International Journal of Innovation and Research in Educational Sciences
Volume 5, Issue 3, ISSN (Online) : 2349–5219

Effectiveness of Information and Communication Technology (ICT) integration in Chemistry Subject

Elvin H. Wenceslao and Bryant C. Acar*
*Corresponding author email id: bryantacar@gmail.com

Date of publication (dd/mm/yyyy): 07/06/2018

***Abstract* – This study aimed to integrate the Information and Communication Technology (ICT) on selected topic in Science and Technology (CHEMISTRY) to the Third Year High School Students of Ipil National High School, Ipil, Ormoc City as basis for an Integration Plan. This study utilized the Quasi - experimental research design. The researcher asked permission from the principal and Head teachers to use the Division Quarter test Paper as an instrument to measure the performance level of the students before and after the ICT integration in the lesson being prepared. The researcher prepared video and power point lessons from the internet especially You Tube through You Tube downloader and prepared video lesson from Constel in a power point presentation in every lesson delivered especially during discussion. Based from the findings of the study, the test result manifest that the Computational Skills and theoretical skills in Science and Technology (Chemistry) was enhanced through the use of Information and Communication Technology. Hence, ICT was effective in improving the skills of students in chemistry.**

***Keywords* – Chemistry Teaching; Experimental Research; Information Communication Technology; Integration of ICT in Teaching.**

I. INTRODUCTION

In many researchers, the information and communication technology (ICT) integration has been very successful in improving the performance of the learners. ICT enhances the visual and operational knowledge of the learners. In Ipil, National High School it has been a prime objective to promote in learning through the use of ICT.

A considerable amount of study has been done on the less supply of textbooks in third world countries which include Mathematics, Science and High School literature anthologies (Zulla, 2001). Hence, study by Fiske (1993) revealed that student's performance is affected by the availability of appropriate material used in teaching.

According to Guderya (2004) in his study, ICT has become one of the sets of tools for teaching and learning whereby the objective is to promote creativity among the students and teachers and the integration of computers as means of improving teaching and learning within a schools system. Her research supports the positions that for an effective use of ICT students have to see it demonstrated and be encouraged to acquire information through a variety of tools for learning.

The records of the test results of Ipil National High School, Ipil, Ormoc City for the school year 2008-2009 shows that the achievement level of the Third year students in Science and Technology III (Chemistry) was very low. The performance level ranges from 30 – 50 percent only which is below the passing rate. On the other hand, Science and Technology I, II, and III shows the same performance. In this manner, Ipil National High School is pointed out as one of the low performing School in whole Ormoc City Division and it always marked below 75 percent in the National, Regional, Division and even in the School based Periodical Tests.

This study focused on the effectiveness of the application of Information and communication technology (ICT). The result of the study was the basis for ICT integration plan.

II. REVIEW OF RELATED LITERATURE

This study utilized the concept on Active Learning Model (ALM) (Glazer, 1992). ALM refers to techniques where students do more than simply listen to a lecture. Students are DOING something including discovering, processing, and applying information. Active learning "derives from two basic assumptions: (1) that learning is by nature an active endeavor and (2) that different people learn in different ways" (Meyers and Jones, 1993). Research shows greater learning when students engage in active learning. It is important to remember, however, that lecture does have its place and that you should not do active learning without content or objectives. The elements of active learning are talking and listening, writing, reading, and reflecting (Fouts, 2000).

Tiene & Ingram (2001) state that some characteristics of active learning are: Students are involved in more than listening, less emphasis is placed on transmitting information and more on developing students' skills, students are involved in higher-order thinking (analysis, synthesis, evaluation), students are engaged in activities (e.g., reading discussing, writing), and greater emphasis is placed on students' exploration of their own attitudes and values.

It is the practical procedures for using existing media to deliver effective instruction which includes instructors' intellectual ability to use practical techniques to deliver instruction. Lerner (1971) defines instructional technology as being "a systematic way of designing, carrying out, and evaluating the total process of learning and teaching". Individuals who work in the instructional technology field, at times, focus on incorporating new developments of equipment technology with knowledgeable understandings about processes of learning to bring about improvements on ways to deliver instructions (Lardizabal, 1997) Carl Berger and Rosalind Kam define Instructional Design as a systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes

Copyright © 2018 IJIRES, All right reserved

development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities. Is the science of creating detailed specifications for the development, implementation, evaluation, and maintenance of situations that facilitate the learning of both large and small units of subject matter at all levels of complexity.

