

Effectiveness of Supplementary Electronic Audio Course Materials among Students of Enugu State University of Science and Technology, Enugu, Nigeria.

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ABSTRACT: *The research sought to determine the effect of exposure to supplementary electronic audio course materials on the performance of students in terminal examinations. The research was conducted in two classes of the department of Business Administration in the Enugu State University of Science and Technology located in Nigeria. A quasi-experimental design was used for the study. From a student population of 180, the subjects of the study consisting of 167 samples were selected. Out of the sample, 79 students were purposefully selected as experimental subjects while 88 students were placed in the control group. Data were collected using structured questionnaire, records of class attendance and end-of-semester results while CD-ROMs containing TextAloud audio recording of selected course materials were distributed to the experimental group as the study treatment. Data collected and analyzed using ANOVA showed no significant effect of exposure to audio recording on the examination scores of students lumped into one group but revealed that combinations of gender, course level, and class attendance with exposure had significant interaction effects on academic performance of students. Data analysis also showed that highly exposed students performed much better than those with low or zero exposure. The overall conclusion from the findings of the study is that exposure to audio recording of course material is highly beneficial to students that are highly exposed to it.*

Keywords: *academic performance, effectiveness, electronic audio course materials, exposure.*

1. Introduction

1.1 Nature of the study

It is now generally accepted that e-learning which incorporates the subject matter of the present study, is an enhancing approach in education ([1] O'Donoghue, Singh, and Dorward 2001. Furthermore, there is widespread adoption of e-learning by educational institutions across the globe ([2] Hemsley 2002, [3] Hartley 2002, [4] O'Hearn 2000). Yet, the specific contributions of different e-learning components to learning outcome are still a subject of debate ([5] Demetriadis & Pombortsis 2000.

With respect to the specific field of oral communication, while it is generally acknowledged as a standard tool in the teaching learning transaction, the effectiveness of its use in the physical classroom is obviously limited by its

transient nature; hence one of the appeals of use of electronic audio devices for course content delivery is its potential to reduce the limitations inherent in classroom lecturing. In fact, a recent study has indicated high demand by students for supplementary electronic audio course materials ([6] Anowor and Anigbo, 2014).

However, although it can be plausibly hypothesized that exposure of students to supplementary course material would enhance their learning outcome, there is need to conduct this study to empirically ascertain the precise effect of such exposure on student academic performance. This assertion is supported by the generally accepted need to test the effect of any new educational technique on learning outcome before adopting it as a method. Failure to do that will result in basing educational practice on mere assumptions, which is scientifically unacceptable.

The main aim of this study is to find out what effect exposure to supplementary electronic audio course materials has on the performance of students in terminal examinations. The study further determined the interaction effects of gender, course level and study habit on the exposure outcome.

The objectives of the study were to find out:

1. The effect of exposure to audio CD recording on academic performance of students
2. The interaction effect of gender and exposure on the academic performance of students
3. The interaction effect of course level and exposure on the academic performance of students
4. The interaction effect of class attendance and exposure on the academic performance of students.

To answer the research questions arising from the set objectives, the following hypotheses were formulated and tested:

1. H_{01} : Exposure to supplementary audio CD lecture material has no significant effect on the academic performance of students
 H_{a1} : Exposure to supplementary audio CD lecture material has significant effect on the academic performance of students
2. H_{02} : There is no interaction effect of gender and exposure on the academic performance of students
 H_{a2} : There is interaction effect of gender and exposure on the academic performance of students
3. H_{03} : There is no interaction effect of course level and exposure on the academic performance of students
 H_{a3} : There is interaction effect of course level and exposure on the academic performance of students
4. H_{04} : There is no interaction effect of class attendance and exposure on the academic performance of students
 H_{a4} : There is interaction effect of attendance and exposure on the academic performance of students.

