teaching demands interactive activities which without will make the trends of its knowledge acquisition to be discrete and disjointed in the course of learning scientific concepts and application of procedure to the natural world from the classroom which could portray science as difficult and abstractive. Effective science teachers aimed at educational goal through activities involving laboratory exercises, laden activities with problems solving and logical procedures to interpret facts from the nature. This will make science teachers to be non-robotic but rather curriculum complaints and agents to support sustainable development. Therefore, science teachers need to incorporate deferent teaching strategies because students tends to operate in different Zone of Proximal Development (ZPD) during learning, besides, science is characterised with varying contents presentation in accordance with curriculum dictates. At this zone students can complete a range of tasks independently or collaborate with peers to solve problems under the watch of a guidance and assistance of adults or more-skilled individual (Mishra, 2013; Bautista, 2013), learning is believed to take place at this zone. This therefore prepares teachers not to be myopic or stereotyped in the usage of talk and chalk strategy of teaching a typical form of conventional strategy alone to avoid the learners from being passive in the class of science.

In the context of Physics as one of the physical sciences, Physics teachers are expected to assess cognitive, affective and psychomotor abilities of students using

different strategies while learning (Adebisi, 2021). Furthermore, Physics involves problem solving, appropriating laws and principles to solve questions in the classroom and experimenting where students need to observe, measure, interpret and plot graph as major exercises that demand involvement of students (Adebisi, 2022). Therefore differentiated learning strategies become imperative to allow students of different zone of proximal development learn better in Physics. For this reason, it is important that the teachers should employ teaching strategies that will enhance students' participation and interactions. Besides, there is a need to close the gap in knowledge between the fast and slow learners during the learning exercise in the classroom. There are several interactive strategies in literature, but this paper is examining collaborative and reciprocal peer- tutoring strategies.

Collaboration rests on axis of mutual engagement of the learners to work together in a small group as a team in solving problems. Collaborative strategy gives rise to collaborative learning which is an active enterprise in teaching and learning. Collaborative learning tends to feature more fluid, shifting roles, with group members crossing boundaries between different areas of work, or co-deciding the best ways to collaborate on their joint project (Dillenbourg, 1999; Bereiter&Sardamalia, 2006). The activities of collaborative learning are ideally suited for scientific inquiry inclined. The difficulty of getting regular feedback in convectional learning is reduced to minimal during collaborative endeavours among the students, also, the association as a team increase interactive learning in a way that maximize students' involvement and promotion of reflective and critical thinking. Further advantages of collaborative strategy are learners' improved ability to evaluate problems critically, apply effectively learned concepts to new situations or contexts, Its strength lies in the combined forces applied to address common goals or problems (Novicevic, Buckley, Harvey, & Keaton, 2003). There is a strong evidence that students working in small groups outperform students working individually in several key areas, including knowledge development, thinking skills, social skills, and course satisfaction (Barkley, Major, and Cross, 2014; Johnson & Johnson, 1994; Stroebel& Van Barneveld, 2009). This study extends its view to the implementation of reciprocal peer tutoring strategy.

Reciprocal peer-tutoring strategy is a teaching intervention strategy anchors on students' involvement by which students alternate between the role of tutor and tutee. According to Fantuzzo, Polite and Grayson (1990), in Reciprocal Peer-tutoring strategy students gather in groups of two or more are trained to work together on a given academic activities. With this, the students work together in peers to learn better in social context to review their lessons, cooperate with other students in group and evaluate each other's activity through observations and interactions. The benefits of this strategy is that every student is carried along in the course of learning and exclusively a social interaction affairs which will alleviate or

remove fear imbibed by some students in a large class as obtainable in convectional learning. The purpose of different strategies is to enhance among other learning outcomes is the performance of students. It is important to look for the ways against the backdrop of poor performance in senior secondary schools Physics through innovative strategies that will equally enhance students' interest towards the subject. Students' interest can be an underlying factor for the performance of students because it is psychological based. If the strategy used by the teachers is monotonous and scaring it might induce less attention, lack of curiosity and concentration. It is obvious that interest is a psychological variable that can determine interactions and learning habit that are prevalent in the class.Interest is a critical factor to all adventures in life and is influence does not exclude any category of humans. Interest is one of the internal factors that influences (Azmidar, Darhim, &Dahlan, 2017). They further state that Interest is not spontaneous but can be turn up due to participation, experience, and habit when studying or working. Such interest could be situational which can be brought up within the mind frame of students at an instance. It is a motivational factor that could be as a result of situations during the course of learning and such is known as situation-interest that is needed in the study of science. Situation-interest is unplanned, momentary and environmentally activated that can be actualized to refine and give direction to an individual's personal interest. Situation-interest appears to be especially important in catching students' attention (Durik&Harackewicz, 2007; Mitchell, 1993). Teachers mode of delivering their strategy is utmost perquisite to stimulate situation-interest which can rise the to developing personal interest in the lesson and in the subject and this can be done through students' learners involvement that are interactive and enquiry based.

