EXPLORING THE USE OF COMPUTER-AIDED INSTRUCTION IN REMEDIAL CLASSES

Jackie Lou C. Besaña[1], Lowell M. Gabunilas[2]
[1]Los Arcos National High School, Los Arcos, Prosperidad, Agusan del Sur
[2]University of Science and Technology of Southern Philippines, Cagayan de Oro City, Philippines
*For Correspondence: Tel. +639368942401, Email: lowell.gabunilas@ustp.edu.ph

ABSTRACT: *Remedial classes are important interventions to help learners catch up to their peers. Remedial classes usually do not follow the same setting and scheduling as regular classes and, because of this, there is a need to utilize innovative instructions. This study explored the use of three different modalities of computer-aided instruction (CAI) in remedial classes namely, Powerpoint presentation (PPT), Audio-visual presentation (AVP), and PhET simulation (PhET). The results show that the pretest and posttest scores of the students in remedial classes using CAI's differ significantly, with the scores under PPT having the best improvement. The results promote the advantage of using CAI's in remedial classes.*

Keywords: Educational, Technology Instructional Technology, Remedial Class, Science Education

I. INTRODUCTION

Background of the Study

In the Philippine K to 12 curriculum where the spiral progression approach is applied, revisiting the students' previous lessons and connecting them with the current lessons is important. In science education, as perceived by most students, physics is a complicated and difficult subject [1]. Physics education in the Philippines has been in an inconvenient situation. In the previous decade, Filipino students' achievement in physics was found to be below the international standards [2]. There have been improvements recently in the educational system and in the physics education, but some obstacles are still in the way [3, 4]. The students in the K to 12 curriculum are expected to learn the competencies set for them in their grade levels in order to successfully advance to the next grade level. Competencies are learned from the lessons in the subjects. Connecting a lesson from the preceding grade level to the present one when such is determined as the least learned may require additional effort from the teacher and the institution. To determine the least learned competencies of a certain subject or topic, DepEd, through the National Diagnostic Test Form 2 of DepEd Order 236, s. 2004, explicitly presented the range for mastery level. A percentage rating of 75%-100% indicates "mastery"; 50%-74% as "nearing mastery"; and 0%-50% as "no mastery". In Los Arcos National High School, where this study was conducted, among Grade 8 students, the least learned competencies in physics were reported to be in the Newton's Laws of Motion. This phenomenon was reported by the science teachers in their first quarter least learned competency report for the three consecutive school years 2016-2017, 2017-2018 and 2018-2019, respectively. This is consistent with the 2017 National Achievement Test (NAT) results in Science, with a mean percentage score (MPS) of 35.68% with the whole Caraga Region at 36.50% and the whole Division of Agusan del Sur at 39.30% [5]. An intervention with emphasis on the least learned competencies is therefore needed.

When a student fails to grasp a lesson in a grade level, a special kind of intervention called remedial teaching is conducted to ensure competency essential for the succeeding grade level. Because remedial teaching is usually done on top of the regular class schedules, the resources allocated to it, especially time, are relatively small. The teachers are encouraged to utilize the most appropriate and exciting approaches to make remedial teaching as efficient as well as effective.

In conducting classes, teachers should make the available science tools, materials, media, and technological resources accessible to students as much as possible to provide them with the time, space, and resources needed for learning. A practical science learning environment requires a broad range of fundamental scientific materials and specific tools for particular topics and learning experiences. In this connection, instructional materials play a significant role in the context of the teaching and learning process for they are used to enhance the learning experience. In the digital age, schools have adopted Computer-Assisted Instruction (CAI). It serves as a supplementary material to the conventional instruction which contributes to the individualization of education and gets students to take an active part in the learning process [6]. Furthermore, there is a need for educators to prepare students for their future careers by integrating technology in classrooms because computer literacy is part of learner's 21st century skills. With the speed at which technology is developing and impacting the world, it is impossible to imagine education in the 21st century not being immersed in technology [7].

In the setting of this study, the most common CAI modalities are multimedia presentation (PowerPoint presentation), computer simulation (PhET), and instructional videos. Their use in instruction has been explored for their potential. For example, it is found that students are more likely to answer concept tests correctly after seeing demonstrations with PhET simulations [8]. Video-based learning materials boost students' creativity and help increase their motivation [9]. And the use of PowerPoint presentations in the classroom is shown to promote significant positive change on learners' scores [10]. Nonetheless, in the context of constrained resources and limited time such as in remedial classes, the question is which method is more effective? The answer is usually left to the teacher to decide and it is up to her to examine the different aspects to consider and choose the most appropriate for learning.