Lerner (1971) as cited by Sayo (2005) the presentation of instructional materials also play a role in student learning. The development of programmed instructional materials evolved from the stimulus – response theory of learning. Such materials are designed to teach many areas of the curriculum, including reading and arithmetic. The essential principles of programmed instruction are: to break down the subject to be taught to an ordered sequence of steps or stimuli items; to provide a means for the students to respond in a specified way to each item or stimulus and to record the response; to reinforce the students' response by providing immediate knowledge of the results; to make each sequential step very small to ensure that the students will make few errors and practice mostly correct responses; and to move the students step by step, from what is know to what should be learned.

The stimulus-response approach to cognitive learning postulates that the educator can design teaching materials and manipulate the environment in such a fashion that specific cognitive skills will be learned.

Some learn best by listening to an explanation; others know that to learn something they must read about it or watch it being done; while still other individuals learn best by writing it down or going through the action themselves. As early as 1886, the clinical observation that individuals have a predilection for one perceptual input avenue over others was made by Fouts (2000), who categorized people as "audiile", "visile", and "tactile" learners.

In his book entitled Exploring Current Issues in Education Technology, the author Tiene (2001) stated that "Learning is more effective if more senses are tapped. A student has to have more than one of his senses stimulated when a lesson is presented".

The effectiveness of the teaching-learning process can be increased greatly through the proper use of instructional aids. Instructional aids cannot teach by themselves. They need a skillful teacher to make them effective. Where to get these materials is a common problem of most teachers. It is true that some of them are expensive, but the teacher can avail himself of a number of materials with just a little ingenuity and initiative. Lardizabal, et al (1997).

Towards the end of last century, we witnessed scientific breakthrough and technological advances, particularly in information and communication technology (ICT). Such situation created new business opportunities and brought about major changes in the way people live, learn, think, work and do business, and in their relations with each other. ICTs have linked communities around the world, broken down economic and cultural barriers between peoples and made faster movement of people, goods, information and capital across nations. These are leading us towards regional and global integration and the coming up of a "borderless economy" or "global village." ICTs have reshaped the educational landscape by transforming the content and modes of delivery/acquisition of learning as well as how the educational institutions operate.

As quoted by Ruba and Abdallah (2006), Sandholtz (1997), stated that the integration of technology is divided into five phases which are entry, adoption, adaptation, appropriation and invention. In the early stage which is the entry stage, the traditional method was a common practice in those days where by the instructional activities were more teacher centered activities. In the adoption stage, the traditional methods were still in practice but group activities were also implemented in the teaching. The activities in this stage were mainly on keyboarding, word processing and drill and practice. Although in the adaptation stage, the traditional methods were still the main approach in the teaching, students were given opportunity to use computers in helping them with their homework. Meanwhile, the appropriation stage showed a new way of integrating technology in which the technology became a part of the teaching, while in the invention stage teachers became more inventive in their teaching where the use of technology was varied according to students interest and capability. And today, the latest technology is ICT of Information and Communications Technology. From the reformation in the western countries especially United States of America (USA), ICT has become an important tool in teaching and learning processes. According to Neo (2004), ICT has influenced teachers to the progression of new perception and innovative teaching techniques. Nowadays, teachers use technology not only to help them with their work but as a part of the teaching and learning process. With the technology students would learn to use the language as well as the technology.

In ESL classroom, it is very important for teachers to create the most interesting and effective lessons as possible so that the students would be able to gain as much knowledge as they could. Therefore, by implementing ICT in the ESL classroom, it is believed that the teaching and learning process would be more efficient and enjoyable. Norhayati and Siew (2004) believe that ICT is the most innovative and interesting technology by which it has contributed such swift development in the field of computing, entertainment and education. This development has opened the boundary that encircled these fields long ago. Thus, ICT these days are not about keyboarding and word processing any longer, it is actually about the access to the information needed. It is about everything that people can get especially when Internet is a part of the technology.

ICT provides so many opportunities for the society to explore in which they could get the access on computing, entertainment as well as education easily and fast. Such development has created so many opportunities and challenges to the society, which is actually a positive remark in preparing the society for different situations whereby they will learn so many new things. It is hoped that with this development, the society would be able to improve their life to betterment. Hence, integrating ICT in the ESL classroom would create positive outcomes for

Copyright © 2018 IJIRES, All right reserved

both the teaching and learning process as teachers and students will not only get and learn unlimited knowledge from the ICT but they will also improve their knowledge and life.

