An Analysis of the Effect of ICT Integration in High School Test Performance in Masbate, Philippines

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Abstract

Information and communication technology (ICT) has permeated all sectors of the economy including education where it is expected to improve student performance. This paper aims to provide educators and policy makers with guidance and insights on whether investments in ICT have benefited the learners and how far has ICT been integrated in Philippine high school education. A survey of the private and public high schools in Masbate, Philippines was conducted to determine the effect of different ICT resources on educational performance of students using the education production function as the framework. Using the test scores for the 2007 National Career Assessment Exam (NCAE) as the dependent variable, an OLS regression was done to analyze the impact of ICT resources and other school and teacher attributes that affect student outcomes.

Mixed results for different subjects were observed but the consistent variables that positively affect student performance were the year of integration and the number of school buildings. ICT resources such as televisions, radios, dot-matrix printers, CD writers and digital imaging devices positively affected student outcome. However, software, color printers, overhead projectors, fax machines and the pc-student ratio were significant factors that were inversely related with student performance.

Keywords: information communication technology (ICT), ICT integration, knowledge-based economies, education production function

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1. Introduction

The Philippine government has been committed to modernize the Philippine educational system, in particular, on basic education, in its effort to make each and every student at par with other students in the developed economies. This is because in today's knowledge-based global economy, the capability to utilize and produce information and to transform it into knowledge and vast array of goods and services is very essential to economic growth and social development. Along with this effort are the continuous curricular changes and reorientation, teacher training and investment in school facilities and infrastructure, one of which is geared towards the vision of equipping each public school with the modern computer and other information and communication (ICT)-related gadgets and instructional materials.

While access to education has significantly improved for the last five years, the quality of basic education persists to be in question as learning competency indicators paint a disturbing picture for the Philippines' bid to produce highly skilled labor force that will spell a big difference in a globally competitive-knowledge economy. For instance, in the 2004 National Achievement Test given by the Department of Education (DepEd), nearly 98 percent of the examinees failed to get the passing score of 75 percent. In the High School Readiness Test, only 64 percent got a grade of 75 percent or higher. Furthermore, from 1996 to 2004 results of the International Mathematics and Science Study (TIMSS), the country has a consistent poor performance whose rank is very close to the bottom.

DepEd has initiated in 1996 a computerization program with the goal of preparing Filipino students for employment and competitive career by teaching them to master the new forms of technology being used in the workplace. Philippine education experts have long realized that public schools do not just want to teach students how to use technological tools, computers and other high-technology learning gadgets. They also would like to harness and enhance the power of technology towards developing the entire teaching-learning process, specifically in its bid to make each and every public school student empowered in this highly globalized and integrated world economy.

However, integrating ICTs into the learning-teaching equation is not that simple and easy as it seems, and certainly there are broader prerequisites of achieving classroom technological advancement. This paper aims to provide educators and policy makers with guidance and insights on whether investments in ICT has benefited the learners and how far has ICT been integrated in Philippine high school education. A survey of the private and public high schools in Masbate, Philippines was conducted to determine the effect of different ICT resources on educational performance of students using the education production function as the framework. Using the test scores for the 2007 National Career Assessment Exam (NCAE) as the dependent variable, an OLS regression was done to analyze the impact of ICT resources and other school and teacher attributes that affect student outcomes. The paper is organized as follows. The next section outlines the rationale for ICT integration in school curriculum. It proceeds with a presentation of the education production framework which serves as a spring board for the next section in the analysis of the effect of ICT integration in Masbate, Philippines. The problems of ICT integration are then discussed. The last section concludes.

2. ICT Integration in School Curriculum

As one examines their educational system, highly industrialized and knowledge-based economies have dramatically restructured their learning systems and reoriented their educational paradigm towards the paramount goals of excellence and economic relevance. The integration of information and communication technology (ICT) has become important feature of their educational curricula, school activities and programs. For instance, in OECD (Organization for Economic Cooperation and Development) member countries, curricular reforms were initiated "driven by a perceived need to reorient schooling from rote learning, shallow but wide coverage, and individualistic learning processes to higher level skills, problem solving, in depth study, and collaborative learning" (OECD 2001a). The OECD book "Learning to Change: ICT in Schools" (2001b) describes the "pervasive use of ICT in schools to be motivating" and succinctly justifies the economic, social and pedagogical implication and rationale for ICT integration in the classroom as presented in Table 1.