Significance of CAI in Science Education

Computer-Assisted Instruction (CAI) is a term applied to a teaching or learning situation involving interaction between computer and student [11]. Computer-based teaching and learning produced positive effects in the classroom and is seen to increase student motivation [12]. It has been used to supplement academic achievements and promote mental skills [13] and to promote and achieve personalized learning [14]. The use of computers in instruction is generally categorized according to Taylor's classification as follows: 1) tutor, 2) tool, and 3) tutee [15, 16]. As a tutor, the computer is programmed first to present information, then practice questions, and finally, receive responses from the learners. In the tool mode, the computer is used to accomplish a task. It assists or acts as a tool in the learning environments. In the tutee mode, the computer acts as a student. It receives Instruction from the learner and performs specialized tasks.

Computer-assisted instruction is advantageous in clarifying scientific concepts [17]. It is more useful in stimulating the different levels of the cognitive domain, in enhancing visualization and reorganization of science facts in the learners' cognitive structure and in increasing the retention level of students as compared to traditional methods. The application of computer technology to all aspects of human endeavor had necessitated the use of CAI as it provides opportunities to support the shift to student-centered learning and is capable of creating a more interactive and engaging learning environment for teachers and learners [18]. Tambade & Wagh [19] reported that the application of computer technology in teaching makes a real difference in student learning. It can address misconceptions and help students develop functional understanding of scientific concepts and principles.

Selecting a Modality

Some computer technologies present particular types of content better than others. Making a thoughtful decision on which technology is appropriate for the content is an excellent step. For example, some scientific concepts are difficult to explain using chalk writing, but two PowerPoint figures could easily demonstrate it and would make students better understand scientific terms [20]. Students rated lectures with PowerPoint slides higher than those without slides [21] and gave better ratings to their course, self-efficacy [22] and to their instructor [23].

The use of video has also become an essential part of education. Several meta-analyses have shown that technology can enhance learning [24] and that video, specifically, can be a highly useful educational tool [25]. Videos may have particular value for student preparation in their science classes because students find it more engaging [26] and because it can be used in illuminating the abstract or hard-to-visualize phenomena [27]. However, the medium is not inherently effective. Students are most likely to disregard segments of educational videos [28] and that some videos have little effects to student performance [29].

Although simulations are not new in science education, PhET has made them more meaningful and accessible to the learners. PhET interactive simulations present scientific concepts in visual form which enable students to engage in scientists-like explorations and help them develop problem-solving and knowledge acquisition skills similar to experts [8]. Even without direct manipulation by the student, PhET is found to be effective in improving academic performance [30, 31].

CAI has been a subject of many educational researches and will still be in the future as more technologies are being developed.

Objective of the Study

This study explored the use of CAI in remedial classes. Specifically, it aimed to determine significant differences in the scores of students in remedial classes utilizing PowerPoint presentation (PPT), audio-visual presentation (AVP), and PhET. Analyses and generalizations of this study may help educators in designing effective technology-based remedial classes.

II. METHODOLOGY

The Participants and Locale of the Study

This study employed quasi-experimental design with three heterogeneously grouped (sections) students of Grade 8 (N=82) as the participants. Each section was scheduled to be the experimental group in one day and then control in another (see Table 1). Experimental groups were exposed to instructions using AVP and PhET simulations. Instructions using PPT were assigned to control groups. This counterbalancing approach provided equal opportunities for the learners to experience different CAI's. A pretest was given to the students across all groups and a segmented pretest for every remedial session. After each session using the pre-determined CAI, each group was evaluated using the segmented post-test covering only specific subtopics and another post-test on the Three Laws of Motion.

Table 1. Scheduling and Arrangement of Remedial Classes

Remedial Sessions	Group A (Hyacinth)	Group B (Lotus)	Group C (Water Lily)
	Pretest		
First Law of Motion (Law of Inertia)	Segmented Pretest		
	AVP	PhET Simulation	PowerPoint
	Segmented Posttest		
Second Law of Motion (Law of Acceleration)	Segmented Pretest		
	PhET Simulation	PowerPoint	AVP
	Segmented Posttest		
Third Law of Motion (Law of Interaction)	Segmented Pretest		
	PowerPoint	AVP	PhET Simulation
	Segmented Posttest		

	Posttest

Experimental Group Control Group Evaluation

Table 1 shows the distribution of different CAIs and subtopics of the Laws of Motion across all Grade 8 sections. The study was conducted in the first quarter of 2020 in Los Arcos National High School, in Agusan del Sur province, Philippines.

Table 2. Distribution of Respondents per Class

Classes	Male	Female	Total
Grade 8-Hyacinth	13	15	**28**
Grade 8-Lotus	14	13	**27**
Grade 8-Waterlily	12	15	**27**
TOTAL	**39**	**43**	**82**

Table 2 shows the three sections in remedial classes and the number of respondents in each section.

Research Instruments and Materials

The following are the instruments and materials utilized in the study.