1.2. Review of literature

It is generally accepted that e-learning, which incorporates the use of electronic audio lectures, is an enhancing approach in education. In an article entitled, Virtual Education in Universities: a technological imperative, [1] O'Donogue et al (2001) contend that technology will undoubtedly offer many benefits for the learner. Another article edited by [7] Audrey, Lipsplitz and Steven (2008), titled, 'E-Learning: 21st Century Issues and Challenges', reports that students generally appear to be at least as satisfied with their on-line classes as they are with traditional ones. Furthermore, [2] Hemsley (2002), [3] Hartley (2002) and [4] O'Hearn (2000) affirm widespread adoption of e-

learning by educational institutions across the globe. Studies carried out on the effectiveness of electronic audio lectures indicate that they are at least as useful to students as the traditional face-to-face classroom lectures. In an article entitled ‘Where are audio recordings of lectures in the new educational technology landscape?’ [8] McKenzie (2008) asserts that the increasing availability of audio recordings of lectures is having an impact on the role of the traditional lecture in universities but that less is known about the impact of listening to recorded lectures on the quality of the learning experience.

The aim of [8] McKenzie’s study was to examine undergraduate psychology student’s perceptions of attending lectures versus listening to audio recordings of lectures. Data were collected as part of a larger survey of psychology students’ perceptions of the teaching and learning resources used in undergraduate units. In all core psychology units the audio lecture recordings were made available to students online through the university’s library lecture recording system. Students had access to the lectures slides via Blackboard, but these were not synchronized with the audio recordings as would be the case with a lecture capture system such as Lectopia. For all students, the audio recordings of lectures were available as an extra resource to supplement existing teaching practice. Comparing student ratings of lecture attendance and audio lecture recordings indicates that, *in reality*, listening to recordings was at least as effective as attending the lectures at meeting each of the learning objectives. In fact, students rated listening to a recorded lecture as meeting the objectives of acquiring information and clarifying what needs to be learned significantly more highly than attending lectures.

The result of [8] McKenzie’s study where undergraduate psychology students were asked how well attending lectures and listening to audio recordings of lectures met a range of learning objectives, showed that, compared to attending lectures, listening to recorded lectures was at least as effective in meeting the learning objectives, and is even rated significantly higher than attendance in relation to acquiring information and clarifying what needs to be learned. [8] McKenzie’s study did not however empirically test the effect of listening to recorded lectures on learning outcome, which is the purpose of the present study.

A similar study by [6] Anowor and Anigbo (2014) titled, ‘Demand for e-learning audio resources among students in Enugu State University of Science and Technology’, indicated high demand by students for supplementary electronic audio materials. However, although the study showed that there was an overwhelming desire among the subjects for supplementary audio versions of lectures, testing the effectiveness of recorded audio lectures was not part of the objectives of this study. Other scholars who contend that, among students, there is strong agreement that lecture recordings are a useful learning resource includes: [9] Cramer, Collins, Snider & Fawcett (2007); [10] Soong, Chan, Cheers & Hu (2006); [11] Williams & Fardon (2007).

On the role of lecture attendance however, studies show that students use the recorded lectures to supplement, not replace, going to lectures ([12] Copley, 2007; [13] McElroy & Blount, 2006; [14] Phillips, Gosper, McNeill, Woo, Preston & Green, 2007). It has also been found that the reasons why students access lecture recordings are most commonly for review and revision (especially around exam time) and to ‘catch up’ a missed lecture (due to travel time, timetable clash, sickness or work commitments); but also because some students prefer the convenience of listening to recordings, and to help with language difficulties ([10] Cramer et al., 2007; [12] Copley, 2007; [15] Fardon, 2003; [13] McElroy & Blount, 2007; [16] McNeill, Woo, Gosper, Phillips, Preston and Green, 2007; [10] Soong et al., 2006; [11] Williams & Fardon, 2007).

