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ICT Integration: Enhancing Pupils' Performance in Elementary Science

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Abstract — This study aimed to determine the effect of Information and Communication Technology (ICT) integration in enhancing the pupils' performance in Elementary Science. A total of 80 respondents were selected among Grade III pupils at Miputak East Central School, Miputak Dipolog City. This study was employed quantitative approach with the pre-test post-test experimental design. Pupils were classified into two groups namely the Experimental Group (teaching with ICT integration) and the Control Group (teaching without ICT integration). The t-test showed the performance of pupils from the Experimental Group had higher increased in post-test than the Control group. This concluded that integration of ICT in Science lessons affected pupils' performance. This study is also attempted to determine the significant difference in the pupils' performance in Science with or without ICT integration. Both groups showed improvement in their post-test. However, the Experimental Group revealed higher level of performance compared to the Control Group. The findings showed that ICT integration in Science lessons enhanced pupils' performance than without ICT integration. Based on the findings, several action plans have been made to provide some insights into the application of ICT integration in Science subject.

Keywords — Information and Communication Technology, teaching and learning, Science subject, education, performance, elementary school

I. Introduction

In a rapidly changing world, basic education is essential for an individual to be able to access and apply information. Such ability includes ICTs integration in the classroom particularly teaching Science. As educational technologies and new learning methods evolve, teachers are expected to adopt and assimilate rich and exciting learning environments. Although many teachers are aware of the educational potential of integrating ICT, a considerable number of them opted to teach in a traditional, teacher-centered manner, because of underdeveloped and underutilized school-related policies such as ICT plan, ICT support and ICT training (Hildevan, Jo Tondeur 2007).

Oliver (2000) emphasized that the integration of information and communication technologies (ICT) can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas like Science.

Albion, Peter (1999) affirmed that the focus on information technology in education has shifted towards curriculum integration. Consequently, teacher education programs need to prepare graduates for teaching with IT. Graduates should possess both skills in the use of IT and belief in their capacity to integrate IT into teaching.

Mary E. Webb (2012) stressed that ICT-rich environments already provided a range of affordances that have been shown to enable learning of science but integrating these affordances with other pedagogical innovations provides even greater potential for enhancement of students' learning.

Harris (2002) concluded that the benefits of ICT will be gained "…when confident teachers are willing to explore new opportunities for changing their classroom practices by using ICT. As a consequence, the use of ICT will not only enhance learning environments but also prepare next generation for future lives and careers.

According to Cabero (2001), "the flexibilization time-space accounted for by the integration of ICT into teaching and learning processes contributes to increase the interaction and reception of information. Such possibilities suggested changes in the communication models and the teaching and learning methods used by teachers, giving way to new scenarios which favour both individual and collaborative learning.

Based on the extensive usage of ICTs in education the need appeared to unravel the myth that surrounds the use of information and communication technology (ICT) as an aid to teaching and learning, and the impact it has on students' academic performance. ICTs are said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality. However, the experience of introducing different ICTs in the classroom and other educational settings all over the world over the past several decades suggests that the full realization of the potential educational benefits of ICT. The direct link

between ICT use and students' academic performance has been the focus of extensive literature during the last two decades. ICT helps students to their learning by improving the communication between them and the instructors (Valasidou and Bousiou, 2005). The analysis of the effects of the methodological and technological innovations on the students' attitude towards the learning process and on students' performance seems to be evolving towards a consensus, according to which an appropriate use of digital technologies in education can have significant positive effects both on students' attitude and their achievement. Research has shown that the appropriate use of ICTs can catalyze the paradigmatic shift in both content and pedagogy that is at the heart of education reform in the 21st century. Kulik's (1994) meta-analysis study revealed that, on average, students who used ICT-based instruction scored higher than students without computers. The students also learned more in less time and liked their classes more when ICT-based instruction was included. Fuchs and Woessman (2004) used international data from the Programme for International Student Assessment (PISA), they showed that while the bivariate correlation between the availability of ICT and students' performance is strongly and significantly positive, the correlation becomes small and insignificant when other student environment characteristics are taken into consideration.

