

EVALUATING THE PEDAGOGICAL COMPETENCE OF INTERDISCIPLINARY STRATEGIES IN THE TEACHING OF PHYSICS IN SECONDARY SCHOOLS IN AKWA IBOM STATE

Dr Patrick J. Uko

Faculty Of Education Akwa Ibom State University, Ikot Akpaden, Mkpata Enin L.g.a Nigeria

Uko, Mary Patrick (Ph.D)

Department Of Educational Foundation College Of Education, Afaha Nsit, Nsit Ibom Local Government Area, Akwa Ibom State

<https://doi.org/10.54922/IJEHSS.2024.0716>

ABSTRACT

Some science topics in the secondary school curriculum, especially in physics, are often encountered by learners to be difficult as their teachers use didactic approaches in lesson delivery. This often results in poor learners' achievement evidenced in their poor outings in public examination. This study was designed to evaluate the pedagogical competence in the application of interdisciplinary strategies in the teaching of selected difficult topics in physics in secondary schools in Akwa Ibom State. Three research questions and three null hypotheses guided the study. A quasi-experimental research design was adopted for the study. Simple random sampling technique was used to select 115 senior secondary one (SS1) students from 6 intact classes as the sample size. A 25-item Physics achievement test developed from the contents taught was used to collect data for the study. The instrument had a face and content validation by three specialists. Kuder-Richardson (K-R20) was used to determine the internal consistency of the test items and a coefficient of 0.89 was obtained. Mean and standard deviation was used to answer the research questions while ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings show that there was a change as students taught using interdisciplinary strategies had higher mean achievement score than their counterpart and that gender had no significant influence on the achievement. Also, there was no interaction between gender and method. It was recommended that interdisciplinary strategies should be integrated into the teaching of difficult concepts in physics for effective teaching and learning and for improved academic achievement.

Keywords: Interdisciplinary Strategies, Pedagogical Competence, Physics Teaching, Students' Academic Achievement.

1. INTRODUCTION

Learning achievement is often considered as the most critical aspect of an instructional encounter since it basically determines the outcome of the entire gamut of an instructional process. Based on this, it is vital that result-oriented strategies be deployed by teachers in the teaching of the various components of the school curriculum. The most rewarding strategies are the ones with the potential of accelerating learning due to both the scaffolding and traveling effects on the learner's mental structures. Greater emphasis must therefore be placed on the selection of teaching strategies utilized by the teachers.

Tophart Glossary (2023) views learning achievement as the measurement of the amount of academic content a student learns within a given time frame. It could equally be seen as the extent

to which a learner has attained their short or long term educational goals. El Education (2023) associated student's achievement with mastery of knowledge and skills, high quality student's work and character. Ali et al., in Ohanyelu (2022) emphasized that academic achievement is crucial in creating the most excellent quality students, who will become great leaders of tomorrow and manpower force, hence responsible for the country's economic and social development. So far, a nexus has been established between learning achievement and economic growth of a nation.

Bush Centre Briefing (2016) affirmed that, educational achievement strongly predicts economic growth through a positive correlation between growth and the quality of the workforce. A study conducted by Ramirez et al (2006) disclosed that global educational policies are geared towards aggregate student's achievement, as a means of increasing economic growth. The importance of economic growth of any nation cannot, by any means, be underestimated, as it defines their existence. Hanushek & Woessmann (2021) testified that economic growth determines the future wellbeing of societies and that the long run growth in Gross Domestic Product (GDP) of nations is a function of the skills of a nation's population. Science and technology play a key role in the development of any nation. In the same vein, physics is an important subject in the trinity of science. In Nigeria and other nations, physics is accorded prominence because of its central and pivotal role in technological development and other sustainable human development. Ayodele (2016) had noted that the technological culture of any nation cannot be firmly rooted without physics. The influence of physics cuts across all areas of modern technology and human existence.

