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TECHNOLOGY INTEGRATION USING OUTCOME BASED EDUCATION APPROACH IN TEACHING INTRODUCTORY PHYSICS

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Abstract

The study was focused on determining the effectiveness of an approach in education which is outcome-based and integrated technology in teaching introductory physics among second year BSIT/BSCS students of Cavite State University enrolled in six (6) chosen campuses during the second semester of school year 2014-2015. Through Purposive sampling and census method three hundred fifty nine (359) students and eight (8) instructors were used as participants respectively. The researcher used Quasi-experimental research design. Seven (7) instruments were employed in the study. At $p<0.05$ level of significance using t-test independent mean, standard deviation, percentage and Analysis of Co-Variance(ANCOVA) hypotheses were tested. The result suggests that the technology integration intervention used for physics instruction utilized by the experimental group was effective in improving the students' test scores. Results revealed the rejection of three null hypotheses tested thus, development of learning plans employing Technology Integrated Strategy (TIS) using outcome based education approach is highly recommended to actively involve the students in the teaching- learning process. The study

conducted was limited in determining the effectiveness of TIS in teaching physics, therefore it is recommended to replicate the study in other discipline and the instrument crafted by the researcher may be used by other institution in promoting technology integrated lesson presentations. Administrators are highly encouraged to initiate the conduct of workshop about the use of TIS on various disciplines through continuing education program.

Keywords

Technology Integrated Strategy (TIS), Students' Achievement

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1. Introduction

With the present need and demands of the society, the need to develop 21st century skills among students becomes imperative in order to respond to the present trends and issues. This can be materialized using the outcome based education approach. This approach focuses on the action taken by the students after being taught. It is more concerned with what the students do in the acquired concepts, theories and principles.

In tailoring the application of new approaches, methodologies and strategies in teaching, one of the major considerations is the students or the learners. Nowadays, students still follow the same pattern of learning as they always have; they compare new information with their previously acquired knowledge. However, today students preferences differ based on their experiences with computer technology especially on how information is presented.

As one of the Higher Education Institutions of the country, the researchers' university, the Cavite State University also envisioned to provide quality education and to produce individuals who are globally competitive and morally upright. In realizing this vision, one of the many programs and projects of the university is to encourage all faculty members to conduct researches that will help improve the service of the institution in all areas, especially in the curriculum offerings.

The study is anchored in the principles of Outcome- Based Education (OBE) which were viewed in three different ways- as a theory of education, as a systematic structure for education or as classroom practice (Killen, 2000).

Tucker (2004) stressed that outcome-based education emphasized the importance of achieving higher order thinking skills and mastery among the learners rather than the accumulation of course credit.

Cooperstein, S. and Weidinger, E.(2004) stressed that attention, organization and repetition is necessary in transferring information to the long-term memory. This is important to truly employ the principles of constructivist learning. There is a need for the students to reflect on what they have discovered.

Millennial is the term used to describe college students nowadays, they possess characteristics that are the result of the times they grew up, and the experiences they have had (Strauss & Howe, 2007). Their traits have impacts and influenced the kind of classroom in the modern era. Students nowadays tend to have shorter attention span; they want instant results and have low level of patience. The approach in teaching them must capitalize on their interests and abilities in order to ensure an effective teaching and learning process.

Physics 2 is a course that deals with the study of waves, optics and electromagnetism, more often than not, the approach used in teaching the course is focused on the problem solving, and that is why students perceived the subject as a very difficult one. Integrating technology in presenting the lessons in physics can create a difference on how student learns.

The invention of new technology changes the way science teaching is done. It offers students aid in understanding concepts and theory by observing phenomenon and viewing results in graphic ways which made learning easier. Engagement to the given task is evident and reduced behavioral problems are observed while students are using technology and a project-learning approach is employed.

The role of the teacher is also changed upon the integration of technology in the teaching and learning process. The teacher became content expert, facilitator of activities and coach. It strengthened the relationship between teacher and student and the teaching and learning process become more meaningful.