Becker (2000) found that ICT increases student engagement, which leads to an increased amount of time students spend working outside class. Coates et al. (2004) showed that students in on-campus courses usually score better than their online counterparts, but this difference is not significant here. ICTs especially computers and Internet technologies enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. ICT helps in providing a catalyst for rethinking teaching practice (Flecknoe,2002; McCormick & Scrimshaw, 2001) developing the kind of graduates and citizens required in an information society (Department of Education, 2001); improving educational outcomes (especially pass rates) and enhancing and improving the quality of teaching and learning (Wagner, 2001; Garrison & Anderson, 2003). ICT can help deepen students' content knowledge, engage them in constructing their own knowledge, and support the development of complex thinking skills (Kozma, 2005; Kulik, 2003; Webb & Cox, 2004). Studies have identified a variety of constructivist learning strategies (e.g., students work in collaborative groups or students create products that represent what they are learning) that can change the way students interact with the content (Windschitl, 2002). Albert Bandura, Girasoli and Hannafin (2008) urged the use of asynchronous CMC tools to promote student self-efficacy and hence academic performance. Fister et al (2008) also depict the power of tablet PCs to improve mathematics instruction. ICTs have the potential for increasing access to and improving the relevance and quality of education. The use of ICT in educational settings, by itself acts as a catalyst for change in this domain. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves and Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

The common problem experienced by the teacher-researchers in teaching Science is the low academic performance of pupils and the findings cited by the number of researches that ICT Integration in classroom instruction enhanced the level of pupils' performance, have prompted the researchers to find out the effectiveness of such method to Grade 3 regular sections of Miputak East Central School.

II. Methodology

The study was conducted at Miputak East Central School and was included two (2) regular sections of the Grade 3 level. Each section had forty (40) pupils for a total of 80 pupil-respondents.

ICT-Integration for the second quarter Science lessons in Grade 3 includes both software and hardware facilities. PowerPoint presentation, video clips, interactive internet sites, LED television, LCD projector, laptop and speakers were the tools used for ICT-integration.

Data Gathering Methods

The purpose of this study was to determine the effect of ICT integration in enhancing the pupils' performance in Science among Grade 3 pupils. Due to the nature of the study and the research questions that were explored, the researchers adopted a quantitative approach.

Stratified random sampling was used to ensure the generalization and the accuracy of the data. Population of this study was the 80 pupils in regular classes of Miputak East Central School. Respondents were randomly selected. Twenty (20) pupils are selected for the Control Group and another twenty (20) pupils for the Experimental Group. The selection of sample was based on the final rating grade of Science subject in the first quarter that ranges from 80% - 85%.

This study was employed the pre-test post-test experimental design wherein a test consisting of 20 items with TOS was prepared by the researchers. The validity and reliability of the researcher-made test were established before administering it to the respondents.

The test questions were crafted based on the competencies for the second quarter lessons on Living Things and Their Environment (Animals) as provided in the Science Curriculum Guide. The same set of test questions was used for both pre-test and post-test. At the start of the study, both the control and experimental groups, each comprising of twenty (20) pupils took the pre-test. Data was collected for analysis using Statistical Package for Social Science (SPSS). Then, an experiment was carried out for both groups. The experimental group was exposed to Science lessons delivered with ICT-integration whereas the control group had the same Science lessons but without ICT-integration. The two groups were handled by the same Science teacher. Following the experiments, a post-test session was conducted for both groups for data collecting.

Data collected were then presented by using descriptive statistic. Descriptive analysis was used to study the effect of ICT integration in Science lessons on the enhancement of pupils'

performance in Science. The t-test was also used to determine whether there was a significant difference of the pupils' performance in Science with or without ICT integration.

III. Results and Discussion

Problem 1: *What is the level of pupils' performance in Science without ICT integration?*

Table 1. Pre-test and Post-test of the Control Group without ICT integration

Variable	Pre-Test			Post-Test		
	Mean	SD	Verbal	Mean	SD	Verbal
Control Group	9.30	2.69698	Satisfactory	11.90	3.17722	Very Satisfactory

** significant at 0.05 level of significance*

Table 1 presents the pre-test and post-test scores of the control group without using ICT integration.