In spite of the well known importance of physics in the life of our country, physics students offering the subject in exit/public examinations are not performing well, as revealed by the West African Senior School Certificate Examination (WASSCE) results of Akwa Ibom State Students from the year 2009 to 2019.

Many reasons could be advanced for this development especially at the secondary school level. One of them is the perception by students that the subject is difficult and associated with abstracts and mathematical concepts. Another, is the way the subject itself is being taught by teachers, using mostly the conventional and didactic teaching methods. Other problems, as observed by Jegede and Adebayo (2013), WAEC Chief Examiners' report (2018) and Adeyemi in Olufunke (2022) include negative attitudes of students towards physics, gender difference, poor science background among others.

Gender, in the views of Yang cited in Olufunke (2022) refers to the social attributes and opportunities associated with both male and female and the relationship between women and men, as well as the relations between girls and boys. American Psychologist Association cited in Olufunke (2022) refers to gender as the attitudes, feelings and behaviours that a given culture associates with a person's biological sex. Gender is socially and culturally oriented and therefore, it is dynamic. Gender difference has continued to be an issue of concern to educators and researchers. In Nigeria, reports from some studies requesting female and male adolescents to indicate their choices of subjects revealed that the adolescents selected different courses that followed gender stereotypes. Male prefer mathematics and sciences while the female opted for reading and life sciences (Aina, 2013; Olufunke, 2022). Gender, contributed to poor achievement of students in Physics. Babajide cited in Olufunke, (2022) in his research reported disparity in the education of girls and women in science and technology in Nigeria. These factors constitute major

threats to meaningful learning of physics by students of the Nigerian School System. They are the main viruses that must be eliminated.

Generally teachers are at the forefront of student's learning during instructional encounters and the extent to which the students succeed in school is hugely determined by the quality of teachers facilitating instructions, as well as the teaching strategies deployed by them.

The instructional strategies utilized by teachers must have pedagogical competencies if the learners must profit, at least optimally, from an instructional encounter. Teachers must come to the realization that they have to bring up learners to view the world as a place where every knowledge encountered should be optimized. For this to be actualized, learners must be made to have interdisciplinary understanding of concepts, especially the sciences. The monumental and unprecedented breakthroughs of the 21st century in the field of science and technology as experienced globally therefore calls for the deployment of teaching strategies capable of accelerating learning achievement by students (Uko and Uko,2020)

Interdisciplinary teaching is a method, or a set of methods used in teaching across curricular disciplines or bringing together separate disciplines around common themes, issues or problems (Wikipedia, 2022).

Holdbrook and Rannikmae (2019) contend that interdisciplinarity implies combining subjects or more disciplines into a new form of integration such that boundaries start to break down.

In the same vein, Goldsmith, Darrick, Karen, & Dave (2022) averred that the hallmark of interdisciplinary education is the integration of notions and guiding principles from multiple disciplines to systematically form a more complex, and hopefully coherent framework of analysis that offers richer understanding of issues under examination. Berzqvist, Jerneck, Richter & Steen (2019) perceived interdisciplinarity as a concept, a process, a methodology and a reflexive ideology.

Herbert (2021) had expressed that an effective teacher should prepare students for their future in the 21st century, problem-solve and make connections beyond the silos of single discipline classroom. There are plethora of benefits accruing from the adoption of interdisciplinary teaching approach, one of which is the socially relevant knowledge (Dezure, 2017). Gombrich & Hogan (2017) advanced two primary reasons for implementing interdisciplinary education as – learning how to understand relate and engage in the approaches of different academic discipline and fastering of metacognition. Sudderth (2022) believes that interdisciplinary teaching expands what student actually learn by allowing them tackle problems that don't fit neatly into one subject. It also changes how students learn by guiding them to synthesize multiple perspectives instead of taking what they are told by the teacher at face value as well as creating a chance for them to hone skills such as critical thinking and communications.

