

Impact of Discovery-Based Learning Method on Senior Secondary School Physics

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Abstract: *The purpose of the study is to ascertain the impact of discovery-based learning method on teaching and learning of physics in secondary schools in Awgu Education Zone. Two research questions and two hypotheses were posed to guide the study. The study adopted a descriptive survey design. A sample size of 490 respondents made up of 291 male and 199 female teachers were drawn using stratified random sampling techniques from four senior secondary schools in Awgu Education Zone. The instrument used for data collection was a 10 - item questionnaire. The instrument had face validity and reliability co-efficient of .77 obtained using Cronbach Alpha formular. Mean statistic was used to answer the research questions while the hypotheses were tested at .05 level of significance using t-test statistic. The result of data analysis show that; discovery-based learning method has helped to a great extent in effective teaching and learning of Physics. Also, discovery-based learning method has promoted research in Physics. The respondents classified by gender did not differ on the extent to which discovery-based learning method helped in effective teaching and learning, improved students' knowledge and promoted research in Physics. Conclusion and recommendations were equally highlighted.*

Key words: *Discovery-based, effectiveness, learning, Physics, Impact.*

I. Introduction

One of the main principles of science and technology is to teach students with notion of discovering, engaging in critical thinking, questioning and developing problem solving skills. The curriculum for science and technology therefore should be developed to educate science – literate students to enable them inquire and solve problems facing them.

Science teaching is based on the understanding of natural phenomena and the nature of science requires inquiring and discovering. [1] cited in [2] stated that learning happens by discovering, which prioritizes reflection, thinking, experimenting, and exploring. Discovery learning approach to education is more closely aligned with constructivist concepts of exploration, discovering and invention [3] Constructivist theory is the basis for discovery learning. Under both constructivism and discovery learning, educators subscribe to the idea that “knowledge cannot be transferred from one person to another” [4] Instead, a student needs to experience an event in order to make it truly meaningful. In a constructivist classroom, the role of the teacher is less defined. The teacher is no longer the focal point of the classroom. Instead, the suppose instructor is now seen as a facilitator, mentor, coach, or consultant additionally, the role and expectations of the students are transformed. Interest should not be on the content level a student manages to retain, rather on the manner in which the students learn, or constructs knowledge.

People who use self discovery in learning turn out to be more self-confident. Discovery is a way from the unknown to the known by the learners themselves [5] The active participation of the learner in the learning process is called discovery learning [6] In discovery learning, students construct knowledge based on new information and data collected are used by them in an explorative learning environment [7] .

Physics as a science subject demands a lot of abstract thinking for its understanding. It requires the learner to store and manipulate many bits of information in memory. Most students find it difficult to solve problems in physics because of the abstract nature of the subject, and often the instructional methods used are obsolete. This can result to poor academic achievement and retention on the part of the students. Physics is a subject that grew up with civilization as man's quantitative need increased. Physics as a unique subject promotes the acquisition of specialized science skills and knowledge. It arose out of practical problems and mans need to solve these problems. Its teaching is to bring about scientific thinking in students.

Investigations reveal that secondary school students' achievement in Physics in both internal and external examinations have been consistently poor [8] and [9.] A number of factors could contribute to the students' poor achievement in Physics in the senior secondary school certificate examination. Researchers [10], [11] and [12] have variously identified such factors as students' poor academic background, insufficient qualified teachers, lack of motivation on the part of the teachers and their students and inappropriate teaching methods. The need to foster students' achievement in Physics has given rise to innovative strategies that provide room for students' active participation in the lesson. Teaching methods should facilitate the learning

process for both genders. Teachers ought to be mindful that unless the teaching method matches the different learning styles observed to be the dominant modality for each gender, students may not comprehend [13]

Discovery learning unites students and content simultaneously. Additionally, scientists will agree that discovery-based learning replicates a true scientific experience for students [4] and [15].

As a result of the foregoing the researcher got motivated to empirically ascertain the impact of discovery-based learning method on teaching and learning of physics in secondary schools in Awgu Education zone of Enugu State.