Table 1. The rationale for ICT integration in schools

Rationale for ICT	Implication
Economic	"…focus is on the perceived needs of the economy – present and future – and the requirements in many areas of employment to have personnel with ICT skills. Knowledge and familiarity of ICT is an important aspect of employability as the 21st century unfolds. There is a widespread expectation on the global scale that those nations successfully embracing the information age will benefit economically. Awareness of this dimension will encourage learners to acquire such skills, and some to take ICT as an additional optional subject leading to vocational specialism, including the study of computer science in further or higher education."
Social	"…focuses on facility with ICT becoming a prerequisite for social participation in society and the workplace. Competence with ICT is seen as an essential "life skills" in the same way as literacy and numeracy, so much so that the range of skills and the process supported by ICT is brought together in the notion of digital literacy, which becomes both a requirement and a right for all learners. It is therefore important to find ways to compensate those with limited access to computers outside school. Societies will suffer if some of their members have little or no facility with ICT, especially since public and other services are increasingly becoming available on-line. As usage of ICT becomes more extensive across society, wider benefits will also flow – better links with home and scholl, greater parental involvement in student progress, and greater scope for schools and other educational institutions to play and inter-active part in community life and development."
Pedagogical	"…concentrates on ICT teaching and learning. The potential for this has developed rapidly and dramatically with advances in ICT, from the early "drill and practice" program, and limited use in a small number of subjects. ICT can increase the breadth and richness of learning, not least through the topicality and realism that the new resources can bring. It can support the development of higher order thinking skills, including analysis and synthesis."

Source: "Learning to Change: ICT in Schools". OECD (2001b)

The 2002 Revised Basic Education Curriculum (RBEC) is a curricular change instituted by the Philippine government which recognizes that ICT skills are of paramount importance in alleviating poverty and in achieving competitive advantage in the global economic arena. Among its salient features is the inclusion of basic learning competencies in computer skills in both elementary and secondary education. Its proponents emphasizes that "…(W)e have to educate our Filipino learners to filter information critically, seek credible sources of knowledge, and use data and facts creatively so that they can survive, overcome poverty, raise their personal and national esteem, and realize a gracious life in our risky new world."

In the high school education level, the set of ICT lessons is relatively far more broad and deeper than in the elementary level. It is in this stage where students are taught of the various software program applications such that of MS Word, Excel, and Power point. Integration occurs in the form of collaborative projects conceived by the subject teachers.

These few instances of ICT integration in the classroom set the tone for an important policy imperative to increase the budgetary allocation for the educational sector. The education sector in the Philippines is allocated, on the average, with less than three percent (3%) of gross national product, a relatively low percentage when compared to other countries. With this as the greatest constraint, the education sector is faced with the challenge in keeping at pace with the past moving trend of technology and information revolution around the world. A typical Filipino school does not have access to computers and the internet. In most cases like those cited above computers are available but supplies for maintenance and operation is inadequate to maximize the use of ICT. For example, the lack of printers and other computer peripherals hamper most teachers and students to not fully derive the benefits of ICT diffusion. Students do not appreciate computers to the fullest when it is not connected to the internet. Moreover, these examples of limited "connectedness" are not assurance of an effective ICT education. Teachers have to really learn to collaborate with each in order to meaningfully integrate ICT across all subject areas. The RBEC has set the legal basis for collaborative and team teaching giving a greater emphasis on richer integration of all subjects through thematic teaching. However, most teachers, who play a central role in the teaching-learning equation, are still not convinced to fully integrate ICT in the classroom particularly because of the fear – the "technophobia" in using hi-tech educational gadgets. Some are afraid to step out of their "comfort zone." There are still a greater number of them who are not familiarized or reoriented with the system of collaborative and team teaching; some others, on the other hand, are unwilling to work with teachers from other fields or subjects.