For that reason, ICT now plays as a purpose for having a better teaching and learning atmosphere Neo (2004). This is hoped that the integration of content and technology would provide a more efficient teaching and learning process in which the teacher and the students could teach and learn effectively.

According to Kajee (2004), researchers of ICT and ESL believe that ICT would harmonize the teaching and learning environment as well as promote equal participation among the students. ICT is believed to help teachers to create not only interesting lesson but also effective language classroom. With today's technology, teachers could present their lessons in the most interesting and effective ways which then will let them have more opportunities to communicate with the students as well as cooperate with them. Thus, this would enable teachers to balance their role and the students' role in the classroom where students would have more opportunity to collaborate among themselves doing the activities in their classroom.

Similarly, Nooreen (2004) states that integrating electronics environment or ICT in language learning would create a more complex system as compared to traditional media technology. ICT produces wider chances for teachers and students to explore both technology and language. It is clearly seen that ICT provides so many advantages for teachers in imparting knowledge and information to the students. It will not only help teachers to create the most successful lessons but it also enables the students to work in their own capability. ICT help teachers to help students learn independently. As a result, the teaching and learning process would be more students centered or directed which in turn will provide a great deal of opportunity for students to learn at their own pace.

III. METHODOLOGY

Research Environment.

This study was conducted at the Ipil National High School, located at Barangay Ipil, Ormoc City. Ipil is a semi- urban community with occupants of more than 7000 people living on it with an area 713.028 hectares. It has seven puroks and sitios and the means of living are fishing, sugar cane plantation, alcohol manufacturing, hatchery and rice planting.

Ipil was accessible by tricycle, bus, or jeepneys with a span of 10 to 15 minutes back and fort to the city. This community has complete infrastructures, like Church, alcohol factory, Hatchery, hardware, Internet Café, Drugstore, Apartments, and even bakery.

Just like other Public High School, the school of Ipil also adopts Basic Education Curriculum. The School has comprehensive computer laboratory donated by Luli Arroyo a daughter of Former President Gloria Macapagal Arroyo. Since then, the school has won for its Best practices of ICT operation through out region Eight. It is empowered by 43 teachers, one principal, with two Head Teachers and Guidance Councilor. It has also one guard serving 12 hours a day, three utility men, one book keeper and one Disbursing Officer.

Research Participants.

The research participants of the study were the Third Year level high school students of Ipil National High School utilized two sections classified as control and experimental group with a maximum of 60 students per classroom. Form the seven sections in third year, the advisory sections of the researchers was chosen as the control and experimental groups. Hence, random selected was used to identify which is control and experimental group. These sections treated equally by giving them the pretest and post test in the same manner.

The participants were very familiar to the researcher because these students were handled by the researcher as their advisory teacher of the Chemistry subjects.

Research Instrument.

One of the research instruments was the Division Quarter Test with 100 items divided into 50 points for theoretical and 50 points for computational. The researcher asked permission from the principal to use the Division Quarter Test in Science and Technology III (Chemistry) as test instrument of the study. In test questions given, the selected topic in Chemistry was adopted based on the lesson plan and time frame of the subject: Structure of the Atom. The pre-test was administered to identify their scores relative to their knowledge of the lessons. In the same manner, the same test material was used in giving the posttest in order to identify whether the participants have exhibited mastery level. But prior to the administering of the posttest, the researcher prepared the different materials of the study such as Video from the Internet that was saved in the flash drive, Compact Disc which was composed on the topic of Structure of Atom in every session being administered in order that students were recalled and retained the lessons. A comprehensive power point presentation of the three topics was prepared.

IV. FINDINGS

I-A. Pretest Performance between the Control group and Experimental group in terms of Theoretical skills.

The result showed that both groups the experimental and control group in theoretical skills gained a fair rating before the ICT integration of the lesson.

I-B. Pretest Performance between the Control group and Experimental group in terms of Computational skills.

The result showed that both groups are majority gained a fair rating in the computational skills before the ICT integration of the lesson.

II-A. Posttest Performance between the control group and experimental group in terms of theoretical skills.

The result Shown that the experimental group has greater mean percentage scores than that of the control group after the integration of the Information and Communication Technology (ICT) of the lesson. This is due to the exposure of the students to the ICT and it

Copyright © 2018 IJIRES, All right reserved

implied that the ICT integration in teaching was significantly effective in improving the scores of the students. Furthermore, it implied that the use of ICT promoted enthusiasm among students. Critical thinking and sense of independence were practiced in the ICT integrated teaching and so the teachers accounted for its success and effectiveness.