As [8] McKenzie (2008) has observed, less attention has been paid to investigating whether listening to a recording of a lecture that was delivered primarily for students sitting in the lecture theatre has an impact on the quality and

nature of the learning experience. The same author however opines that in terms of information transmission, listening to a recorded lecture would be at least as effective as attending in person and that in that case, lecture recordings may be sufficient to meet the needs of today's students. [12] Copley (2007) has in contrast reported that students mostly still attend lectures for the opportunity to interact and because 'live' will always be better, while [16] McNeill et al., (2007) also identified the motivational aspect of 'live' lectures, and the 'added value' of having the lecturer present as important reasons for attending. The present study addresses one of the limitations of the work of McKenzie and others, namely the empirical testing of the effectiveness of audio recordings of lectures.

Some studies claim that recorded lectures have little to no effect on student results ([17] Leadbeater et al. (2013) found that despite high usage, lecture recordings did not appear to significantly affect academic performance. [14] Phillips *et al.* (2011) however suggest that more frequent access to recorded lectures leads to more positive results and learning behaviours while it is evident that reductions in student lecture attendance due to the availability of lecture recordings had a negligible effect on student attainment ([18] Karnad, 2013).

In other studies, students are found to be strongly in favour of having recordings available and believe they are useful ([19] Pale, Patrovic & Jaren, 2014; [20] Bacro, Mulugeta & Fitzharris, 2011). Most students prefer the classroom as the primary learning space with online modes viewed primarily as a supplement to, or occasional replacement for, the face-to-face experience. ([25] Farrington, Tar, Douglas, Bird, Pittaway, Hoffman & Bel., 2014), [18] Karnad, (2013) found that students largely use recorded lectures to catch up on missed lectures and as a revision tool for exams and assessments, and often find recorded lectures to be a useful learning tool. According to [21] Marchand, Pearson & Albon. (2014), using recorded lectures to catch up may be because of a clash of classes, or because students are overloaded with assignments, or because they are ill or working or have some personal reason for not being able to attend a particular class. Illness or competing priorities such as work or other lectures were more cited reasons for students missing lectures than availability of recorded lectures. [22] Massingham & Herrington (2006), [23] Danielson, Preast, Bender, & Hassal. (2014) found that students were most likely to view the captured lectures in the courses that moved quickly, relied heavily on lectures, and that that recorded lectures were perceived as highly relevant to their future success, and contained information not available in other formats.

II Research methodology

The research design is ex-post-facto. Ex-post-facto design has been described as a quasi-experimental study examining how an independent variable, present prior to the study, affects a dependent variable. In an ex-post-facto design, people are not randomly assigned to an experimental group or control group. They are purposefully put in a particular group based on some prior characteristics they have. (Education Portal, 21 September 2014). This design is appropriate for this study since it was carried out on students who are exposed to audio materials and their course mates who are not. There was no randomization of the subjects. The study made use of a sample of two homogeneous groups of research subjects, with and without treatment of the independent variable of 'exposure' respectively, that were selected through purposive sampling.

From a student population of 180, 79 students were purposefully selected as experimental subjects while 88 students were placed in the control group. Only 13 students who did not have examination scores were excluded from the sample.

Selection into the experimental group was based on expressed ability to listen to audio recording on CD Rom. A further breakdown of the population showed that 132 students in the population were in Year 3 of the degree course, while 48 were year 2 students.

2.1 Development of Instruments

Instruments were developed to collect data required for the study as follows:

- Structured questionnaire to collect bio-data of the subjects of the study namely, their gender and the experimental subjects' regularity in utilizing the received audio course material
- Attendance record of the research subjects regularity in class room lectures on the selected courses
- Achievement scores of the subjects of the study on the departmental terminal semester examination.