Goldsmith, Hamilton, Honsby and Dava (2022) realized that students who are regularly exposed to classroom conversations and assignments that tackle real world problems in an interdisciplinary fashion, often engaged in significant learning, realizing cognitive gains and are better positioned to understand challenging problems and frame viable solutions. Rannikmae and Holbrook (2019) noted that many of the world's great problems require an interdisciplinary approach in arriving at potential solutions. And also that most creative thinkers in the world are people who can make linkages between different areas of studies taught. This study seeks to investigate the pedagogical competencies of using interdisciplinary teaching strategies in the teaching and learning of selected difficult concepts in physics.

PURPOSE OF THE STUDY

The purpose of this study was essentially to:

1. Determine the mean achievement scores of students taught physics using the interdisciplinary teaching strategies and those taught using the conventional method.
2. Find out the mean achievement scores of males and female students taught physics, using interdisciplinary teaching strategies.
3. Establish the interaction effect between interdisciplinary teaching strategies and gender.

RESEARCH QUESTIONS

In investigating the pedagogical competence of interdisciplinary strategies in the teaching of selected difficult topics in physics, the following research questions were raised.

1. What is the mean achievement score of students taught physics using interdisciplinary teaching strategies and those taught using conventional method?
2. What is the mean achievement of male and female students taught physics using interdisciplinary teaching strategies?
3. What is the interaction effect between the interdisciplinary teaching strategies and gender?

HYPOTHESIS

The following hypothesis were formulated for the study and was tested at $P > 0.05$ level of significance.

1. There is no significant difference in the mean achievement scores of students taught physics using interdisciplinary teaching strategies and those taught using the conventional method.
2. There is no significant difference between the mean achievement scores of male and female student taught physics using the interdisciplinary teaching strategies.
3. There is no interaction effect between interdisciplinary teaching strategies and gender.

2. THEORETICAL REVIEW

EXPERT NOVICE THEORY BY PATRICIA BENNER

The expert-novice theory proposed that experts nurses develop skills and understanding of patients' care over time through proper educational background as well as a multitude/combination of experiences.

The expert-Novice theory presents a systematic understanding of how skills and understanding of a practice situation or event evolves from the learners over time.

The theory maintains that for learners to develop competency, they transverse through five stages cycle of Novice, Advanced beginner, competent, proficient and expert. The theory further advanced that the transition from Novice to expert undergo a circular process rather than linear. And moreso, that the learner's movement from one stage to another does not usually follow a systematic pattern but rather is in a repeat mode to allow for new skills to be learnt.

Two personal characteristics that can bring about successful evolution from Novice to Expert level, is a deliberate practice and the willingness to take risk in going beyond the norm. on the other hand, Novice tend to possess shallow concepts and isolate them as separate factorial knowledge which prevent them from understanding or solving complex problems with an interdisciplinary manner. The expert-Novice theory has revealed that experts acquire more extensive and organize knowledge, equipping them with the capacity to be more efficient in perceiving meaningful patterns as well as the manipulation of relevant information

with cross-cutting concepts. These eventually result in their ability to perform exceedingly well in practice as compared to the Novice.

Understanding the differences in cognitive processes between the Expert and Novice opens the window for recognizing the nature of interdisciplinary learning. Experts are always in the habit of funding core concepts and central theoretical constructs in the cohesive framework of related concept and then transfer from one domain to another in solving problems related to a given concept. This is what interdisciplinarity is all about. Within the realm of science, the best way to learn and understand complex problems of the real world is the interdisciplinary approach, as the various science disciplines are not isolated but one. It is therefore important that science teaching and learning paves way for the establishment of meaningful connection across multiple scientific contexts with unifying themes. The expert-novice theory by Patricia Benner therefore provide a theoretical framework for the interdisciplinary teaching strategies where this study is adopting for use in the teaching of selected difficult topics in Science Education.

SOCIAL CONSTRUCTIVISM THEORY BY LEV VYGOTSKY

Social Constructivism theory is a learning theory propounded by Lev Vygotsky in 1976. The theory states that Language and Culture are the frameworks through which humans experience, communicate and understand reality. The theory is of the position that cognitive abilities are facilitated by social guidance and construction. The development and formation abilities including memory, problem solving, attention and learning is a function of culture, being the major mediator. Vygotsky perceives learning as a collaborative process where knowledge evolve from individuals in the process of interacting with their culture and society.