II-B. Posttest Performance between the control group and experimental group in terms of computational skills.

The result showed that the Experimental group has greater mean percentage scores than that of the control group after the ICT integration of the lessons.

III-A. Test of Difference in the Pre-test and Post-test Scores of Students in Experimental and Control Groups Based on Theoretical Skills.

The result showed that the test scores of the students have improved from pre-test to post-test as revealed in the findings in both control and experimental groups. In experimental group, the computed the hypothesis is rejected. Hence, the use of ICT improves the performance of students from pre-test to post-test. In the control group, the hypothesis is rejected. This means that the lecture-based teaching is also effective in discussing the theoretical perspectives in teaching science.

III-B. Difference in the Pre-test and Post-test Scores of Students in Experimental and Control Groups based on Computational Skills

The result showed that the test scores of the students have significantly improved from pre-test to post-test in the experimental group as revealed in the findings. In experimental group, the computed T which is 10.341 is higher than the critical value which is 4.028 and so the hypothesis which states that there is no significant difference in the pre-test and post-test in experimental group with ICT integration is rejected. Hence, the use of ICT improves the performance of students from pre-test to post-test. ICT enhances the computational skills of the students. In the control group, the computed T which is 1.418 is lower than the critical value which is 4.028 and so the hypothesis which states that there is no significant difference in the pre-test and post-test in the control group is accepted. This means that the lecture-based teaching in the control group is not that significantly effective in enhancing the computational skills of students.

III-C. Difference in the Post-test Scores of Students in the Experimental and Control Groups in the Aspects of Theoretical and Computational Skills.

The result showed that the test scores of the students were significantly better in the experimental group compared to control group as revealed in the findings. In theoretical skills, the computed T which is 10.628 is higher than the critical value which is 4.028 and so the hypothesis which states that there is no significant difference in the post-test scores in the experimental and control groups is rejected. Hence, the use of ICT in the experimental group significantly improves the performance of students compared to control group. ICT enhances the theoretical skills of the students. The results implied that the ICT integration in the experimental group was significantly effective in improving the scores of the students. In computational skills, the computed T which is 11.218 is higher than the critical value which is 4.028 and so the hypothesis which states that there is no significant difference in the post-test scores in the experimental and control groups is rejected. Hence, the use of ICT in the experimental group significantly improves the performance of students compared to control group.

V. Conclusion

Based from the findings of the study, the test result manifest that the Computational Skills and theoretical skills in Science and Technology (Chemistry) was enhanced through the use of Information and Communication Technology. Hence, ICT was effective in improving the skills of students in chemistry.

VI. Recommendations

1. The proposed integration plan should be utilized.
2. The TLE teachers should seriously teach the students about the basic computer program in order for the students to learn and could not find difficult to access to the desired subject.
3. The teacher in any subject should give the students a project by which they will be using computer aided instruction to support their learning in computer.
4. The teachers in Science and technology should integrate the information and communication technology (ICT) in every lesson as much as possible, especially for those topic which somehow and someway the students find difficult to understand and comprehend the lesson.
5. The school should conduct INSET which related to the ICT al least twice a year to help the teachers in manipulating and upgrading their learning capacity to handle computer-aided instruction.
6. The head of the school should closely monitored the teacher's performance on ICT integration to their lesson to assess the whether the implementation is really a big help in increasing academic performance of the students especially in Chemistry.
7. The school heads should inform the policy makers, especially the stake holders about the ICT implementation so that they will be fully aware on what they are going to help so that the ongoing program will be fully realized.
8. The school administration together with the help of the PTCA officers should ask assistance specifically financial assistance to the Government Organization (GO's) Non- Government Organization (NGO's), Local Government Unit (LGU's) in acquiring the additional ICT gadgets and rooms to fully implement the aid program.
9. The school must have a plan for the integration of ICT in teaching and learning in the school as a part of the overall school plan.

Furthermore, the researcher is giving the authority to the future researcher to conduct similar study to check and verify the usability and importance of this study in

Copyright © 2018 IJIRES, All right reserved

attaining the good academic performance not only to the chemistry subject but also to all subject.

ACKNOWLEDGMENT

The authors would like to thank the people who has been a back load of support in making this Experimental Research possible and doable. The president of Western Leyte College, Mr. Emmanuel Fiel and Vice President, Mrs. Erlinda Verendia, for their financial support and trust. Their colleagues in Graduate Studies who inspired them to be an example of practicing "publish or perish" scheme in the educational setting. For the students who patiently answered the tools.