1. Questionnaire – This researcher-made questionnaire was utilized in pretest and posttest. It underwent validation by experts.
2. Segmented Tests – three different segmented tests were given before and after the remedial sessions. Each test covers a specific subtopic. The items in the segmented tests are extracted from the researcher-made questionnaire.
3. PhET Simulation – This free simulation software on Newton's Laws of Motion was downloaded for offline use from the PhET website.
4. Audio Visual Presentation (AVP) - six videos were used in the remedial sessions the videos underwent content validation by experts.
5. PowerPoint Presentation (PPT) - the PowerPoint presentation for the selected topics was developed by the researcher and validated by education experts.

III. RESULTS AND DISCUSSIONS

Table 3. Mean Test Scores of the Students

Variables		Mean	N	Std. Dev.	Std. Error Mean
Controlled	Pretest_PPT	3.45	82	1.62	0.17878
	Posttest_PPT	4.18	82	1.87	0.20687
Experimental	Pretest_AVP	2.80	82	1.18	0.13036
	Posttest_AVP	3.39	82	1.50	0.16531
Experimental	Pretest_PhET	2.73	82	1.57	0.17357
	Posttest_PhET	3.23	82	1.47	0.16213

Table 3 shows that the students employed with PPT in the remedial session get the best improvement in scores with a posttest mean of 4.18.

Table 4. Mean comparison test between pretest and posttest scores of the students using the different CAIs

		Mean Diff	Std. Dev Diff	t	df	Sig. (2-tailed)
Pair 1	Hyacinth Pre and Posttest	-2.54	4.47	-3.003	27	0.006
Pair 2	Lotus Pre and Posttest	-1.59	3.71	-2.229	26	0.035
Pair 3	Waterlily Pre and Posttest	-0.52	4.05	-0.665	26	0.512

Using paired-sample t-test (Table 4), significant improvements in the scores of the students were observed except for students in the Waterlily section. This implies that the use of computer-aided instructions may enhance the performance of students undergoing remedial classes.

Table 5. Mean comparison test between segmented pretest and posttest scores of the students using the different CAIs

		Mean Diff	Std. Dev Diff	t	df	Sig. (2-tailed)
Pair 1	Pretest_PPT - Posttest_PPT	-0.73	0.72	-9.191	81	0.000
Pair 2	Pretest_AVP - Posttest_AVP	-0.59	0.70	-7.552	81	0.000
Pair 3	Pretest_PhET - Posttest_PhET	-0.50	0.59	-7.633	81	0.000

Another paired-sample t-test, (Table 5), reveals significant differences in the mean scores when segmented posttest scores of the students are computed against their respective segmented pretest scores which imply that each CAI helps improve the students' learning performance.

Table 6. Multiple Comparisons Using Three Remedial Modalities

Learning Resource (I)	(J)	Mean Difference (I-J)	Std. Error	Sig.
PPT	AVP	0.75610*	0.24751	0.007
	PhET	0.91463*	0.24751	0.001
AVP	PPT	-0.75610*	0.24751	0.007
	PhET	0.15854	0.24751	0.798
PhET	AVP	-0.15854	0.24751	0.798
	PPT	-0.91463*	0.24751	0.001

*The mean difference is significant at the 0.05 level

Post hoc analysis using Tukey HSD (Table 6) shows that remedial classes using PowerPoint Presentation (PPT) have better results than using PhET and AVP. This is interesting because while students generally prefer lectures with PPT [21- 23] many studies found that PPT has minimal effects on academic performance [32]. Although not included in the scope of this study, it is good to note the probable impact of the teacher's role during the remedial classes. In tandem with an excellent lecturing skill, a well-done PowerPoint presentation has the power to deliver a clear message and to capture and hold students' attention [33, 34]. PowerPoint presentations can make contents more appealing; therefore, they helped them take students' attention [35]. The post hoc analysis also conveys a result similar with the findings of

Ndihokubwayo [31] suggesting that when it comes to utilization as learning tools, PhET and videos are equally effective.

IV. CONCLUSION AND RECOMMENDATION

In this study, instruction with PowerPoint was determined to be the better modality in the conduct of remedial classes. However, there are unaccounted factors that might have tipped the balance to its favor. For example, the teacher's involvement in the PPT was higher compared to PhET and AVP where students were less dependent on the teacher. In addition, we consider the conditions during which this study was conducted. On the 8th of March 2020, Pres. Rodrigo Duterte signed Proclamation 922 placing the whole Philippines under state of public health emergency because of the presence of COVID-19 in the country. Face-to-face classes in all levels were suspended starting from the last week of March 2020. Therefore, this study was conducted with an unusually limited amount of time. No follow-ups and repeated exposure of the participants to the three CAI modalities had been conducted. Furthermore, this study did not take into account the learning styles of the participants and the teaching styles of the teacher. Investigations taking these as factors or predictors are suggested. It is also recommended that the effects of different modalities of CAI to the motivation of the students be included in future research.

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