The implication is that cognitive development stems from social interactions arising from guided learning within the zone of proximal development as children and their colleague con-construct knowledge. Arising from all these, the main thrust of this theory is that social interactions produce cognitive development of children which eventually lead to the acquisition of skills such as self determination, problem solving, inquiry, critical thinking etc.

Vygotsky's social aspect of learning advocated for the need to support leaners in the learning process. He referred to this support as scaffolding of the skill to be learnt is within the zone of proximal development.

EMPIRICAL REVIEW

Guven & Alpaslan (2022) conducted a study, aimed at examining the effects of interdisciplinary science activities on 5th grade students' creative problem-solving skills and 21st century skills. The study sampled 50 in Cankaya district in Ankava in 2018 – 2019 academic years. 5th grade students consisting 26 girls and 25 boys. The instrument used for data collection were the creative century skills test (CST). The research design was a one groups pre test/post test preexperimental design. The findings of the work revealed that interdisciplinary science activities positively affected students' creative problem solving skills and the 21st century skills.

A study titled interdisciplinary teaching practices: Primary and secondary education curricula was undertaken by Kanmaz (2022), in Denizi, Turkey. It was aimed at investigating the views of primary and secondary school teachers in interdisciplinary teaching practices and their level of use. The study sample consisted of 413 classroom and branch teachers working in the primary and secondary schools in the central district of Denizi. The design of the study was the explanatory

mixed design a descriptive scanning model used for the qualitative aspect of the study while the phenomenological method was used for the quantitative aspect.

Two instruments were used for data collection. The interdisciplinary teaching approach questionnaire and a semistructured interview form. The interdisciplinary teaching approach questionnaire was used to gather quantitative data which the semi-structured form was used in gathering qualitative data. Findings revealed that teachers had positive views on approach and found the approach as being relatively useful although the implementation was not effective in their classes as the approach wasn't sufficiently incorporated into the curriculum. Also, teachers view differed by the variables of professional seniority and teaching levels, while gender variable was not found to be a significant predictor.

Korucu & Kabakb (2021) conducted a study on, the effects of stem and other innovative interdisciplinary practices on academic success, attitude, career awareness. A meta-synthesis study desing was adopted. Researches about STEM education, that are brought to the forefront by innovative interdisciplinary approaches, that are carried out in different areas, regions for different purposes were considered and examined. The studies were gathered under certain headings and themes and a broad perspective about the studies was presented. They reached 186 works in the framework of STEM and other innovative approaches worldwide, except for Turkey. 48 of these studies were from 21 different countries, written in 4 different languages, selected between 2009-2019. These studies were evaluated in 9 different themes and 24 sub-concepts. The studies included all partners (students, teachers, parents and others) of the education system. The impact of innovative interdisciplinary practices on students' academic achievement, scientific process skills and career awareness were positive. Gender was an important factor in perception and attitudes. In-school and out-of-school activities were effective in acquiring 21st century skills. Education partner's attitude towards innovative interdisciplinary approaches were also positive. It was revealed that in some studies, limitations such as physical space, time and cost disrupted the realization of activities and sometimes, negative situation where the teachers did not have the necessary training formation and felt inadequate for these activities. Existing curricula, which are shaped within the framework of knowledge-based examination system, were also seen as another limiting factor. At the end of the research, they suggested to all partners of the education system that participated in the research that the applications should be carried out in innovative interdisciplinary fields.