The above observation further strengthens the studies conducted by Rodrigo (2001) and Tinio (2002). The former reveals that high school teachers, students and school administrators in Metro Manila are constrained to utilize ICT in achieving the desired educational competencies through active and independent learning. She averred that the schools do not have the "necessary hardware, software and connectivity to pursue the achievement of these goals. As a result, their ICT resources are not being tapped in a way that is consistent with their professed goals". One major factor that compounds this problem is the high student-to-computer and student-to-peripheral ratios. Moreover, she opined that the use of ICT is only limited during 'computer classes' where the subject matter to be taught is computer-related. Thus, any learning outcomes from ICT use would be computer-related as well "instead of towards broad, generic skills such as problem solving, independent and collaborative learning, and communication."

The latter, on the other hand, enumerated the barriers why ICT utilization in the teaching-learning process is very limited or not fully maximized. The study reveals that: "(L)ack of enough computers is the single biggest obstacle according to the respondents, with a mean ranking of 2.35. All other issues have mean rankings considerably lower than this. Lack of enough technical support for operating and maintaining ICT resources and the lack of teacher training opportunities are considered barriers to change as well. So too are the lack of space for computers and the general lack of funds for operations, including maintenance of equipment, purchase of supplies, and electricity."

3. Educational Production Function Framework

Consistent with the educational production function framework employed by Hanushek (1995) and Glewwe (2002), this study measured student performance as a function of educational inputs. The framework suggests that output of the educational process, which is the individual student performance, is directly related to schooling inputs. As Glewwe (2002) concludes, researchworks on production function of student performance should be taken as suggestive and not definitive and if good conventional studies agree on the significance of an input, there is likely to be a causal relationship. Specifically, in this study, the model is expressed as:

Student Performance = f *(ICT capital, non -ICT capital, ratio of ICT teachers to non ICT teachers, other ICT resources, personal computer-student ratio, teacher's educational attainment, school type, year of integration, internet connection)*

where Student Performance is output measure based on student scores on standardized achievement tests. The rationale for using test scores is that they are important to educators and valued to some extent by parents (Hanushek, 1986). In addition, test scores are important in selecting students for further schooling and used for predicting future school performance. It is also argued that test scores are more appropriate in the earlier grades where emphasis is more on basic cognitive skills (Hanushek, 1986).

The variable IT capital is expanded to include both computer hardware and software. Including software in the measure is done because they complement hardware and the number and variety of software application in a school also indicates the level of computer use (Tinio, 2002). Non-ICT capital includes school investment on building and other facilities. Teachers are classified as computer literate and non-computer teachers. Dummy variable to measure the educational attainment of the teacher's was also included. The study by Williams (2001) showed this variable to be significant and in the meta-analysis by Hanushek (1995), almost 56 percent of the cases showed the estimated coefficient for this variable to be statistically significant.

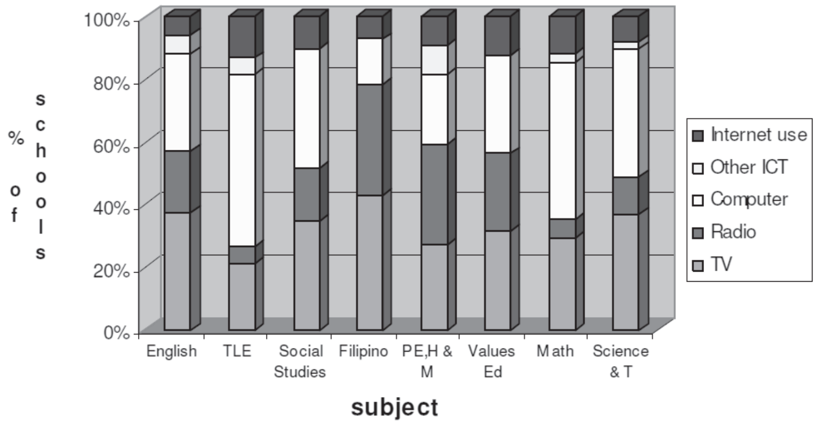
Other ICT resources like radios and televisions used in instruction are also included. The reason behind is that these were the first ICT introduced in education and since education is a cumulative process, inputs applied in the past still affect students' current performance level (Hanushek, 1986). However, their value in explaining output might diminish over time (Hanushek, 1986). As cited in Kremer (1995), existing randomized evaluation show that radios and textbooks have significant effects on educational outcomes with students receiving radio instruction scoring higher than those using textbooks as the medium. The PC-student ratio reflects the number of students per computer during computer classes. Dummy variables for the school type were also included to take account of differences in organization structure. Internet connection and year variables were also included to measure internet access and differences in the year of ICT integration of the schools.