The teaching of science in many schools over the years has been following a rigid and stereotyped pattern at detriment to students' performance and interest. This has made sciences especially physical sciences like Physics and Chemistry scaring to students at the secondary schools education level. However, with the input from global researches ongoing in many countries of the world, it is evidently shown that teaching of science should go beyond conventional methods to arose the interest and enhance performance. Besides, the contributions of Psychology theorists have no doubt added valuable input to handle different students in the class of science. To this end this research tended to see the contribution of collaboration and reciprocal peer-tutoring strategies to enhance students' performance and situation-interest in Physics learning as obtainable in lower schools and in other subjects, therefore the study was conducted.

Theoretical Framework

The study is underpinned on research works of cognitive .of Jean Piaget and social constructivism of Lee Vygotsky.. Piaget rejected empiricism and idealism view on intelligence and he claimed that knowledge is continually developing in a relation between nurture and nature. This is underlying principle of adaptability level of cognitive development that a child is born to be naturally active and dynamic in a given environment, the basis of interaction which promotes organization of thinking and knowledge into structures (schemas). Piaget considers schemas to be the basic building blocks of thinking (Woolfolk, 1987).A child schemas are created through the process of assimilation and accommodation the phenomenon that describe both the mental and physical actionsin understanding and knowing (Baken, 2014). In assimilating knowledge, students incorporate their experiences and observations into logic of their existing or developing understandings. Accommodation occurs when there is a conflict or mismatch between new information and the students' internal models, leading students to adapt their existing understandings and expectations to incorporate their new perceptions and experiences. The theory points out the tendency that two learners are likely to respond differently to the same stimuli because of differences which distinguish them from each other. .

In collaboration and reciprocal peer-tutoring learningstudents acquire knowledge individually as well from the others in the group, there could be conflict of ideas which will prompt critical thinking, discussion, discovery that could lead to cognitive development. Teachers' role at this point is to facilitate learning through contributory information to group members.

The Vygotsky works covered child development, development of higher mental functions and the significant role of parents on a child through social interactions. The tenet of child interactions with the society proposed by Lee Vygotsky articulated shared knowledge for the sustenance of the child and the cognitive growth in the given society as a result of active interactions, constructive feedback and collaboration with others. This is premised oninternalization which is characterised with shared knowledge, appropriation and demonstration.Vygotsky emphasized the importance of internalization in cognitive development (DeVries, 2000). Vygotsky argued that ability to solve problems independently or with an adult's help determine intelligence. This led to the concept of zone of proximal development (ZPD) proposed by Vygosky which he stated thus.

> ''What we call the zone of proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined

> through problem solving under adult guidance or in collaboration with more capable peers''(Vygotsky, 1935/1978a, p. 86.