In a study carried out by Guven , G. & Sulun, Y. (2019), the purpose of the study was to investigate the effect of interdisciplinary approach-based energy instruction on pre-service science teachers' academic achievement and conceptual understanding regarding the concept of energy. To this end, the study was designed as a quasi-experimental study with the pretest-posttest control group design. The activities related to the concept of energy were conducted by using the interdisciplinary approach and the same activities were conducted by using the methods and techniques based on the existing approaches. A total of 66 pre-service science teachers participated in the study lasting for 10 weeks. ANOVA/Post Hoc Test was used in the analysis of the data. The result of the study, showed that the use of the interdisciplinary instructional approach in teaching the concept of energy increased the pre-service teachers' academic achievement and conceptual understanding more than the traditional approaches. Thus, it was suggested that during the instruction of the energy concept, the features of this concept should be taught in a certain developmental order and the interdisciplinary approach should be used in the activities conducted to teach this concept.

A study was undertaken by Olufunke (2022), to investigate the influence of gender on students' achievement and attitude towards physics in secondary schools in Ondo State, Nigeria. The study adopted quasi-experimental pre-test post-test design. A total of 138 students were drawn from three secondary schools from each of the three senatorial districts of Ondo State as the sample for the study. The students in the three schools were taught using the normal classroom instructional method. Physics Achievement Test (PAT) and Physics Attitudinal Scale (PAS) were developed, validated and used to generate the data for the study. The data collected were analysed descriptively using mean and standard deviation, and inferentially using ANCOVA. The results of the study showed that there was no significant influence of gender on students' achievement on Physics. This implied that female students were found to be as good as their male counterparts in achievement in Physics. The findings from the study also showed that attitude of students towards Physics was not determined by gender. Based on the findings of the study, recommendations were made that, the curriculum should be designed to be unbiased. Male and female students should be treated equally in the classroom while there should be sensitization for equality among the students.

In a study conducted by Korsun (2017), the aim was to prove the advisability of using the interdisciplinary approach for the formation of learners' situational interest in physics. The general method of using the interdisciplinary approach in physics teaching was created. The study of new material, the formation of abilities and skills, and the work on projects were the forms of the interdisciplinary links in physics teaching used. The scheme for interest formation towards physics in the context of development of situational and individual interest were analyzed. The tools for the formation of learners' situational interest in physics were allocated according to the interdisciplinary approach. These were phenomena of nature, phenomena of everyday life, link between theory and practice. The results showed that interdisciplinary approach in physics teaching increases the level of learners' situational interest. Proposed general method of the interdisciplinary approach was recommended to be used in the teaching of other science subjects.

3. METHODOLOGY

Design of the Study

The study adopted a quasi-experimental with pre-test, post-test, nonrandomized controlled group design.

Study Area and Population

The area of the study was Akwa Ibom State in the South-South Zone, Nigeria which has thirty one local government areas. Akwa Ibom States has three Senatorial Districts which are; Akwa Ibom North East, Akwa Ibom North West and Akwa Ibom South. There are 264 public secondary schools in the state. The population comprised of all senior secondary two students offering physics in the 264 public secondary schools in the state. The target population was 3,653 senior secondary two students offering physics in the 6 randomly selected schools, 2 each from the three senatorial districts of the state.

Sample and Sampling Technique

Six intact classes of SS 2 students from each of the six secondary schools offering physics, were selected using simple random sampling of balloting with replacement for the study. A sample size of one hundred and fifteen (115) Senior secondary two (SS2) physics students in all were selected for the study. Each of the six intact classes of the schools were assigned, experimental and

control groups. Then, for each school, one physics teacher was purposefully chosen who was relatively well qualified and experienced in teaching physics.

Instrumentation

The instrument used for data collection in the study was a 25-item physics achievement test developed from the contents taught. Each questions had one correct option and three distractor indices and was scored 4 marks each totaling 100% in all.

Validation of Instrument

The instruments were given to three experts for face and content validation. Two of the experts specialized in science education (physics) and one was an expert in test and measurement. Their corrections were effected in the final copy of the test.

Reliability of Instrument

In determining the reliability of the instrument was piloted on 20 physics students in one of the schools in the study area that did not participate in the study. Kuder-Richardson (KR20) was used and the reliability coefficient of 0.89 was obtained, showing a high reliability index.

