

Effects of Utilizing Physics Podcasts on the ICT Literacy Skills of Grade 9 Junior High School Students

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In this current educational landscape, educators are being challenged to look for innovative ways to teach and integrate various literacy skills essential for the 21st century. As a form of Information and Communications Technology (ICT) tools, podcasting is now an emerging trend in pedagogy because it offers an alternative means of delivering content and enhances the learning and skills of today's learners. To verify this, the study aimed to determine whether the integration of 13 podcasts episodes as supplementary instructional materials in teaching different physics concepts could yield significant and positive increase on the level of ICT literacy skills among the students. It utilized an experimental pretest-posttest one-group design involving Grade 9 junior high school students from a laboratory school in Laguna, Philippines. A researcher-made instrument called ICT Literacy Skills Inventory (ICTLSI) was administered to the research sample in order to measure the impact of this teaching strategy on student ICT literacy skills, particularly on the following proficiencies: (1) Define, (2) Access, (3) Manage, (4) Integrate, (5) Evaluate, (6) Create, and (7) Communicate. Results showed that there was a positive increment in the pretest and posttest mean scores of the students after the intervention. Furthermore, four out of the seven proficiencies – Define, Access, Evaluate, and Create exhibited a result with significant improvement. It was found out that podcasting is pedagogically powerful in enhancing the level of ICT literacy skills among the students since it provides advantages to complement traditional curriculum delivery.

Keywords: *Information and Communications Technology (ICT) literacy skills, instructional material, physics education, podcast*

Introduction

As the use of digital technology becomes more embedded in today's daily routine, ICT devices have become inextricable to individuals as they deal with various aspects of their lives. Modern educators have already begun recognizing its potential to facilitate better learning and develop globally competitive students for the 21st century (Brown & Slagter van Tyron, 2010). However, these levels of exposure and engagement of today's learners in the internet and digital technology do not necessarily translate to digital literacy. This highlights the need to equip them properly with the skills they need to discern and utilize accurate information in this modern generation. Hence, the development of innovative and appropriate teaching approaches as well as valid and reliable techniques to assess students' technology competence is certainly essential.

In the Philippines, the government has been committed to modernize the educational system to be at par with its neighboring ASEAN countries. In February 2015, the Department of Education (DepEd) launched the National Strategic Planning Initiative for ICTs in Basic Education. Since its introduction, the use of ICTs has become considerably more prevalent in most elementary and secondary school curricula, as it aims to

broaden access and improve the quality and efficiency of basic education with the aid of different ICT tools (Bonifacio, n.d.; Camacho & Pintor, 2009; Department of Education [DepEd], 2010).

To respond to the calling of this educational program, podcast, an ICT tool, was used as instructional material in teaching high school physics classes. Podcast remains a resource yet to be tapped to improve student learning (Scutter, Stupans, Sawyer, & King, 2010). By description, it is a digital media file that plays audio and/or video components that can be downloaded and/or streamed online (Salmon, Mobbs, Edirisingha, & Dennet, 2008). While podcasts were not primarily intended for educational purposes, more and more educators were using them given the convenience of building a digital multimedia library among students and the availability of free downloadable softwares in the internet (Edirisingha, Rizzi, Nie, & Rothwell, 2007).

Furthermore, using the integration of podcasts to physics learning as the intervention of the study, its effects were measured on the level of ICT literacy among the students. According to the Association of College and Research Libraries (2000), Information and Communications Technology (ICT) literacy skills refer to a set of

Table 1
Components of ICT Literacy Skills According to the Educational Testing Service, 2003

Proficiency	Description
Define	Using ICT tools to identify and appropriately represent an information need
Access	Collecting and/or retrieving information in digital environments
Manage	Using ICT tools to apply an existing organizational or classification scheme for information
Integrate	Interpreting and representing information, such as by using ICT tools to synthesize, summarize, compare and contrast information from multiple sources
Evaluate	Judging the degree to which information satisfies the needs of the task in ICT environments, including determining authority, bias, and timeliness of materials
Create	Adapting, applying, designing or inventing information in ICT environments
Communicate	Communicating information properly in its context (audience, media) in ICT environments

abilities requiring individuals to recognize when an information is needed and have the ability to locate, evaluate and use them effectively. As shown in Table 1, it is comprised of seven proficiencies and their corresponding descriptions, namely: Define, Access, Manage, Integrate, Evaluate, Create, and Communicate (Educational Testing Services, 2003, p.2).