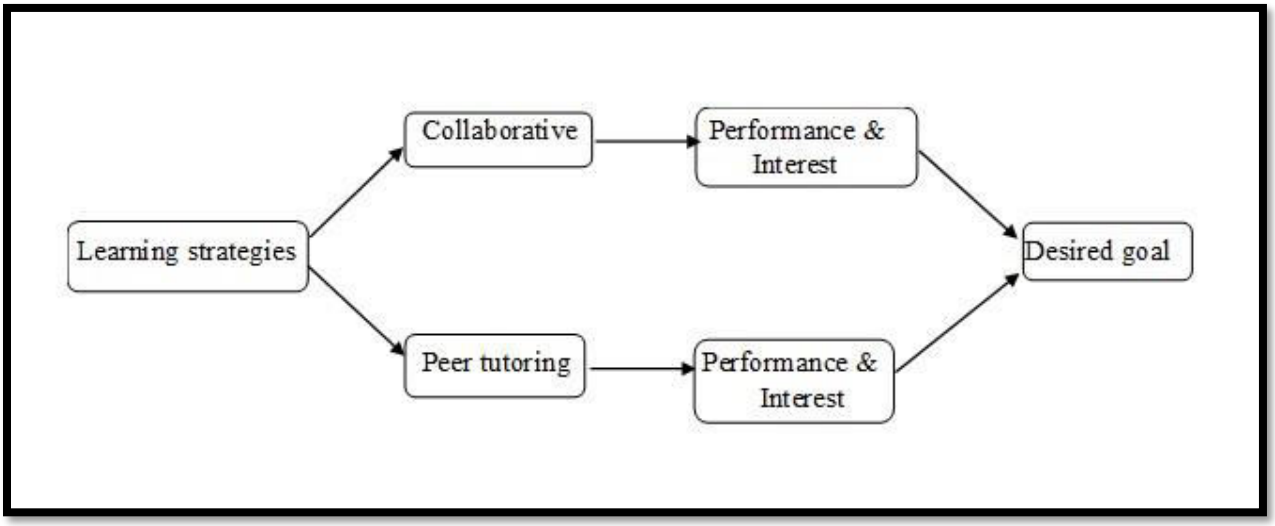
Cole and Cole (2001) point out that the term proximal shows the assistance provided goes slightly beyond the learner's current competence complementing and building on their existing abilities. Vygotsky describes the present level of development of the learner and the next level attainable through the use of mediating semiotic and environmental tools and capable adult or peer facilitation (Karim, Mohamad, Saman, 2010). This brings about the influence of collaboration and peer-tutoring which are germane to teaching.

Literature Review

The concept of interest is germane to all humans and it has tendency to influence the drive of individuals towards outward disposition. Interest is a domiciled nature that is capable of being aroused or stirred up over a particular situation or objects. It could be preference or situation influenced.Interest is a motivational variable that can inform us about why individuals are inspired to engage and to learn specific subject matter (Hidi, 2000). Interest is a self- motivated factor that has strength to step up an individual personal interest and can be active when all surroundings variables are at congruent with it. Interest development can arise through situation interest during the activities of engagement, if students repeatedly experience situation interest in relation to what is learnt , such may eventually develop enduring interest known as individual interest (Renninger& Hidi,2019).Interest, according to Ardodo&Gbore, (2012) possesses the strongest strength for predicting performance. Long(2019) in his study aimed at a possible association between interest and mathematics performance in a technology-enhanced learning environment, results showed that there was significant relationship between interest and the performance among students with lower mathematics ability level. In another study conducted by Arhin and Yanney (2020) on 200 respondents from the population of 670 on the relationship between students' interest and academic performance in Mathematics at Agogo State College. The findings showed show that there was significant relationship between students' interest in studying mathematics and academic performance with high positive correlation (r = .813). Mathematics and Physics shared many things in common, so interest could be considered important for students during the learning of Physics. Ogunleye, Awofalaand Adekoya (2014) asserted thatMathematics and science at lower stage of education are sharing common objectives and the former is desirable for a better academic performance in the latter. Science consists of interrelated concepts and several activities that demand good and appropriate mindset for students to perform better. The complex

path to a good performance involves series of actions in integration of skills and knowledge through assimilation and accommodations to produce a valuable result in the domain of teaching. This demands effective teaching and coordination in the class for students to be involved in the learning process. Steinert and Snell (1999) state that the use of interactive strategies as a resource could help the students to become more engaged in learning and to retain more information as a result of interest stimulations in learning environment.

Figure 1: A Schematic diagram showing interactions among the study variabl



The schematic diagram in Figure 1 shows the influence of each of Collaborative and Reciprocal Peer Tutoring strategies on the performance and situation-interest in Physics. The two strategies can produce desired goals of learning Physics.

Purpose of the Study

The purpose of the study was to investigate performance and situation-interest of Physics students when exposed to collaborative, reciprocal peer tutoring and conventional strategies. The specific objectives of the study are to:

(i) examine the influence of collaborative, reciprocal peer tutoring and conventional strategies on the performance of secondary school Physics students in Osun State of Nigeria.

(ii) examine the influence of collaborative, reciprocal peer tutoring and conventional strategies on the situation-interest of secondary school Physics students in Osun State of Nigeria.

(iii) assess the influence of collaborative and reciprocal peer tutoring strategies on the delayed performance of secondary school Physics students in Osun State of Nigeria.

Research Hypotheses

(i) There is no significant difference in the performance of Physics students when exposed to collaborative, reciprocal peer-tutoring and convectional strategies in the study area.

(ii) There is no significant difference in the situation-interest of Physics students when exposed to collaborative, reciprocal peer-tutoring and convectional strategies in the study area.