4. RESULTS

Data obtained for research question one are presented on table 1.

Table 1: Mean and Standard Deviation of students’ scores in both experimental and control groups

GROUP		NO. Of Students	Mean	Standard Dev.	Mean Gain
Experimental	Pre-Test	53	36.90	8.037	21.31
	Post-Test	53	58.21	8.760	
Control	Pre-Test	62	33.88	7.040	16.86
	Post-Test	62	48.73	6.225	

Table 1 shows that the mean achievement gain for the experimental group is 21.31 while that of the control group is 16.58 indicating the superiority of the experimental group over the control group in physics achievement test.

Data obtained for research question two are presented on table 2.

Table 2: Mean and Standard Deviation of students’ scores in both experimental and control groups across Gender

GROUP		Gender	NO. Of Students	Mean	Standard Dev.	Mean Gain
Experimental	Male	Pre-Test	30	37.03	8.66	18.92
		Post-Test	30	55.95	8.23	
	Female	Pre-Test	23	31.73	7.30	
		Post-Test	23	58.93	9.26	
Control	Male	Pre-Test	32	32.64	7.71	19.39
		Post-Test	32	52.03	8.51	

Female	Pre-Test	30	34.13	6.33	
	Post-Test	30	49.30	5.66	15.17

Table 2 shows the mean achievement scores of male and female students in both the experimental and control groups. The mean achievement gain for the male and female students in the experimental group are 18.92 and 27.20 respectively, while that of the control group are 19.39 and 15.17 for males and females respectively. This shows that the female students benefitted more from the intervention than their male counterpart.

Data obtained for research question three are presented on table 3.

Table 3: Test of interaction between method and gender on students’ achievement in physics

Gender	Groups	Mean Achievement For Experimental	Mean Achievement For Control
Male		18.92	19.39
Female		27.20	15.17

In Table 3 above, it is seen that the mean achievement gains are higher in the experimental group for both male and female students than in control group. This implies that there is no interaction between gender and methods on students’ achievement in physics.

Table 4: summary of (ANCOVA) by approach and gender

Sources	Sum of squares	<i>df</i>	Mean square	<i>f</i>	Sign <i>f</i>
Corrected model	698.76	4	174.69	3.11	0.02
Intercept	13730.45	1	13730.45	244.06	0.00
Pre-test	4.036	1	4.04	0.72	0.74
Group	578.96	1	578.96	149.00	0.00
Gender	30.02	1	30.02	0.61	0.43
Group*Gender	79.53	1	79.53	0.17	0.90
Error	6188.42	110	56.26		
Total	326961.00	115			
Corrected Total	6687.18	114			

As can be seen in Table 4, *f* value of 149.00 is significant at 0.00 for methods at 1 and 114 degree of freedom (*df*), since 0.00 is less than 0.05 significant level set for the hypothesis. The hypothesis, therefore is not accepted. There is significant difference in mean achievement scores of students taught physics using interdisciplinary strategies and those taught with conventional method. The findings also revealed a no significant difference for gender at 1 and 114 degree of freedom (*df*), since *f* value of 0.61 is not significant at 0.43 for gender at 1 and 114 degree of freedom (*df*). This is because 0.43 is greater than 0.05 significant level earlier set for the

hypothesis, therefore the hypothesis is accepted. That is, there is no significant difference in the mean achievement scores of male and female physics students taught with interdisciplinary strategies. It also revealed that f value of (0.17) is not significant at .90 for the interaction between groups and gender at 1 and 114 degree of freedom (Df) since .90 is greater than .05 significant level set for the hypothesis. Hence, the hypothesis is not rejected and so there is no significant effect between teaching methods and students' gender in the mean achievement scores of students in physics.