Overall, this research study aimed to determine whether the integration of podcast as supplementary materials in teaching different physics concepts to Grade 9 junior high school students could yield significant and increased levels of ICT literacy skills, particularly in terms of its different proficiencies (Figure 1). Paired samples t-test on the mean pretest and posttest scores of the students was employed as the statistical procedure to analyze the results of the study.

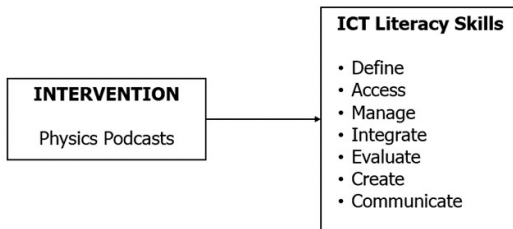


Figure 1. Conceptual framework of the study.

Methodology

Research Design

The study used an experimental pretest-posttest one-group design involving Grade 9 junior high school students. Before the intervention, Information and Communications Technology Literacy Skills Inventory (ICTLSI) was administered to the students for pretesting. After the eight-week integration of podcasts in their physics classes, the same questionnaire was given to the students as posttest. The research design of the study is as follows:

$O_1 \quad X \quad O_1'$

where:
 X = Intervention (Integration of physics podcasts)
 O_1 and O_1' = Pretest and Posttest, respectively, of the Information and Communications Technology Literacy Skills Inventory (ICTLSI)

Both quantitative and qualitative analyses of data were employed in the study. To analyze quantitative data, a paired samples t-test on the mean pretest and posttest scores was conducted using the SPSS software. All hypotheses were tested at a significance level of .05. Entries from student’s online journals were also collected to verify the results of the study qualitatively.

Sample

Two out of the three intact classes of Grade 9 junior high school students from a laboratory school in Laguna, Philippines served as the participants of the study. Two out of the three class sections were randomly selected using draw-lots technique. The sample size was composed of 82 students (50 female, 32 male), with ages that range from 14 to 16 years old. For ethical purposes, there were no incentives given or bearing in the academic grade of the students who took part in the research. Moreover, all podcast episodes were also distributed to the students of the section that was not involved in the research after the conduct of the study.

Instrument

ICT Literacy Skills Inventory (ICTLSI) is a researcher-made questionnaire that uses a 5-point Likert scale in which the students would indicate the degree of their agreement or disagreement on the statements about ICT literacy skills that are presented. The scale used for student’s responses is as follows:

- 5 – always true for me; there are very few times when I don’t feel this way,
- 4 – usually true of me; I feel this way more

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- than half the time,
3 – sometimes true of me; I feel this way about half the time,
2 – not often true of me; I feel this way less than half the time, and
1 – almost never true of me; I hardly ever feel this way.

It was validated by a panel of experts from the Educational Technology Area of the College of Education in the University of the Philippines Diliman, Institute of Computer Science in the University of the Philippines Los Baños, and Information and Media Technology Division in the University of the Philippines Open University. It had an initial number of 45 statements, which was reduced to 30 statements after the pilot testing and the post-evaluation of the panel experts. The questionnaire had 19 positive and 11 negative statements, with the number of items and maximum points, as shown in Table 2.

Table 2
Number of Items and Maximum Points for the Seven Proficiencies of the ICTLSI

Proficiencies	Number of items	Maximum points
Define	4	20
Access	4	20
Manage	5	25
Integrate	4	20
Evaluate	5	25
Create	4	20
Communicate	4	20
TOTAL	30	150

*The Cronbach's alpha of the instrument was computed and yielded a value of .842

Intervention

The "Physics Station" is a collection of 13 podcast episodes, which was developed by the researchers. For 15-20 minutes, each episode featured the conversations of its two hosts about different application of physics topics in everyday life. The topics covered were as follows: (1) Introduction to Physics, (2) Famous Physicists and their contributions, (3) Work – with two episodes, (4) Power, (5) Energy and its many forms, (6) Conservation of Mechanical Energy, (7) Center of Gravity, (8) Torque, (9) Uniform Circular Motion, (10) Law of Planetary Motion, (11) Law of Universal Gravitation, and (12) Heat and Temperature. These podcast episodes were uploaded in an Edmodo group, an online networking application that enables teachers to share content, quizzes, and assignments, as well as manage communication with students and colleagues. The students accessed these materials online through their mobile phones, laptops, and/or tablets. After listening, they had to accomplish their assignment and submit it. Moreover, the students recorded comments on their overall learning experience in their online journals in Edmodo.