1.1. Purpose of the Study

The study tried to:

1. Ascertain the impact of discovery-based learning method on teaching and learning of Physics in secondary schools in Awgu Education zone.
2. Determine the extent to which discovery-based learning method promotes research in Physics subject.

1.2. Research Questions 1

The following research questions guided the study:

- (1) To what extent has discovery-based learning method helped in effective teaching and learning of Physics?
- (2) To what extent has discovery-based learning method promoted research in Physics?

1.3 Hypotheses

The following hypotheses were tested at .05 level of significance.

1. There is no significant difference between the mean scores of male and female teachers on the extent to which discovery-based learning method helped in effective teaching and learning of Physics.
2. There is no significant difference between the mean scores of male and female teachers on the extent to which discovery-based learning method promoted research in Physics.

II. Method

The study adopted descriptive survey design. The population for the study comprised all the 4,635 teachers in the 23 public secondary schools in Awgu Education zone. A stratified random sampling was used to draw a sample of 490 respondents made up of 291 male and 199 female teachers.

The instrument for data collection was a 10 – item questionnaire. The instrument was face validated by three research experts, two in Educational Psychology and one in Measurement and Evaluation, all from Faculty of Education in Enugu State University of Science and Technology. The reliability of the instruments was determined using Cronbach Alpha and a reliability coefficient of 0.77 obtained. The researcher administered 490 copies of questionnaire with the help of three research assistants. All the 490 copies of questionnaire were correctly filled giving a return rate of 100%. Regarding the decision rule, any questionnaire item with a mean of 2.50 or above was interpreted to mean high extent response for such item while a mean score below 2.50 indicates a low extent response for the items. Mean Statistic was used to answer research questions while hypotheses were tested at 0.05 level of significance using t-test statistic. The t-test was appropriate because it is capable of handling both large and small number samples.

III. Results

3.1 Research Question 1: To what extent is the discovery-based learning method effective in teaching and learning of Physics?

Table 1: Mean Response on the Extent to which Discovery-Based Learning Method is Effective in the teaching and Learning of Physics.

S/N	Items	VGE 4	GE 3	LE 2	VLE 1	\bar{X}
1	Discovery-based Learning method encourages students to be constructive in learning of Physics concepts.	201	142	81	66	2.97
2	Discovery-based Learning method facilitates students' critical thinking in learning Physics subject.	198	138	95	59	2.96
3	It enhances students' skill of exploration and invention in Physics	240	120	66	64	3.09
4	Discovery-based Learning method helps students improve their problem solving skills in Physics subject	187	120	98	85	2.83
5	Discovery-based Learning method engages students in effective inquiry and discovery in learning Physics	150	180	86	74	2.82
N = 490		Grand Mean =				2.93

All items above show that the discovery-based learning method is effective to a great extent in teaching and learning of Physics with grand mean score of 3.93.

3.2 Research Question 2

To what extent has discovery-based learning method promoted research in Physics?

Table 2: Mean Response on Extent to which Discovery-Based Learning Method Promote Research in Physics Subject.

S/No	Items	VGE 4	GE 3	LE 2	VLE	\bar{X}
6	Discovery-based learning method maximizes research work in Physics subjects.	170	140	98	82	2.81
7	Discovery-based learning method facilitates research in Physics projects	136	156	100	98	2.46
8	Discovery-based learning promotes research skills in Physics students.	148	188	79	75	3.83
9	Discovery-based learning improves students' research in Physics subject.	130	178	92	90	2.71
10	Discovery-based learning leads to great achievement in Physics research.	135	181	85	89	2.73
N = 490		Grand Mean = 2.90				

Grand mean of 2.90 which indicates great extent reveals that discovery-based learning promotes research in Physics subject.

3.3 Hypotheses

Ho₁: There is no significant difference in the mean scores of male and female teachers on the extent to which discovery-based learning method helps in effective teaching and learning of Physics in secondary schools in Agwu Education Zone.