The study is also based on the theory of Technological, Pedagogical, Content, Knowledge (TPCK) model of (Mishra & Koehler, 2006). TPCK, emphasized the relationship of the development of knowledge of subject matter (content), with the development of technology, and the knowledge of teaching and learning (pedagogy).

TPCK is a learning model which shows the effectiveness of the interaction of content, pedagogy, and technology knowledge in the teaching and learning process.

Alharbi, A. et al (2013) in their study in mechanics using free software, posited that it is no longer "pedagogical luxury" when we integrate Information Technology and Communication (ICT) in education rather it become a support for the preferred learning environments of the students.

The researcher as a science educator primarily advocates meaningful learning of students in physics, promoting science education and in enhancing the quality of education as a whole. As an observation of physics teaching, most of the teachers handling the course are non- Physics majors, with the use of technology integrated strategy wherein discussion on videos are facilitated , instructors are aided in presenting abstract concepts in a more concrete ways , thus learning the principles and concepts in physics can be elaborated and enhanced.

With her several years in teaching physics, the issues on what strategy to use to help student develop positive attitude toward physics and become independent learners who are ready to face the new trials and tests of the 21st century science education has been her priority. Thus, this study is intended to provide an educational approach which is outcomes-based and integrated with technology in teaching introductory physics. This study is also undertaken to promote alternative teaching strategies.

2. Objectives of the Study

The main objective of the study is to determine the effectiveness of an educational approach which is outcomes-based and integrated technology in teaching introductory physics.

Specifically, the study aimed to describe the teachers' profile according to age; gender, years in teaching, educational qualification, and computer literacy; determine the insights of teachers in teaching optics and students in learning optics using technology integrated strategy; find out the significant relationship between the insights of the teachers and students in using technology integrated strategy; determine the performance of the students in experimental and control group in the pre and posttest; significant difference in the pre-test score between the experimental and control group; significant difference in post-test score between the experimental and control group; also to determine the students' learning outcome on outcome

based education (OBE) activities and provide subjects in teaching introductory physics that can employ the developed technology integrated lesson design.

2.1 Research Hypotheses

1. There is no significant difference between the insights of the teachers' and students' in using technology integrated strategy.
2. There is no significant difference in the pre-test between the experimental and control group.
3. There is no significant difference in the post-test between the experimental and control group.