5. DISCUSSION OF FINDINGS

The findings of the study revealed that the experimental group performed significantly better than their control group counterpart in physics achievement test. This is a strong indication that the application of interdisciplinary strategies in physics teaching enhanced students' understanding and achievement in physics. The significant performance could be attributed to the relationship between physics and other subjects that demonstrates what they have been practicing in their day to day activities and the new topics. Again, the students' outstanding performance could be due to the joy that the abstract nature of physics topics have been made easy and most often, transformed into concrete realities, because of the linkages of the abstract concepts to other concepts in other subjects that have real life reflections.. This finding is in consonance with the findings of Guven and Alpasan (2022) who opined that when interdisciplinary strategies was systemically and holistically included into schools, students' achievement improved. It is equally in agreement with the submission of (Kanmaz, 2022) who found that teachers agreed that infusing some elements of the child's culture into science curriculum will improve interest and achievement in modern science but implementation was a problem. It is also in line with Sudderth (2022) who revealed that interdisciplinary strategies instructional package facilitates interest in science.

The improved interest in interdisciplinary strategy in science could be enhanced by the integrated wealth of knowledge and experiences of both male and female students gained from interdisciplinary strategy deployed into the physics teaching. Integration of interdisciplinary strategy into physics teaching has no significant effect on male and female students' achievement in physics as revealed by the findings. This could possibly be due to the fact that both males and females participate in local practices in the society and so both are conversant with the knowledge and practices. This could be attributed to the fact that the gap bet and the new field of knowledge has been bridged by the integration of interdisciplinary knowledge.

On the significance of interaction, summary of result presented in table 4, shows that, there is no interaction between gender and teaching approach on students' achievement in physics. This is an indication that integration of indigenous knowledge and practices into physics teaching is superior to conventional approach in enhancing achievement in physics in both male and female students, since gender did not combine with teaching approach to affect the students' achievement in physics. This is in agreement with Olufunke (2022), who found no significant interaction between instructional methods and gender on performance.

6. CONCLUSION

From the findings of the study, the researcher drew the following conclusion:

1. Integration of interdisciplinary strategy and practices into physics teaching enhanced the understanding of physics concepts and hence enhanced students' achievement in the subject.
2. There is no statistically significant difference between the academic achievement of male and female physics students that are taught with integration of interdisciplinary strategy and practices although the female students tend to perform better than the male students that are taught physics with the integration of interdisciplinary strategy and practices.
3. There is no significant interaction effect between the teaching approaches and gender of the students on achievement in physics considering the fact that both male and female students showed improved performance with integration of interdisciplinary strategy and practices than with conventional method.

7. RECOMMENDATIONS

Based on the findings of this study, the researcher recommends that:

1. Indigenous knowledge and practices should be integrated into physics teaching approaches especially under activities. This will help them to easily grasp the new concepts and enhance understanding and achievement.
2. Practical examination in physics which is based on modern science/academic ways of learning should include indigenous knowledge and practices in the society that has physics orientation in them.

REFERENCES

- Ayodele, F. (2016) Effect of co-operative, competitive and individualized interaction pattern on physics student's achievement and attitude in senior secondary schools in BornoState; Published Ph.d thesis.
- Bergqvist, J, Jerneck A, Richter J L & Steen K (2019), Interdisciplinary pedagogy in Higher Education, 7th Biannual Teaching and learning conference at Lund University, November 2019.
- Bush center Briefing (2016) School Achievement can drive Economic growth: preparing 21st century workers. Bushcentr.org/pub/ Bush center briefing oct. 2016.
- El Education (2023) The three dimensions of student Achievement. (<https://eleducation.org>)
- Goldsmith A. H, Hamilton D, Hornsby K & wells D. (2018). Interdisciplinary approaches to teaching, SERC Pedagogical service <https://serc.carleton.edu/ecom/int>.
- Gombrich C. & Hogan M (2017) interdisciplinarity and the students Voive. I Frodeman, Klein J. t. & Pachico, Rcs. (eds.) The oxford Handbooks of Interdisciplinarity. 2nd ed. Oxford:Oxford university press, 544-57 <https://www.oxfordhandbooks.com/view/101093/oxfordhb/9780198733522>.
- Guyen I. & Alpaslan B. (2022) investigation of Interdisciplinary Science Activities on 5th Grade Student's Creative Problem Solving and 21st Century Skills: TOJET: The Turkish Online Journal of educational Technology – January 2022, Vol. 21 issue
- Guyen , G. & Sulun, Y. (2019).Interdisciplinary Approach-Based Energy Education. REMIE – Multidisciplinary Journal of Educational Research Vol. 9 No.1, pp. 57- 87. ISSN: 2014-2862 DOI: 10.17583/remie.2019.3734