The treatment tool for this study was a TextAloud audio CD- recording of the selected course materials developed by the Open and Distance Learning (ODL) Centre of the University with inputs from the course lecturers in the Department of Business Administration of Enugu State University of Science and Technology, as shown in Figs 1 and 2 below:

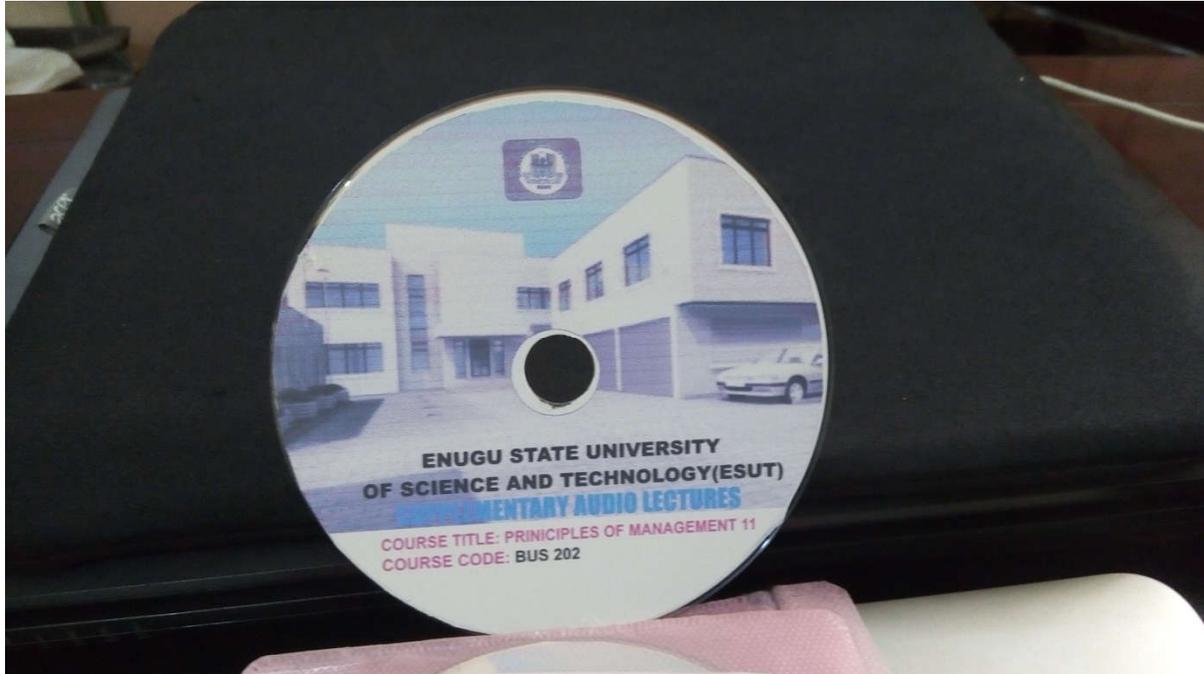


Figure 1

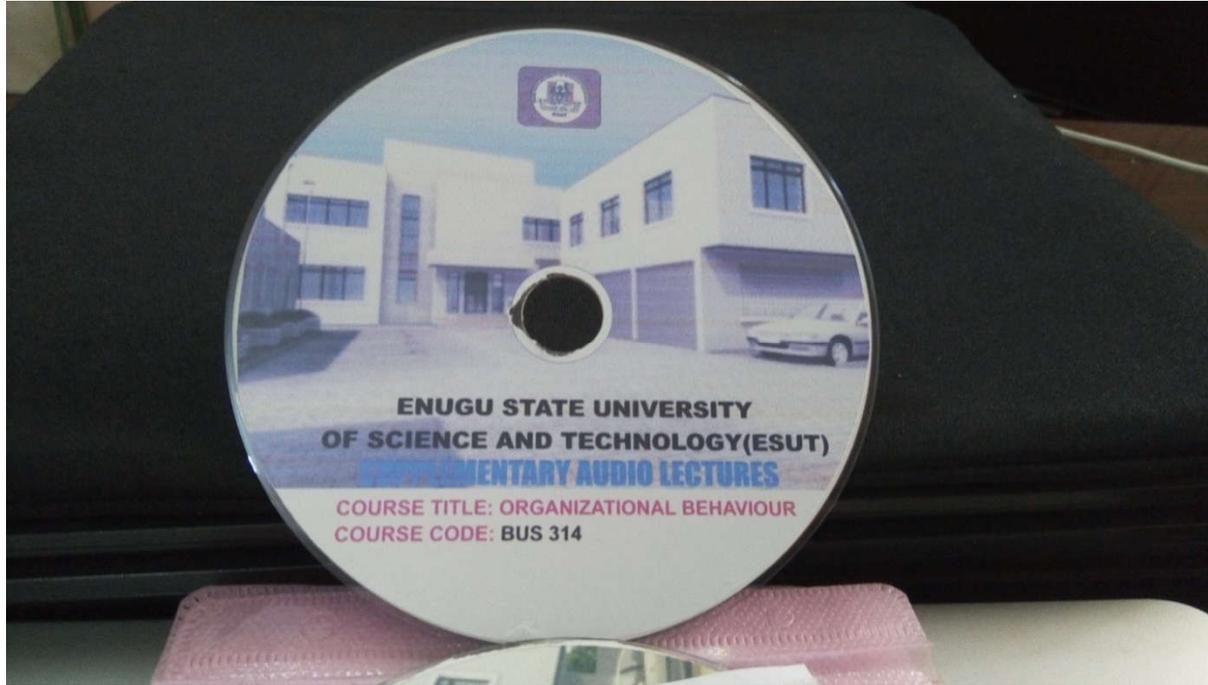


Figure 2

2.2 Data collection

Information on regularity of attendance of classroom lectures and on terminal achievement scores of students were collected from records kept by lecturers of the 2 selected business administration courses namely, BUS 314: Organizational Behavior and BUS 202: Principles of Management.

With the assistance of the course lecturers from the selected department, the audio CDs were made available to selected students and proper records of those who obtained the materials were kept.

The research questionnaire was administered to the experimental subjects of the study to collect needed bio-data and those relating to level of utilization of the CD/DVD audio course material as required to quantify the moderator variables of gender, study habit and subject level.

This was followed by:

- Collection and analysis of record containing data on class attendance of the subjects of the study to determine the level of their classroom study habit
- Collection of data on academic performance of the different categories of the subjects of the study and