2.3 Conceptual Paradigm

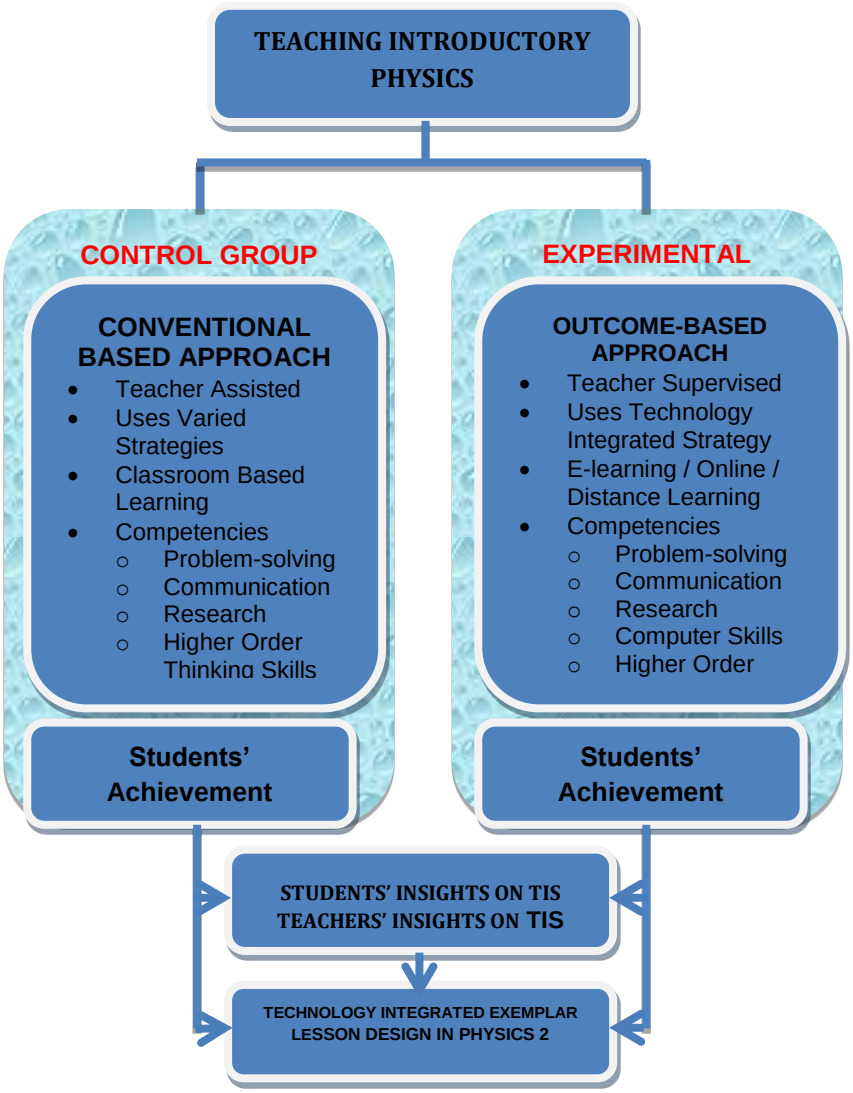

Figure 1: *Conceptual Paradigm of Technology Integration in Teaching*

Physics using Outcome Based Education Approach

The Conceptual model illustrated in Figure 1 shows the processes involved in the achievement of the objectives of the study. The study utilized the TPCK model (Mitch 2006) as the guiding framework. This framework considers the combination of appropriately selected technology with content –based learning experience and pedagogical approaches. As applied in this study, this model was used in the development of the lessons in waves and optics integrating technology in modular form. Teaching Introductory Physics was employed using the conventional based approach and outcome based-education approach utilizing two groups of students as control group and experimental group respectively. The conventional based-approach focused on determining students' achievement using varied strategies employing classroom based learning, teacher assisted and also focused on developing varied competencies. The other variable of the study is the use of outcome-based education approach, dealt with determining students' achievement employing the use of technology integrated strategy, e- learning software and also focused on developing advanced competencies. The study sought to determine the students' and teachers' insights on the use of technology integrated strategy which provide information for the curriculum development aimed at improving students' achievement by constructing exemplar lesson designs in teaching introductory physics.

3. Methodology

3.1 Research Design

The researcher used Quasi –experimental research. Tria G. &Jao L. (2009) described Quasi –experimental research with pre-test – post-test group design as two groups were formed through random assignment. Both groups were pretested and post tested but only one received the treatment. The diagram below illustrates the research design used in this study.

R ----- O1 X O2

R----- O3 No X O4

The dependent variables in this study were the achievement of the students and the effectiveness of technology integration in teaching optics. The achievement of the students was measured using an achievement test. The effectiveness of the technology integration in teaching optics was measured using pre-test – post-test from the developed modules. The qualitative

technique was employed through the use of questionnaire intended to determine the insights of the students in learning optics with technology integration as well as the insights of the teacher in teaching optics.

3.2 Research Locale

This study was conducted during the second semester of school year 2014-2015 in Cavite State University (CvSU), province of Cavite. It offers baccalaureate and graduate studies. The educational institution has ten other campuses spread all over the province.

3.3 Sample and Sampling Technique

The respondents of the study were 367 enrolled students, eight (8) instructors in the tertiary level for the second semester of school year 2014-2015 respectively. Two classes from BSIT and BSCS programs from six (6) chosen campuses were classified as the control group and the experimental group. There was an average of 32students equivalent to one class. Purposive sampling was used in the selection of the participants. The selection of the respondents were done based on second semester school year 2014-2015 enrollees in Physics 2. Census method was also utilized in consideration for the total population of the corresponding instructor handling the course in each campus.

3.4 Research Instruments

There were seven (7) instruments utilized in this study. The first five (5) instruments were researcher made namely(1) E- learning Software-containing Modules on the different topics in waves and optics (2) Physics achievement test (3) Questionnaire for Teachers' Insight on the use of Technology Integrated Strategy (4) Questionnaire for Students' Insight on the use of Technology Integrated Strategy (5) Scoring rubric for research work ,while the next two (2) instruments such as (6)Technology Integration Observation Instrument and (7) Computer Literacy Test were adapted and patterned after the standardized instruments.