4. Level of Development and ICT Infrastructure in Masbate

Using a proportional stratified random sampling and purposive sampling, data for this study were gathered from both private and public high schools in Masbate, one of the poorest provinces in the Philippines. Situated in Bicol Region (Region V), the province was computed with a Gini coefficient of 46.7 and belongs to the rank of the most inequitable provinces in the country (Philippine Human Development Report, 2005). A total of 16 private schools and 37 public schools were requested to answer a survey-questionnaire. Basically, the questionnaire is a survey on the school infrastructure, teachers' use of computers, availability and teacher's use of other ICT resources, inventory of school ICT investments, and questions on ICT financing and procurement. The National Career Assessment Examination (NCAE) scores of fourth-year high school students were obtained from the Department of Education Division Office, Province of Masbate. The data reveals that 31.25 percent of the private schools and 18.92 percent for the public schools have no ICT infrastructure. Nearly 83 percent of the high schools surveyed have no internet connections and only 17.1 percent is connected. Moreover, this 17.1 percent are schools located in the capital and in municipalities near the capital.

In the eight subjects taught in high school, all are using computers to some degree as well as the internet, the television and the radio as shown in Figure 1. Majority of the schools use computers in Technology and Livelihood Education. Subjects like Social Studies, Filipino and Values Education do not use other ICT resources such as overhead projectors, LCD projectors and calculators. To some extent the schools use the Internet in the different subject areas. For a large percentage of the schools, old ICT resources such as the television and radio are still popular tools in teaching.

Figure 1. Type of ICT resources used in high school subjects



5. ICT Integration and School Performance

This paper provides a simple analysis of the effect of ICT integration on educational performance among high school students in Masbate, Philippines. Table 2 provides the definition of both the dependent and independent variables.

The estimated equation for the study is an ordinary least squares (OLS) multiple linear regression where $\beta 1$ is the intercept, $\beta 2$ to 19 are slope coefficients of the 19 explanatory and i = 1...n are the number of schools. School performance, Qi, is the average of mean percentage score (MPS) for the General Scholastic Ability (GSA) Category:

$$Qi = \beta 1 + \beta 2SOFTi + \beta 3COMi + \beta 4OTHERICTi + \beta 5BLi + \beta 6NETi + \beta 7LITi + \beta 8TEDPHDi + \beta 9TEDMSi + \beta 10YRi + \beta 11PCi + \beta 12Xi + \beta 13CPi + \beta 14DMi + \beta 15CDi + \beta 16DIDi + \beta 17LCDi + \beta 18FMi + \beta 19OHPi + \mu i$$

Since ICT has different impact on different subjects (Higgins et al, 2005), regression was done on the three core subject scores, namely:

$$Sciencei = \beta 1 + \beta 2SOFTi + \beta 3COMi + \beta 4OTHERICTi + \beta 5BLi + \beta 6NETi + \beta 7LITi + \beta 8TEDPHDi + \beta 9TEDMSi + \beta 10YRi + \beta 11PCi + \beta 12Xi + \beta 13CPi + \beta 14DMi + \beta 15CDi + \beta 16DIDi + \beta 17LCDi + \beta 18FMi + \beta 19OHPi + \mu i$$

$$Math_i = \beta 1 + \beta 2 SOFT_i + \beta 3 COM_i + \beta 4 OTHERICT_i + \beta 5 BL_i + \beta 6 NET_i + \beta 7 LIT_i + \beta 8 TEDPHD_i + \beta 9 TEDMS_i + \beta 10 YR_i + \beta 11 PC_i + \beta 12 X_i + \beta 13 CP_i + \beta 14 DM_i + \beta 15 CD_i + \beta 16 DID_i + \beta 17 LCD_i + \beta 18 FM_i + \beta 19 OHP_i + \mu_i$$

$$English_i = \beta 1 + \beta 2 SOFT_i + \beta 3 COM_i + \beta 4 OTHERICT_i + \beta 5 BL_i + \beta 6 NET_i + \beta 7 LIT_i + \beta 8 TEDPHD_i + \beta 9 TEDMS_i + \beta 10 YR_i + \beta 11 PC_i + \beta 12 X_i + \beta 13 CP_i + \beta 14 DM_i + \beta 15 CD_i + \beta 16 DID_i + \beta 17 LCD_i + \beta 18 FM_i + \beta 19 OHP_i + \mu_i$$

Each model was individually checked for problems of multicollinearity, heteroscedasticity and autocorrelation.