(iii) There is no significant difference between the delayed performance of Physics students exposed to collaborative strategy and those exposed to reciprocal peer tutoring in the study area.

Research Method

The study adopted quasi -experimental design of non-equivalent pretest posttest control group design. The study involves two experimental groups of collaborative and reciprocal peer tutoring groups and one conventional group. The three groups used for the study are intact to avoid the disintegration of the classes and they were taught with the same similar concepts using peculiar characteristics of the strategy for each group. The pretest instruments of performance tests in Physics and situation-interest were administered before the treatment. The treatment on the three groups went on for the period of seven (7) weeks after which the posttest was administered to the three groups.

The target population for the study comprised 3425 secondary Physics students in senior secondary two (SSII) in Osun State of Nigeria. A representative of 148 students constitutes the study sample size from senior secondary school two Physics students selected through multi-stage procedure in this manner. One senatorial district was selected randomly and one Local Government Area (LGA) was also selected through randomization from the selected senatorial district. Two schools were purposively selected from the local government out of which three intact classes were purposively selected on the criteria that the schools are readily available for the study; have certified Physics teachers; having enough students for the research and the classes selected are based on science class. For schools A, has three groups of collaborative, 30 students, reciprocal peer-tutoring, 18 students and conventional, 28 students while group B has three

groups of collaborative, 26 students, reciprocal peer-tutoring,12 students and conventional, 34 students.

The study used two (2) research instruments which are Physics Performance Test (PPT)and Situation-interest Questionnaires(SiT). The PPT was used to determine the performance of the three groups while (SiT) was used to determine situation interest in Physics for the three groups. The PPT was validated by two Physics educators from the Department of Science Education at ObafemiAwolowo University, Ile-Ife, Nigeria. The experts examined the items of the instrument in line with Physics curriculum and make necessary corrections on the use of language and distracters among the options. Situation-interest Questionnaires (SiT) elicited the prevalent interest during the learning. Face and contents validity of SiT was scrutinised by an expert from Education psychology. The reliability of PPT and(SiT) instruments was done by administered to 25 students outside the sample study and found reliable at 0.78 and 0.80 respectively through Kuder-Richardson 21(KR-21) and cronbanch alpha respectively.

Collaborative Teaching Strategy

- Groups of 5-8 students.
- The teacher encouraged each student to actively participate with their group members
- The topic and sub-topics to be discussed in the following class were presented to the students for preparation
- The teacher shared the responsibilities to each member in the group (there is freedom to change what has been given with their peers.
- Time for togetherness was specified
- The teacher watch from a close distance to moderate the discussion
- The teacher comes back to introduced the class work or assignment to be done
- The teacher presented the assignment to be discussed
- The assignment is discussed in the following class by all the students in succession.
- The group repeated the process throughout.

Peer-Tutoring Teaching strategy

- Groups of 2-4 students.
- The topic and sub-topics to be discussed in the following class were presented to the students for preparation

- One of the students in the group take charge of the responsibility of a tutor in a conducive learning environment while others are learning students
- A goal to be reached at the end of the lesson is moderated by the class teacher
- The teacher watch from a close distance to moderate the discussion
- The tutor gave out the assignment
- the tutor evaluate his teaching for the next class
- the tutor presented the assignment to be discussed
- The group repeated the process throughout by alternating the tutor (student) and the students

Conventional Teaching Strategy

- The students are not grouped
- The teacher encouraged each student to actively participate in the class
- The teacher introduced the topic and sub-topics to be discussed
- The teacher taught the whole lessons through talk and chalk strategy
- The teacher gave out the assignment to be discussed
- The teacher repeated the process throughout

Procedure for Data Collection

The researchers sought for willing research assistance among post graduate students. The willing researches assistance were trained and they met up with the criteria as pre-service Physics teachers, and are familiar with National curriculum. The researcherers after obtaining permission from the schools to use administered the pre-test of the instrument on the three groups with help of research assistance. The treatment lasted for seven weeks after that, the posttest instruments were administered on three groups again. The researchers waited for three weeks after the posttest before retention test was administered to collaborative and of reciprocal peer- tutoring groups to ascertain their retention abilities.

Data Analysis Technique

The data retrieved from the administered PPT and SiQ were analyzed with differential statistics of mean and Standard Deviation and inferential Statistics of Analysis of Variance (ANOVA) and Scheffs's Post Hoc analysis.

Findings

(A) Performance Results

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Conflict of Interest Statement
The authors declared no potential conflicts concerning the research, authorship, and/or publication of this article

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