3.5 Procedure

This study is intended to determine the effectiveness of technology integration strategy for the tertiary level. To achieve the objectives of the study on teaching introductory physics with technology integration using outcome based-education approach, the study had undergone several phases, which include planning, developing, try-out and finalization phases.

3.6 Statistical Treatment

The data obtained were analyzed, interpreted, and were presented in tables and charts within the parameters of the statement of the purpose and sequence of items in the research instruments. To guarantee reliable assessment and interpretation of data the researcher used frequency, percentage, weighted mean, standard deviation, t-test for independent sample and ANCOVA in computing and interpreting the data.

4. Results and Discussion

4.1 Teacher- Respondents Profile

The demographic profile of teacher-respondents showed that:

a. Most of the respondents are young teachers.
b. Majority of the teacher –responders were female.
c. The bulk of the teacher- respondents are novice in the teaching profession.
d. A large number of the teacher-respondents were not yet a holder of post-graduate degree.
e. All of the teacher-respondents have competencies and literacy on the use of computers and some of computer software.

4.2 Insights of Teachers and Students on the use of TIS

The result showed that the teachers' insight on use of technology integration have an overall mean of 3.51 and standard deviation of 0.47. While, students'' insight on use of technology integration have an overall mean of 3.11 and standard deviation of 0.44.

Table 1: *Difference on Insights of Teachers and Students on the use of TIS*

Vari-able	**Group**	**N**	**Insight Mean Scores**	**SD**	**t-value**	***p* - value**	**De-cision**	**Con-clusion**
In-sight	Students	179	3.09	0.19	-6.04	<0.01	Reject Ho, Accept Ha	Signi-ficant
	Teachers	8	3.51	0.30				

Teachers' viewed technology integration in teaching would really create a difference in students 'achievements. Considering the careful planning , choice of activities and assessment mode and teachers ' expectations on the assumed positive effects of the use of technology in learning would explain the higher insight score compare to the students. On the other hand, student different views, expectations as well as experiences in the use of technology in learning greatly affect their insights.

Table 1 shows a students and teachers differ in their insight regarding the use of technology in teaching physics (p<0.05). Teachers gave a higher insight score (M=3.51, SD=0.30) compared to students (M=3.09, SD=0.19).

Table 2: *Pre-test Performances of Control and Experimental Group*

Group	**Failed**		**Passed**		**Total**	
	F	**%**	**F**	**%**	**f**	**%**
Control	177	94.1	11	5.9	188	100.0
Experimental	155	86.6	24	13.4	179	100.0
Total	**332**	**90.5**	**35**	**9.5**	**367**	**100.0**

Table 2 shows the result of pre-test performance of the control and experimental group. Data from the table showed that 177 or 94.1 %of the students in the control group got a failing mark and 11 or 5.9 % obtained a passing score. The table also conveys that 155 or 86.6 % of the students in the experimental group got a failing score and 24 or a3.4 % got a passing mark. This means that students from both the control and experimental group did not perform well in the given pre- test.

Table 3: *Post-test Performances of Control and Experimental Groups*

Group	**Failed**		**Passed**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**
Control	117	62.2	71	37.8	188	100.0
Experimental	69	38.5	110	61.5	179	100.0
Total	**186**	**50.7**	**181**	**49.3**	**367**	**100.0**

Table 3 shows the result of post -test performance of the control and experimental group. It can be gleaned from the table that 117 or 62.2 %of the students in the control group got a failing mark and 71 or 37.8 % obtained a passing score. The table also conveys that 69 or 38.5 % of the students in the experimental group got a failing score and 110 or a61.5 % got a passing mark.