Table 2. The Variables and their Definition

Variables	Symbol	*Definition*
Dependent	Q	Average of mean percentage score (MPS) for the General Scholastic Ability (GSA) Category
	Science	MPS in scientific ability
	Math	MPS in mathematical ability
	English	Average MPS in reading comprehension and verbal ability
Independent	SOFT	Number of educational software available
	COM	Number of computers available
	OTHERICT	Number of TVs and radios; weight is based on value therefore one TV is to 1.3 radios
	BL	Number of buildings per school
	NET	Dummy variable for the presence of Internet connection; 1- connected, 0-otherwise
	LIT	Ratio of ICT literate to non-ICT teachers
	TEDPHD	Teachers Educational Attainment Dummy variable for teachers with a PhD degree; 1- PhD, 0-otherwise
	TEDMS	Dummy variable for teachers with an MS degree 1- ms, 0-otherwise
	YR	Number of years ICT has been used for teaching and learning
	PC	Ratio of personal computers to students during class
	X	Dummy variable for the type of school; 1-private, 0-public
	CP	Number of functional color printers
	DM	Number of functional dot matrix printers
	CD	Number of functional CD writer
	DID	Number of functional digital imaging devices
	LCD	Number of functional LCD projectors
	FM	Number of functional fax machine
	OHP	Number of functional overhead projectors (OHP)

6. Results of Regression Analysis

A closer analysis of the results of the National Career Assessment Examination (NCAE) of the fourth year high school students in Masbate shows that the mean percentage score (MPS) of 39.53 percent for the General Scholastic Ability (GSA) category is low (Table 3). GSA subtest covers scientific ability (40 items), reading comprehension (60 items), verbal ability (60 items) and mathematical ability (60 items). The breakdown for the GSA components is also low with MPS of 37.13, 37.6 and 41.68 for Science, Mathematics and English, respectively.

Table 3. Summary of mean percentage scores (MPS) for NCAE General Scholastic Ability, Masbate, Philippines, 2007

	Mode	Minimum	Maximum	Median	Mean	Std deviation
Q	34.84	29.42	68.68	37.82	39.53	7.56
Science	33.18	27.94	65.50	34.60	37.14	8.58
Mathematics	28.15	26.27	66.39	35.34	37.60	9.49
English	37.65	31.20	71.46	40.23	41.68	7.49

Table 4 shows the regression results for each dependent variable namely, Q, mean scores in Science, Mathematics and English. The total number of observations is 51. The partial regression coefficients, their standard errors and level of significance are also presented in the table.

A closer look at the variable representing software shows that it is significant but has an inverse relationship with the dependent variable. This means than an increase in the number of educational software will result to a decline in student performance. This result can be explained by the quality of the software which was not taken into account in the model. In addition, certain instructional technology facilitates better learning and requires more time to adapt and develop (Lea et al., 2001). Other ICT resources such as TVs and radios significantly affect student performance. Although it is only significant for MATH, it is still significant for the overall student performance in GSA as shown in Q.

The effect of the presence of buildings on schooling outcome in general and on Science and English test scores was also found to be significant. It only shows that building infrastructures, which are non-ICT resources, contribute to the improvement in student performance. The small value of the partial coefficient can be attributed to the diminishing marginal productivity of non-ICT capital (Boissiere, 2004).

Furthermore, teachers' educational attainment, whether with a PhD or a MSc, was found to be insignificant. This conforms to the finding of the study by Hanushek and Rivkin (2003), which showed that advanced degrees have no systematic correlation with teacher quality and student performance. YR is the year of integration and also contributes to student performance. This means that the longer the year ICT is used, the more it will improve educational performance.