As shown on the table, the pupils in the control group during the pre-test obtained the mean percentage of 9.30 with a standard deviation of 2.69698. This described that the performance of the pupils resulted to a "satisfactory" performance.

Furthermore, during the post-test the pupils attained 11.90 of mean percentage with a standard deviation of 3.17722. This data revealed that the pupils achieved a "very satisfactory" performance.

Problem 2: *What is the level of pupils' performance in Science with ICT integration?*

Table 2. Pre-test and Post-test of the Experimental Group with ICT integration

Variable	Pre-Test			Post-Test		
	Mean	SD	Verbal	Mean	SD	Verbal
Experimental Group	9.75	3.65449	Satisfactory	16.10	2.82657	Outstanding

** significant at 0.05 level of significance*

As seen in Table 2, the experimental group attained 9.75 mean percentage with a standard deviation of 3.65449 in the pre-test that described "Satisfactory" level of pupils' performance and 16.10 mean percentage with standard deviation of 2.82657 in the post-test that revealed an "outstanding" performance of pupils.

Problem 3: *What is the effect of ICT integration to pupils' performance in Science?*

Results in ***Table 1 and 2*** indicated that performance of pupils from the Experimental Group had higher increased in post-test than the Control group. This concluded that integration of ICT in Science lessons affected pupils' performance.

According to Pittard, Phil and Jessica (2003), ICT provided significant contribution to teaching and learning in all subjects and to all ages. ICT can motivate children and engage them in learning, besides meeting individual learning needs. According to Bruner (1966) theory, to achieve better results, children need motivation to learn. It has been proven in this study where ICT has been integrated in three lessons in the Science classes. As a result, the pupils were more interested to study and improved their performances.

This finding was strongly anchored by the study conducted by Norzita (2004) which proved that teaching and learning using ICT improved the performance of moderate learners.

Problem 4: *Is there a significant difference in the pupils' performance in Science with or without ICT integration?*

Table 3. Significant Difference Between the Control and Experimental Group on their Post-Test Performance.

Test	Group	N	Mean	t-value	p-value	Decision *Ho*
Post-Test	Control	20	11.90	-4.417	.000	Reject
	Experimental	20	16.10			

** significant at 0.05 level of significance*

The t-test was conducted to analyze the performance of 20 pupils for both groups. The Control Group obtained mean scores of 11.90 while the Experimental Group obtained 16.10. Hence, these indicated that performance of pupils from the Experimental Group increased in post-test. The t-value (-4.417) which do not exceed the critical value of 2.00 at 0.05 level of significance and p-value (.000) mean that the null hypothesis should be rejected. There is a significant difference in the pupils' performance in Science with or without ICT integration.

However, it further showed that the Science lessons with or without ICT integration had significantly varied result on the post-test. This means that ICT integration in Science lessons improved more pupils' performance than without ICT integration. This is supported by the statements cited by Cox (1999) that using ICT in lessons can enhance self-esteem leading to expectations of achieving goals. Becker (2001) suggested that ICT used in lessons especially Science subject produced higher quality output of students. Comber et al. (2002) also suggested that ICT can be used effectively in the Science subject to show video sequences of things that are hard to explain or visualize.

IV. Conclusion

The ICT integration in Science lessons effectively enhanced the pupils' performance. The researchers will continue to utilize the lesson plans with ICT integration and pursue the Project IILP (ICT Integrated Lesson Plan) where we will prepare ICT integrated lesson plans with competencies starting in the first quarter and introduce it with other Science teachers as an intervention tool to address least learned skills in Science. Secondly, the researchers will employ Project ICTISIM (Information Communication Technologies Integrated Self Instructional Material) by conducting enhancement sessions to struggling pupils in Science and give them self-instructional materials (SIM) in hard or soft copies to be studied at home or during remediation period. Lastly, inform other science teachers from all elementary schools to use, ICT Integrated Lesson Plans and ICT Integrated Self-Instructional Materials, to establish consistency of result to determine not only reliability but validity as well. This will be done during one of their LAC sessions beginning school year 2018-2019 onwards.

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