ICT Literacy Skills Inventory (ICTLSI) was administered to all the students as pretest. After the 8-week intervention, the same instrument was given to them for posttest evaluation.

Results and Discussion

The study investigated the effects of utilizing physics podcasts on student ICT literacy skills. Specifically, it determined whether there would be significant and positive increase on the student's level of ICT literacy skills particularly on the seven proficiencies: Define, Access, Manage, Integrate, Evaluate, Create, and Communicate.

Initial Comparability on the ICT Literacy Skills of the Students

To measure the level of students' ICT literacy skills prior the intervention, the ICT Literacy Skills Inventory was administered to them. Table 3 shows the descriptive statistics of the pretest results of the students in ICTLSI. It includes the range of the scores (minimum and maximum scores obtained), the mean and the standard deviation for each proficiency of ICT literacy skills and for the over-all scores of the students in ICTLSI. Among the seven, Manage proficiency had the highest mean of, $M = 19.2$ out of 25 points or 77.12%. On the other hand, Communicate proficiency had the lowest mean of $M = 12.6$ out of 16 points or 63.11%. As a whole, the over-all mean for the pretest is 107 points out of the 150 total points to be earned, or about 71.33%.

Table 3
Descriptive Statistics of the Students' ICT Literacy Skills Prior the Intervention

Proficiency	Minimum	Maximum	Mean	Std. Deviation
Define	7	20	15.3	2.9
Access	8	20	14.9	2.7
Manage	9	25	19.2	3.6
Integrate	9	20	14.7	2.5
Evaluate	11	23	16.7	2.8
Create	8	17	13.4	2.3
Communicate	10	16	12.6	1.4
OVER-ALL	83	126	107.0	10.8

This means that even prior the intervention, students already had inherent skills on ICT literacy. It can be supported by the fact that they are dubbed as the "millennials" or "digital natives" of this modern generation. The trend of *millennials* using different ICT tools reflects their learning preference towards a more interactive and portable learning environment. Also, they do not do well in being passive learners and so, engage themselves to online environment which allows them to express their ideas and be more creative (Starlink, 2004). In light with the unique characteristics of today's learners, this study integrated the use of podcasts, as an example of ICT tools, into the student's traditional physics classes with the aim of improving their ICT literacy skills.

Effects of the Physics Podcasts on the ICT Literacy Skills of the Students

After the intervention, the ICTLSI was administered for the second time as posttest evaluation. Descriptive analysis for the posttest results is shown in Table 4. It can be noted that the total mean posttest score obtained by the students is 116.7, or 77.33%. This posttest mean score is 9 points higher compared to the pretest mean score.

Table 4
Descriptive Statistics of the Students' ICT Literacy Skills after the Intervention

Proficiency	Minimum	Maximum	Mean	Std. Deviation
Define	10	20	16.2	2.7
Access	10	20	16.3	2.7
Manage	12	25	19.3	2.9
Integrate	8	20	15.4	2.9
Evaluate	9	25	19.3	3.4
Create	12	20	17.2	2.1
Communicate	6	19	12.9	2.7
TOTAL	80	142	116.7	12.5

Similarly, Figure 2 illustrates the difference between the pretest and posttest scores in terms of the seven proficiencies of ICT literacy skills. The gray bar graphs represent the mean scores of the students on the pretest, while the black bar graphs are for the mean posttest scores. The differences in the mean pretest and posttest scores for each proficiency are as follows: Define = 0.9, Access = 1.4, Manage = 0.1, Integrate = 0.7, Evaluate = 2.6, Create = 3.8, and Communicate = 0.3; with Evaluate and Create proficiencies having the highest difference among the other proficiencies of ICT literacy skills.