Moreover, the PC-student ratio represented by variable PC shows an inverse relationship. This means than a change in PC-student ratio will lead to a reduction in Q, SCIENCE, MATH and ENGLISH test scores. The negative value of PC-student ratio was also observed in the study of Buera (2002) and the most likely explanation is that it poses a diversion. As students have more control of the computer, natural curiosity may lead them to explore tasks outside the learning objectives. Lack of teachers constraints monitoring so most of the time students are left on their own. OECD (2006) also showed that some features of ICT availability and use are connected strongly with student performance. However, this should be taken with caution since it may not apply for all cases. In addition, the type of school does not significantly affect the test performance of the students. This is a puzzle since private and public schools have different levels of ICT investments and have different institutional set-up and organizational structure.

Different peripherals have different impacts on student performance. The partial coefficients of DM, CD and DID show that these ICT resources positively contribute to student performance for different subjects at different levels. Dot matrix printers are significantly positive for student performance in Q, SCIENCE, and ENGLISH. The CD writer is only significant for Science and for Q. Although the variable for digital imaging devices is not significant in the individual regression for the different subject, it is significant in the overall GSA mean percentage score. This shows that the impact of this ICT resource is so significant that although it was only significant in one GSA component, it was significant in the overall MPS. Color printers, fax machines and overhead projectors affect student outcomes inversely. The varying impact of different types of technologies on student performance is similar to the results obtained by Sosin et al. (2004) in their study of College Economics. This could also be explained by the nature of the data since this study only considered the availability of these resources and did not include quality differences.

Table 4. Regression analysis of the effect of ICT Integration in School Test Performance, Masbate, 2007

Dependent Independent	Q	Science	Math	English
Constant	38.384*** (1.48)	35.421*** (1.682)	38.421*** (2.204)	39.834*** (1.705)
SOFT	-0.116** (0.056)	-0.122** (0.064)	-0.177** (0.084)	-0.081 (0.065)
COM	-0.021 (0.149)	-0.219 (0.17)	0.138 (0.222)	0.001 (0.172)
OTHERICT	0.337* (0.3)	-0.059 (0.341)	0.802* (0.447)	0.304 (0.346)
BL	0.455* (0.243)	0.528* (0.276)	0.264 (0.361)	0.52* (0.279)
NET	4.546 (3.116)	4.513 (3.542)	2.928 (4.64)	5.327 (3.589)
LIT	-2.331 (2.895)	1.677 (3.292)	-6.59 (4.312)	-2.328 (3.335)
TEDPHD	0.591 (1.992)	1.762 (2.264)	1.039 (2.966)	-0.2 (2.294)
TEDMS	0.609 (1.627)	-0.432 (1.849)	-0.851 (2.423)	1.815 (1.874)
YR	2.029*** (0.305)	2.101*** (0.347)	2.331*** (0.455)	1.852*** (0.352)
PC	-8.521** (3.434)	-8.13** (3.903)	-10.852** (5.114)	-7.604* (3.956)
X	-2.562 (1.769)	-2.143 (2.011)	-5.162 (2.634)	-1.445 (2.038)
LCD	-0.927 (1.734)	1.084 (0.385)	1.377 (0.505)	0.947 (0.391)
OHP	-4.055*** (1.308)	-0.172* (1.971)	-1.785** (2.582)	-0.837*** (1.997)
CP	-2.781*** (0.904)	-10.919** (4.213)	-6.569** (5.519)	-11.808*** (4.269)
DM	2.424** (0.92)	-2.645*** (1.487)	-4.463 (1.947)	-4.57** (1.506)
FM	-10.258*** (3.706)	-2.662** (1.027)	-2.763 (1.346)	2.468** (1.06)
CD	1.086*** (0.339)	2.974*** (1.046)	1.783*** (1.37)	2.468** (1.06)
DID	4.833* (3.091)	6.434 (3.514)	2.526 (4.604)	5.208 (3.561)
adjR^2	68.5	60.6	53.0	60.5
F value	7.035	5.277	4.133	5.258
Prob > F	0.000	0.000	0.000	0.000

***- significant at 1%; **- significant at 5%; *- significant at 10%

T-test results showed that at 1% level of significance, there is no significant difference between the mean grades of students in schools with ICT resources and mean grades of students in schools without ICT resources. Possibly, this may be explained by the fact that a majority of the schools surveyed were just starting the use of ICT resources in teaching and learning so there is still no observable difference in the mean grades. As discussed in the study of Balanskat et al. (2006), schools with higher e-maturity exhibit a more rapid increase in student achievement than those schools with lower levels. E-maturity is the capacity of a learning institution to make effective use of technology to improve student performance. This capacity develops through time. Furthermore, with the observed level of integration, one may question the strength of ICT utilization. This raises the issue of teacher training and the effectiveness of the type of ICT resource used.