Table 4: *Comparison of Pre-test Scores between Control and Experimental Groups*

Variable	**Groups**	**N**	**Pre-test Mean Score**	**SD**	**t-value**	***p* - value**	**Decision**	**Conclusion**
Pre-test	Control	188	28.51	5.76	14.16	<0.001	Reject Ho, accept Ha	Significant
	Experimental	179	20.11	5.59				

Independent t-test was used to evaluate differences in mean scores for the pretest. The analysis indicated a significantly higher mean score for the control group (M=28.51, SD=5.76) as compared to the experimental group (M=20.11, SD=5.59) this implies that students in the control group performed better in the pre-test as compared to the students in the experimental group.

Table 5: *Analysis of Covariance (ANCOVA) for Post-test by Control and Experimental Treatments*

Source	***SS***	***Df***	***MS***	***F* - value**	***p* –value**
Pre-test	2,926.13	1	2,926.13	49.54	<0.01
Group	1,357.21	1	1,357.21	22.98	<0.01
Error	21,500.95	364	59.07		
Total	**491,991.00**	**367**			

A one-way ANCOVA was conducted for this part of study. Two groups were investigated, the control group and the experimental group. The post-tests were used as the dependent variable while the pre-test was the covariate. The analysis was significant, F (1, 364) = 49.54, p = 0.00 as seen in Table 5 showing the pre-test exerting an effect on the post-test.

The result of pre-test showed that the performance of the students are low this can be attributed to the lack of conceptual understanding of the students to the different physics topics presented to them.

Table 6: *Comparison of Post-test Mean Scores for Control and Experimental Groups*

Groups	**Post-test Mean Scores**	**SD**	***F* – value**	***p* - value**	**Decision**	**Con-clusion**
Control	35.40	6.10	22.98	<0.01	Reject Ho, accept Ha	Signi-ficant
Experi-mental	36.00	9.91				

Results also showed that group difference was significant, F (1, 136) = 22.98, p = 0.00). A higher experimental posttest score (M=36.00, SD=9.91) than the control (M=35.61, SD=6.10) was found after controlling for the effect of the pretest as shown in Table 6.

4.3 Development of Technology Integrated Lesson Designs

The output of this study is an exemplar lessons designs in teaching Physics 2 using Technology Integrated Strategy covering the whole course syllabus. It consists of the topics wave nature, sound waves, light and optics, nature of electricity, magnetism and electromagnetism. As a whole, the entire lessons for the course utilized the e- learning modular approach in teaching Physics anchoring in the outcome-based education approach.

5. Conclusions and Recommendations

The insights of both teacher and student respondents revealed a higher mean and lower standard deviation which implies that the teacher respondents strongly agreed on the positive influence and effect of integrating technology in teaching physics, moreover student-

respondents strongly agreed on effectiveness of integrating technology in teaching physics and its positive impact on the improvement of their learning capacity.

There is significant difference between the insights of the teachers' and students' in using technology integrated strategy, in the pre-test between the experimental and control group and in the post-test between the experimental and control group. The result suggests that the technology integration intervention used for physics instruction used by the experimental group was effective in improving the students' test scores. The output of this study, which is an exemplar lessons designs in teaching Physics 2 using Technology Integrated Strategy utilizing the e-learning modular approach anchored in the outcome-based education approach serves as an alternative teaching strategy to cater the need of our millennial generation.

The result of the study supports the study of Moeller & Reitzer (2011) who concluded that technology can support key practices of student – centered learning. Likewise, the study of Crippen & Earl, 2007 also attested the positive effect of the use of technology on student learning through web-based homework.

The following recommendations were offered, based on above- mentioned discussion derived from this study, Teachers could validate the use of Technology Integrated Strategy in other areas of Physics to further develop and enhanced learning competencies of the students. The study conducted is limited in determining the effectiveness of TIS in teaching physics, it is also recommended to replicate the study in other discipline. The instrument crafted by the researcher may be used by other institution in promoting technology integrated lesson presentations. In addition, to enhance the creativity , innovativeness as well as enrich teachers' competence in using technology, administrators are highly encourage to initiate the conduct of seminar- workshop about the use of different Technology Integrated Strategy on various discipline through continuing education program. Development of learning plans employing Technology Integrated Strategy (TIS) using outcome based education approach is highly recommended to actively involve the students in the teaching- learning process.

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