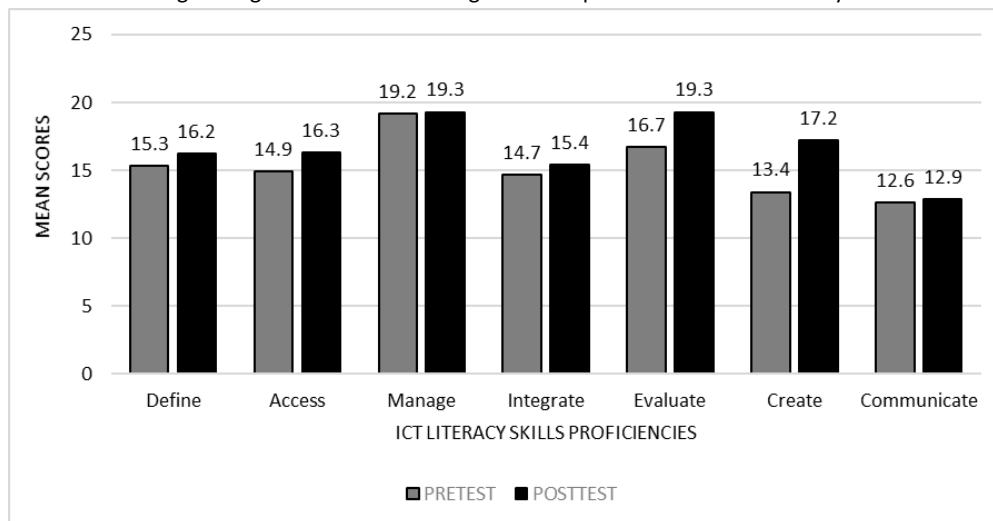


Figure 2. Comparison between the pretest and posttest mean scores of the ICT literacy skills proficiency.

The values may seem to be minimal differences. It can be attributed to the idea that ICT tools are information-handling tools and resources utilized for communication and dissemination of information (Blurton, 2002). The tools have various forms including web-based tools and applications, learning and teaching tools, mobile delivery devices, and other content delivery methods (Cengage Learning Australia, 2010). Podcasts, in particular, cover a very small part in the diverse set of these technological tools. It is one out of the many and complex combinations of available ICT tools used for educational purposes. In this study, the students were only exposed to one form of ICT tools, and that is, to the podcasts only. This could be one possible reason why the results of their mean posttest scores did not vary much with the pretest results. Nonetheless, the mean differences clearly show that there is a positive and improved level of ICT literacy skills among the students after the intervention.

Furthermore, to establish whether there was a significant improvement in the students' mean scores on the components of ICT literacy skills,

two-tailed paired-samples t-test was another statistical procedure applied to the study.

As shown in Table 5, the mean difference between the posttest and pretest scores (column 3), as well as the direction of the t-value (column 8), are all positive. It means that there is an increase in all of the test scores, hence positive improvement on the ICT literacy skills of the students after the intervention. The mean difference of the total scores, $t(81) = 10.08$, $p < .001$ is also statistically significant. Moreover, four out of the seven components of ICT literacy skills have a level of significance or p-value of $p < .05$. These include Define, $t(81) = 2.70$, $p = .008$; Access, $t(81) = 3.96$, $p < .001$; Evaluate, $t(81) = 5.90$, $p < .001$; and Create, $t(81) = 11.12$, $p < .001$. These proficiencies exhibit a statistically significant improvement in terms of the mean pretest and posttest scores. It can be established that the integration of podcasts as supplementary materials enabled the students to identify key concepts, retrieve and assess the essential information they need, which are some of the characteristics of ICT literacy skills. Moreover, their exposure to podcasts allowed them to recognize

Table 5
Results of the Paired Samples t-test for the Pretest and Posttest Scores of the Students

Proficiency	Paired Differences						t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1	Define	.95	3.19	.35	.25	1.66	2.70	81	.008*
Pair 2	Access	1.45	3.32	.37	.72	2.18	3.96	81	.000*
Pair 3	Manage	.06	4.54	.50	-.94	1.06	.12	81	.904
Pair 4	Integrate	.54	3.72	.41	-.28	1.35	1.31	81	.195
Pair 5	Evaluate	2.59	3.97	.44	1.71	3.46	5.90	81	.000*
Pair 6	Create	3.84	3.13	.35	3.15	4.53	11.12	81	.000*
Pair 7	Communicate	.30	3.24	.36	-.41	1.02	.85	81	.398
	TOTAL	9.73	8.74	.97	7.81	11.65	10.08	81	.000*

* $p < 0.05$

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the appropriateness and relevance of information to their learning and tasks-at-hand. This was evident during their classroom participation wherein they could easily use only the important information relevant to the activity. Since they already had an overview of the lessons through the physics podcast episodes, they were able to answer the questions given during the activities. In effect, integrating podcasts to students' learning helped them evaluate different information better.

Consistently, the personal insights posted by the students on their online journals in Edmodo group supported the numerical results of this study. Most of them mentioned (in underlined statements) the effects of utilizing podcasts as supplementary materials to their ICT literacy skills, particularly on how they were able to access and evaluate the information and translate them to learning physics concepts.