7. Problems with the Integration

Data regarding the problems that schools face in the province which hinder the use and full integration of ICT in teaching and learning were gathered during the focused-group discussions and interview conducted during the course of the study. One of these problems is the lack of funds for maintenance of equipment, purchase of supplies and electricity. Although majority of public schools depend on government programs for their ICT resources, the maintenance of these resources comes from the budget of the schools. Usually, maintenance and operating allowance (MOA) are not enough to cover for the cost of repair and maintenance of these computers. In addition, schools in remote towns have to transport their computer to relatively well-off cities and town nearby to have it fixed since there are no technicians in their area. Transport cost would account for additional expense.

In addition, the lack of technical know-how of the teachers and staff compounds the problem of integration. Based on the survey results, almost half of secondary schools teachers still remain to be ICT-illiterate. This translates to the teacher not being able to use the technology in teaching. In addition, there is lack of important infrastructures. There are still rural areas and villages *(barangay)* which are not yet reached by electricity. In one school, generators are used. However, the cost of fuel is a hindrance to the continuous use of computers. Apart from this, 7.31 percent of the schools have no continuous supply of electricity. Moreover, lack of internet connection because of weakness in telecommunications is also a problem. Only 17 percent of the schools surveyed have access to internet services. Lack of initiatives of school heads also poses a problem. The researcher observed that central schools in some towns that cater to a larger population of students do not have ICT resources while other *barangay* schools already have these resources. Lastly, bad weather condition further compounds the problem. In one school, a storm destroyed their computer units so they had to stop offering ICT-related subjects and topics after four years of successful use. This can be linked to the problem of the absence of and/or poor quality school infrastructures such as poor buildings and the lack of classrooms and safe storage rooms.

8. Concluding Remarks

The world today can be characterized on how information and knowledge can be accessed and fully utilized in order to achieve rapid economic and social development. Many economies have come to realize that investment in developing intellectual capital is the key to modernization, global competitiveness and an essential ingredient for economic efficiency and social equity. As World Bank in its 1999 World Development Report argues "(F)or countries in the vanguard of the world economy, the balance between knowledge and resources has shifted so far towards the former that knowledge has become perhaps the most important factor determining the standard of living - more than land, than tools, than labor. Today's most technologically advanced economies are truly knowledge-based."

In general, as demonstrated in this paper, high school education in the Philippines is still faced with the difficulty in fully harnessing the potentials of digital literacy and ICT diffusion. Although there are success stories that need to be told, these are limited to those with ample access to digital infrastructure and ICT-open minded teachers and administrators with the help of the private sector and other education stakeholders. However, the government, being the lead sector, should realize that without a unifying policy framework in integrating ICT in the basic education, the Filipino student will always be lagging behind the global standards for digital literacy and will always be at the losing end of the digital divide. Although the government has set forth some policy change such as the implementation of the RBEC, this only appears to be cosmetic and at the very least, a lip service. The policy framework should be coherent and consistent with the over-all development agenda in equipping the economy towards the requirements of a knowledge and information-intensive society. In addition to the provision of adequate infrastructure and fiscal allocation, this demands a more radical change of the basic education curriculum where ICT and digital literacy becomes the basic component and a separate subject area. The current curriculum, although revised in order to incorporate ICT skills, still leans on traditional approaches where, as described by OECD (2001b) the "dominant curricular and organizational patterns…were not designed for the Internet Age and often inhibits its effective use. ICT offers some gains for traditional curriculum delivery, but its full educational potential cannot be realized without the radical changes in schools structures and methodologies." A more radical curricular reform should be learner-centered and skill-based with a "clearly articulated and measurable curricular/pedagogical goals and objectives" (Tinio, 2002).

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