- Comparison of the terminal results of the experimental and control groups to determine the effectiveness of the study treatment.

2.3 Data analysis

ANOVA was employed using SPSS to analyze data collected in respect of the examination scores of the experimental and control groups as a whole, and those of the subgroups based on other variables of gender, course level and study habit in terms of listening frequency and class attendance.

The decision rule set for testing the hypotheses is: if p value is less than .05, the test is significant, otherwise the test is not significant.

III Findings

Table 1: Mean scores of students by various categories

	N	Mean	Std. Deviation
Experimental	79	51.2222	14.28723
Control	88	50.1932	10.65861
Male(exp)	49	48.6939	16.94256
female(exp)	30	55.4333	7.66399
year2(exp)	37	53.6486	8.13844
year3(exp)	42	49.1429	18.17472
Valid N (list wise)	30		

Table 1 shows differences in the mean scores of various categories of the subjects of the study with higher mean scores recorded for experimental vs control groups, female vs male, and Year 2 vs Year 3 students.

Ho 1. Exposure to supplementary audio CD lecture material has no significant effect on the academic performance of students.

Table 2: Analysis of variance to test if there is significant difference in the performance of the students who were exposed to audio CD recording of material and those who were not

	Sum of Squares	df	Mean Square	F	Sig.

Between Groups	124.224	1	124.224	.656	.420
Within Groups	21212.267	112	189.395		
Total	21336.491	113			

Table 2 shows a p value (Sig) of .420.