"I enjoyed! It made Physics sound easy. I took down every piece of information I could hear. I want to do this again and it's nice that we are making use of technology." (Student 61)

"While listening, I took notes and also searched for the correct spellings of the terms and people that were mentioned. After listening, I realized that podcasts are actually a great method for learning because it requires focus and listening." (Student 9)

"Mas madaling i-search sa internet yung mga concepts na hindi ko maintindihan sa lesson namin, angaling nung podcasts! [It is now easier for me to search in the internet some of the concepts included in our lessons that I find difficult to understand, the podcasts are good!]" (Student 23)

"The experience of listening to podcasts has been great for me because I discovered another media in which I can learn. Since technology is used for us to learn, I look forward to better and more fun avenues of learning physics." (Student 12)

"Pinakinggan ko yung podcast for center of gravity, tapos ni-search ko din sa internet yung concept. Mas madali kong naintindihan at nakakaparticipate na ako sa klase [I listened to the podcast episode about center of gravity, then I searched the concept on the internet. It is easier for me to understand and I got to participate in the classroom discussions]." (Student 50)

In summary, the integration of podcasts as supplementary materials in lecture discussions facilitated active learning among students. Podcasts enriched the contents presented in class making the levels of understanding among the students increased (Chan & Lee, 2005; Edirisingha et al., 2007; Scutter et al., 2010). Moreover, podcasts also offered flexibility and self-control to the learners as they study a certain subject (Dyson, Litchfield, Lawrence, Raban, & Leijdekkers, 2009; Fernandez, Simo, & Sallan, 2009; Ng'ambi & Lombe, 2012). Moreover, Wieman and Perkins (2006) suggested that the integration of these simple and inexpensive tools have found out to be pedagogically powerful. Since students often find physics as a difficult and abstract subject, the use of ICT tools could well satisfy their need for a more student-centered teaching and learning environment. Also, this enables them to achieve maximum learning experience without restricting their knowledge inside the classroom, since podcasts can still be utilized even outside the classrooms (Gurcay et al., 2013).

Conclusion

Based on the results of the preceding analyses, the following findings were established:

1. With the integration of podcasts as supplementary materials, the mean posttest scores of the students on the ICT literacy skills inventory including all of its proficiencies increased compared to the mean pretest scores. Considerable improvement was determined by the 9-point mean difference or about 6.49% positive increment in the level of ICT literacy skills after the intervention.

2. Among the seven proficiencies of ICT literacy skills, four of them exhibited statistically significant improvement as analyzed using paired samples t-test, with $p < .05$. These include Define, Access, Evaluate, and Create proficiencies. This finding shows that podcasting allowed the students to identify key concepts, collect or retrieve important information they needed and evaluate the relevance of such information on their task-at-hand. These skills are very essential in facilitating students to become lifelong learners who are capable of functioning in the 21st century society.
3. Feedbacks of the students on using the podcasts and how it affected their learning as well as improved their ICT literacy skills were also included. The comments on their online journals affirmed the numerical results of the study.

It is clear that ICT tools offer advantages to complement traditional curriculum delivery. Its integration in education can be a good investment for the future since it greatly affects student's achievement and performance. With the ICT integration in every Philippine classroom, the goal is to maximize the use of technology to empower learners to generate their own ideas and content, and for them to develop independence in learning.

Recommendations

The following are the recommendations for future studies and to address unanswered questions or issues in the study:

1. Three out of seven ICT literacy skills proficiencies, namely: Manage, Integrate and Communicate showed no statistically significant improvement based on the pretest-posttest comparison. The study failed to present possible explanations for such findings. With that, it is recommended to include analysis and discussion for these proficiencies for future studies. This can be done by employing more and varied ICT tools, such as web-based applications and other content mobile delivery, in order to develop or enhance all ICT literacy skills proficiencies of the students. While significant progress has been made in the integration of technologies in the formal education, much work still needs to be done to ensure that the integration of ICT tools is optimized and efficiently carried out in every Philippine classroom.
2. This study utilized podcasts as supplementary materials which occurred in a blended/flipped learning setup, wherein a traditional classroom discussion is still incorporated in the intervention. Another study that can be investigated is the potential of podcasts for stand-alone mode of instruction. This means that students will not be required to have a face-to-face instruction instead, every discussion is recorded in podcasts. This suggestion may be applied in the higher education setting, graduate studies or distance and open learning systems.

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