- Hanushek E. A & Woessman L. (2021) Education and Economic growth
<https://doi.org/10.1093/acre/9780190622979.013.651> published online August 2021
- Hurbert, C. (2021) Interdisciplinary learning and the effect on students, Masters thesis and capstone project Northwestern college, Iowa, 2021
- Holbrok, J.& Rannikmae (2019) “interdisciplinarity” and transdisciplinarity: In Akpan B, Visions of the future, Next Generation Education Science Education: Visions of the future, Akpan B (Ed.) Abuja. Next Generation Education, PP 74-90.
- Jedege, S. A. & Adedayo, J. O. (2013): Enriching Physics Education in Nigeria Towards Enhancing a Sustainable Technological Development. Greener Journal of Educational Research. 3(2): 080-084.
- Kanmaz A. (2022) A study on Interdisciplinary teaching practices: Primary and Secondary education Curricula
- Korucu, A.T. & Kabakb, K (2021). The Effects of STEM and other Innovative Interdisciplinary Practices on Academic Success, Attitude, Career Awareness: A Meta-Synthesis Study. Journal of Learning and Teaching in Digital Age, 2021, 6(1), 27-39
<https://dergipark.org.tr/en/pub/joltida> ISSN: 2458-8350 (online) Research Paper
- Korsun, I. (2017). The use of interdisciplinary approach for the formation of learners’ situational interest in Physics. Asia-Pacific Forum Journal on Science Learning and Teaching EdUHK APFSLT. Volume 18, Issue 2, Article 5 (Dec., 2017).
- Olufunke, A. O. (2022). Influence of Gender on Students’ Achievement and Attitude Towards Physics in Secondary Schools in Ondo State, Nigeria. *International Journal of Research in Education and Sustainable Development* | ISSN: 2782-7666 Vol. 2, Issue 6 (June, 2022) | www.ijaar.org
- Ramire, F. O, Luo X, Schofer E, & Meyer J. N. (2006) student Achievement and economic growth; *American Journal of Education*, Volume 113 Number 1.
journals.uchicago.edu
- Sudderth, A (2022) A guide for Interdisciplinary teachings and learnings xqsupershool.org
- Tophat Glossary (2023) students achievement. Definition and meaning/Top hat
<https://tophat.com/Glossary>
- Uko, M.P. & Uko, P. J. (2020). Unfolding the scientific, Digital and Technological Breakthrough(s) of the 21st Century: New Demands for science Teachers using Ethno-science in Akwa Ibom North-West Senatorial District, Nigeria. *Journal of Science Teachers Association of Nigeria (JSTAN)* ISSN: 0795- 7270. Vol. 55 ISSUE 1, Februar, 2020.
- WAEC (2018): Senior Secondary Certificate Examination. Chief Examiners Report, Reports, Lagos office, Nigeria.
- Wikipedia (2023). Interdisciplinary Teaching, Article Talk. en.m.wikipedia.org.
- You, H. S (2017) . Why teach science with an Interdisciplinary Approach: History, Trends, and conceptual Frameworks, Journal of Education and Learning: Vol 6, No.4 2017 ISSN; 1927 – 5250 E-ISSN 1927-5269 URL:<http://doi.org/10.5539/jel.v6n4p>
- Ze Zure, D (2017) Interdisciplinary Pedagogies in Higher Education in R. Frodeman (Ed). The oxford handbook of interdisciplinarity, (2 ed). Online Publication: Oxford university press.