Decision

Since the p value of .420 is greater than .05, the test is not significant,

Conclusion

We conclude that there is no significant difference in the performance of students, as a whole, who are exposed to audio CD recording of course material and those who were not, and therefore do not reject the null hypothesis that exposure to supplementary audio CD lecture material has no significant effect on the academic performance of students .

However, when students were grouped according to the number of times they listened to the audio CD recording, the following result was obtained:

Table 3: Mean scores of students by listening frequency

Exposure level	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1.00	47.227	4.700	37.856	56.599
2.00	50.012	2.318	45.390	54.633
3.00	60.143	7.714	44.761	75.524
4.00	51.917	3.608	44.723	59.111

From the table above, students who stated that they listened three times obtained a much higher mean score (60.143) than the grand mean of the exposed students (51.222) or that of the control group (50.1932) as shown in Table 1.

H₀ 2: There is no interaction effect of gender and exposure on the academic performance of students

Table 4: Analysis of Variance to test the Interaction Effect of Gender and Exposure on Academic Performance.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender	1070.208(a)	1	1070.208	5.343	.024
Exposure	187781.825	1	187781.825	937.514	.000
Interaction	1070.208	1	1070.208	5.343	.024
Error	14221.134	71	200.298		
Total	204044.000	73			
Corrected Total	15291.342	72			

Table 4 shows a computed interaction F value of 5.343 and a corresponding p value (Sig.) of .024.

Decision

Since the p value of .024, is less than .05 the test is significant.

Conclusion

We reject the null hypothesis that there is no interaction effect of Gender and Exposure on academic performance of students and therefore accept the alternative hypothesis that there is interaction effect of gender and exposure on the academic performance of students, with mean scores of 48.69 and 55.43 recorded for exposed males and females respectively as shown in Table 1.

H₀ 3: There is no interaction effect of course level and exposure on the academic performance of students

Table 5: Analysis of Variance to test the interaction effect of course level and exposure on performance

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Course level	1083.021(a)	1	1083.021	5.412	.023
Exposure	188325.761	1	188325.761	941.077	.000
Interaction	1083.021	1	1083.021	5.412	.023
Error	14208.321	71	200.117		
Total	204044.000	73			
Corrected Total	15291.342	72			

Table 5 shows a computed interaction F value of 5.412 and a corresponding p value (Sig.) of .02

Decision

Since the p value of .023 is less than .05 the test is significant.

Conclusion

We reject the null hypothesis that there is no Interaction effect of course level and exposure on academic performance of students and therefore accept the alternative hypothesis that there is interaction effect of course level

Decision

Since the p value of .000 is less than .05 the test is significant.

Conclusion

We reject the null hypothesis that there is no Interaction effect of attendance and exposure on academic performance of students and therefore accept the alternative hypothesis that there is interaction effect of attendance and level of exposure on the academic performance of students with mean scores of exposed students who attended classes 4 times and above being considerably higher than those of students who attended 3 times and below as shown in Table 6.

IV Discussion

Regarding the first research question, the finding is that the null hypothesis that exposure to supplementary audio CD lecture material has no significant effect on the academic performance of students is not rejected. This finding fills the gap pointed out by [8] McKenzie (2008) that less is known about the impact of listening to recorded lectures on the quality of the learning experience. In [8] McKenzie's study students merely subjectively rated listening to a recorded lecture as meeting the objectives of acquiring information and clarifying what needs to be learned significantly more highly than attending lectures, while the present study empirically compared the examination scores of students who listened to recorded lecture materials with those of students who did not.

However, the finding in the present study that students who stated that they listened three times obtained a much higher mean score than the grand mean of the exposed students or that of the control group appears to support [8] McKenzie's assertion that the increasing availability of audio recordings of lectures is having an impact on the role of the traditional lecture in universities. Furthermore the finding of the present study in respect of frequent listeners to audio lectures also supports the contentions of [9] Cramer, Collins, Snider & Fawcett (2007); [10] Soong, Chan, Cheers & Hu (2006); [11] Williams & Fardon (2007) that among students, there is strong agreement that lecture recordings are a useful learning resource.