REFERENCES

[1] Fennimore, T., & Tinzmann, M. (1990). What is a thinking curriculum? Oak Brook, IL: North Central Regional Educational Laboratory. Retrieved May 1999, from http://www.ncrel.org/ncrel/sdrs/areas/rpl_esys/thinking.htm
[2] Fouts, Jeffrey T. (2000) "Research on Computers and Education: Past, Present and Future". Seattle Pacific University, Seattle, WA..
[3] Gersalina, Cirila B. "The Effectiveness of Practice and Drill on the Comprehension of Fractions of Grade Six Pupils of Cuanos Elementary School, District of Minglanilla, Division of Cebu: Proposed Skillbook". Southwestern University, Cebu City, 2005.
[4] Glazer, Robert (1992) Adaptive Education, Individual Diversity and Learning, New York: Holt Richart and Wilson.
[5] Harnad, S. (1982) Neoconstructivism: A unifying theme for the cognitive sciences. In T. Simon & R. Scholes (Eds.), Language, mind and brain (1 - 11). Hillsdale NJ: Erlbaum. Retrieved May 1999, from http: //cogsci.soton.ac.uk/~harnad/Papers/Harnad/harnad82.neoconst.html
[6] Hilgard, E.R. and Bowes, G.H. Theories of Learning, Englewood Cliffs NJ. Prentice Hall, 1990.
[7] Lardizabal, Amparo S., et. al. (1997) Principles and Methods of Teaching. (2nd ed.) Phoenix Press Inc., Quezon City.
[8] Lerner, J.W. (1971). Children with Learning Disabilites. (2nd ed.). Boston: Houghton Mifflin Company.
[9] Tiene, D. and Ingram, A. (2001). Exploring Current Issues in Education Technology. (1st ed.). Boston: McGraw – Hill.
[10] Llamedo, Margarita M. "The Effectiveness of Laboratory Modules on the Knowledge of Students in Zoology 1, Southwestern University: Proposed Utilization" Southwestern University, Cebu City, 2005.
[11] Sayo, Natiadel P. (2005) "Projected Still Graphics and their Effect as a Supplementary Tool in Improving Comprehension Skills of High School Students". Southeast Asia Interdisciplinary Development Institute, School of Organization Development, Antipolo City.
[12] UNESCO, retrieved August 25, 2007 from http://portal.unesco.org/education/en/ev.php.
[13] http://www.hsrc.ac.za/research/timss/index.html
[14] http://www.oecd.org/topic/.retrieved April 10, 2008.
[15] http://www.unicef.org/voy/discussions/showthread.php?t=5547 retrieved April 10, 2008.
[16] http://www.naaee.org/npeee/workbook.pdf.retrieved April 10, 2008.
[17] http://www.pubbliaccesso.gov.it/normative/law_20040109_n4.htm retrieved April 10, 2008.
[18] http://www.pubbliaccesso.gov.it/normative/DM080705-A.htm retrieved April 11, 2008.
[19] http://www.section508.gov/index.cfm?FuseAction=Content&ID=3 retrieved April 11, 2008.
[20] http://asd.itd.cnr.it/griglia.pdf retrieved April 11, 2008.
[21] http://www.centriausili.it.retrieved April 11, 2008.
[22] http://www.sd2.itd.cnr.it/cnr_sd2/upload/file_20061228102129_3509_GLIC.pdf.retrieved April 12, 2008.
[23] http://www.becta.org.uk/page_documents/research/wtrs_ictsupport.pdf.retrieved April 12, 2008.
[24] http://publications.becta.org.uk/display.cfm?resID=27692&page=1835 retrieved April 15, 2008.
[25] http://www.washington.edu/doit/Brochures/PDF/ud_edu.pdf retrieved April 15, 2008.

AUTHOR'S PROFILES

DR. ELVIN H. WENCESLAO
The principal author is currently a graduate school lecturer of Western Leyte College of Ormoc City. He teaches leadership; planning; philosophy of education and research subjects. He also serves as chairman of the thesis committee and thesis adviser for the last 2 years. He is also a regional and division trainer in core and sp--ecialized subjects for senior high school in department of education.

DR. BRYANT C. ACAR
The co-author is currently the Graduate Studies Dean of Western Leyte College of Ormoc City and a lecturer in the department. He teaches leadership and management subjects. He also serves as chairman of the thesis committee and thesis adviser for the last 8 years. He is also a regional trainer in applied subjects for senior high school in department of education.

Copyright © 2018 IJIRES, All right reserved