Table 3: T-test Mean Rating of Male and Female Teachers on the Extent to which Discovery-Based Learning Method helps in Effective Teaching and Learning of Physics in secondary Schools in Agwu Education Zone.

Respondents	N	\bar{X}	SD	d/f	t-cal.	t-crit.	Decision
Male Teachers	291	2.98	0.77	488	0.68	1.96	Ns
Female Teachers	199	2.76	0.82				

TABLE 3 revealed that the t-calculated is 0.68, while the t-critical value is 1.96. Since 0.68 is less than 1.96 at .05 level of significance, thus, the null hypothesis is not rejected. This indicates that there is no significant difference between the mean scores of male and female teachers on the extent to which discovery-based learning method is effective in the teaching and learning of Physics by SS II students.

Ho₂: There is no significant difference in the mean scores of male and female teachers on the extent to which discovery-based learning method promotes research in Physics.

TABLE 4: T-test Mean Response of Male and Female Respondents on the Extent to Which Discovery-Based Learning Method Promotes Research in Physics Subject.

Respondent	N	\bar{X}	SD	d/f	t-cal.	t-crit.	Decision
Male Teacher	291	2.91	0.71	488	0.45	1.96	Ns
Female Teacher	199	2.84	0.76				

In TABLE 4 above, the t-calculated (0.45) is less than the t-critical (1.96) at .05 level of significance. Thus, the null hypothesis is not rejected indicating that gender is not a significant factor in the extent discovery-based learning method promotes research in Physics subject.

IV. Discussion

The result of data analysis on TABLE I revealed that the use of discovery-based learning method is effective to a great extent in the teaching and learning of Physics. This result is in agreement with the findings of [16] who found out that discovery-based pedagogy works best in promoting meaningful learning when the learner strives to make sense of the presented materials by selecting relevant incoming information, organizing it into a coherent structure, and integrating it with other organized knowledge. Above is contrary to the view of both [17] and [18] who emphasized that because discovery learning relies on an extensive search through

problem-solving space, the process taxes learners' limited working memory capacity and frequently does not lead to learning. In addition, learners need the ability to monitor their own processes of attention to relevant information [19]

From the result of data analysis on TABLE 2, it has been observed in this study that the use of discovery-based learning method promoted research to a great extent in Physics subject. Above statement supports that of [1] cited in [2] who emphasized that discovery-based learning encourages learners to be constructivists and that practice in discovery teaches the learner how best to acquire information to make it more available. Again, Bruner implied that the act of discovery teaches the learner how best to acquire information to make it more readily relevant and available. All assertions made above favour research work to the latter.[1] cited in [2] also warned that the learners' mind has to be prepared for discovery if it should favour research. Bruner claimed that discovery was more often the result of a learner gaining insights that transforms his/her knowledge base through new ways of organizing the previously learned information. Furthermore, the prepared mind for Bruner was one with experience in discovering itself. All these in one way or the other boasts research.

However, in TABLES 3 and 4, the results revealed that there were no significant differences in the mean response scores of male and female respondents on the extent discovery-based learning method is effective in teaching and learning Physics and on the extent discovery-based learning method promoted research in Physics. This showed that both male and female teachers have similar view regarding the use of discovery-based learning method in Physics subject. Apparently, both sexes noted equally the efficacy of discovery-based learning method in teaching Physics in senior secondary schools.

V. Recommendation

The following recommendations were made:-

- (1) Seminars and workshops should be organized by secondary school teachers on other teaching/learning methods.
- (2) Teachers are encouraged to use discovery-based learning method regularly as it enhances teaching and learning of secondary school subjects.

VI. Conclusion

The following conclusions were made:-

- (1) Discovery-based learning has helped to a great extent in effective teaching and learning of Physics.
- (2) Discovery-based learning has promoted to great extent research in Physics.
- (3) The respondents classified by gender did not differ on the extent to which discovery-based learning promoted research in Physics and improved student's knowledge in physics.

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