The findings on the first research question of the present study also appear, in one sense, to support findings by [17] Leadbeater et al. (2013) that despite high usage, lecture recordings did not appear to significantly affect academic performance and, in another sense, the suggestion of [14] Phillips *et al.* (2011) that more frequent access to recorded lectures leads to more positive results and learning behaviour.

On the whole, the reason for the finding that exposure to supplementary audio CD lecture material did not have significant effect on the academic performance of the subjects of the study lumped together may be on account of discrepancies relating to uneven presence of independent moderator variables such as other available academic support, access to other learning resources and possession of superior previous knowledge among the sample of the study. It was also seen that the mean scores of groups of students with different levels of exposure differed remarkably, with the highly exposed students performing better than those with low or zero exposure.

Findings on the other four hypotheses of the study indicate significant interaction effects of certain combinations of other independent variables with exposure on academic performance. This is in contrast with the main finding of non effectiveness of exposure to audio recording of lecture materials. However the findings are not surprising since it is known that in the case of combinations of variables, such as in the present study, it is possible to obtain non-

significant values representing both independent or main effect variables but a highly significant value for interaction ([24] Uzoagulu, 1998); Hence it has been remarked that an interaction means that the main effects cannot be relied upon to tell the full story because when there is an interaction effect, it means the main effects do not collectively explain all of the influence of the independent variables on the dependent variables. See [ANOVA: Understanding Interaction - Wilderdom](#), www.wilderdom.com/statistics/Interaction.html. (retrieved on December 15, 2016).

On the role of lecture attendance however, the finding on the fourth hypothesis that there is interaction effect of attendance and level of exposure on the academic performance of students appears to support studies by [12] Copley, (2007), [13] McElroy & Blount (2006), and [14] Phillips et al.(2007) showing that students use the recorded lectures to supplement, not replace, going to lectures.

The literature available, or reviewed for the present study, did not reveal any study on the interaction effect of the variables of sex, course level, and study habit on the effectiveness of exposure to recorded audio lecture materials. It is however interesting to find, through this study, that the effectiveness of listening to audio recording varies depending on such variables as sex, course level, listening regularity and class attendance.

V. Conclusion

The findings of this study will highly benefit the society as a whole and the university system in particular. The enhancement of learning outcome through the use of technology, which the study indicates, contributes to making instruction better able to improve knowledge and skills that are required to lift society to a higher level. The findings of the study are also useful in making the products of the university system more knowledgeable and better skilled in the different areas of competence required for meeting the needs of the larger society.

Technology enhanced education, which the findings of the study indicate will result in making the prevailing huge cost of imparting and acquiring knowledge and skills more productive in that it will reduce the time wastage involved in analogue-based procedures to the barest minimum. This is because the findings of the study indicate ways of reducing failure rate in the education system. Furthermore the rapid improvement in the knowledge and skills of university graduates, which the findings of the study indicate, will lead to higher rate of graduate employability and self-sustainability that will result in greater gross national product.

The findings of the study will enhance technological skill among the students who will utilize electronic audio course material during the course of their study. Since the utilization of electronic audio course material has been found to be beneficial among the subjects of the study, a wider population of students could benefit from this technologically-enhanced learning method when applied.

The study was limited by some factors that the researchers did not control. The previous knowledge of the students was not determined. It was not known if the subjects of the study were homogeneous in intelligence. The research did not also investigate other forms of academic support utilized by the students. It was also not known to what extent the examination scores awarded the students actually measured their knowledge of the course contents. It is therefore possible that a different result could be obtained if such extraneous variables were controlled.

Consequently another research to replicate this study with greater control of the relevant extraneous variables would be desirable and useful.

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