

Conference Paper

Teachers' Competency on the Use of ICT in Teaching Physics in the Junior High School

Catherine Bergonia Briones

Doctorate Student at Philippine Normal University (PNU)-Manila Campus, Scholar of the Department of Science and Technology (DOST) - NCGSME

Abstract

This descriptive-correlational research determined the teachers' competency in the use of ICT in teaching Physics and the students' performance in Physics-8. Findings of the study revealed that: (1) The ICT competency level of the Grade-8 Physics Teachers is proficient. The teachers are in the basic level both in Pedagogy and Organization and Administration domains; (2) The ICT-based innovative practices performed by the teachers in teaching Physics which were categorized into three themes such as (1) lesson preparation, (2) lesson implementation, and (c) collaboration; (3) There is a moderate positive correlation that exists the between the teachers' level of competency in the use of ICT and the students' performance in Physics. The relationship is found to be significant; (4) The teachers perceived that the use of ICT; helped improve students' understanding of science ideas, increases students' motivation in learning science ideas, stimulates students' interest to scientific ideas, facilitates the teaching and learning process, and provides teacher the opportunity to be innovative in delivering the lesson. The teachers also enumerated the top five most pressing challenges encountered that includes the following; poor/no internet connection, lack of seminars and trainings in ICT, lack of technical support, lack of time to plan and prepare lessons using ICT, and unavailability of ICT tools and software: and (5) An Enhancement Program entitled "ICT Competency Enhancement Program for Physics Teachers." was proposed to address the advancement of the competency level of the teachers in the use of ICT for a more innovative teaching and learning process.

Keywords: challenges in using ICT in teaching Physics, correlation students' performance and teachers' ICT competency, ICT competency enhancement program, Physics teachers using ICT, teachers' ICT competency

Corresponding Author:
Catherine Bergonia Briones
catherinebriones28@gmail.com

Received: 23 April 2018
Accepted: 8 May 2018
Published: 4 June 2018

Publishing services provided by
Knowledge E

© Catherine Bergonia Briones. This article is distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use and redistribution provided that the original author and source are credited.

Selection and Peer-review under the responsibility of the IRCHE 2017 Conference Committee.



1. Introduction

In a developing world perspective, two of the most powerful forces of the 21st century are the globalization of economy and the rise of Information Communication Technologies.

Since 1986, the Department of Science and Technology (DOST) has been responsible for the implementation of National Research and Development Strategies. DOST and the associated Philippine Council for Advance Science and Technology Research and Development (PCASTRD) have published a list of "Priority Science and Technology Areas" which include (a) Biotechnology; (b) Information Technology; (c) Materials Science; (d) Electronics and (f) Photonics [1].

Nowadays, technological advancement is a part and parcel of the educative processes. Human beings are intelligently gifted to come up with these latest and trending software, applications, and devices used in various fields. In the field of education, there are several applications used that facilitate the operation of the school as a system. There are studies that revealed the use of Information and Communication Technology in teaching particularly in Science which indeed enhances students' understanding of scientific facts and ideas. Some of the significant contributions of using ICT in teaching which includes: (a) making students' learning more effective; (b) increasing students' motivation; (c) enhancing students' sense of achievement; (d) providing students with access to richer sources of data and information; (e) helping students to become autonomous learners; (f) reducing pressure on students by letting them work at their own speed; (g) enhancing students' literacy skills; (h) making teachers take a fresh look at the way they teach; and (i) freeing teachers from administration to focus on students' learning. These significant contributions in the educative process provides the means to further evaluate and enhance the use of technology in the teaching process, especially nowadays that the other ASEAN nations and the countries are adapting the international curriculum of Junior High School and Senior High School known as the K to 12 [2].

In the Philippine setting, with the K-12 curriculum, the 21st century skills needed by a holistically developed Filipino are the Information, Media and Technology skills, thus, the use of ICT in teaching and learning process plays a vital role in developing these lifelong skills needed by the learners as they go out of the school and face the reality of workplace. Therefore, the effective integration of ICT is a general prerequisite and must be carefully undertaken by the teachers to guide the learners in attaining or developing these skills. The vision of the Department of Education (DepEd) for ICT in education

is "21st Century Education for All Filipinos, Anytime, Anywhere. This means an ICT-enabled education system must transform students into dynamic life-long learners and values-centered, productive and responsible citizens as indicated in the DepED ICT4E Strategic Plan [3].

Integrating ICT in teaching and learning process at present remains a challenging task on the part of teachers due to some reasons like: the ratio of student-computer and teacher-computer, lack of trainings in integrating ICT, lack of confidence and competence in ICT, lack of technical support and lack of accessibility to ICT resources.

All throughout the years, the Department of Education in the Division of Camarines Sur is becoming more responsive to the rapid technological advancement and changes in ICT that is evident in the study of Nacario [4]. It studied the readiness and acceptability of ICT integration in basic curriculum and it revealed that the initial ICT integration in teaching particularly in Science, Math, English and TLE is an indicator of faculty and students' readiness and acceptance of ICT in some schools of Camarines Sur. Likewise, their study recommended conducting a study that will correlate ICT competencies to students' achievement in Science. Hence, the Researcher being a Junior High School Physics teacher for three (3) years was motivated to determine whether the teachers' level of ICT competency in the use of ICT in teaching Physics in the Junior High School will affect the students' achievement in Physics.

2. Objectives of the Study

This study was conducted to determine the teachers' level of ICT competency in the use of ICT in teaching Physics in the Junior High School. Specifically, the study aims to determine (a) the level of ICT competency of teachers in the use of ICT in teaching Physics in Junior High School based on the DepEd ICT competency standards?; (b) the innovative practices of teachers in the use of ICT in teaching Physics; (c) if there is any significant relationship between the teachers' level of competency in the use of ICT and the performance of the students in Physics; (d) the gains and challenges met by the teachers in integrating ICT in teaching Physics in the ten identified schools; (e) the enhancement program that can be designed and proposed to further enhance the ICT competency of the teachers.

3. Materials and Methods

The descriptive-correlational design was used to determine the relationship of the teachers' level of ICT competency to the performance of students in Physics. Quantitative data was gathered using survey questionnaires for teachers and immediate supervisors and achievement test in Physics for the students to determine the teachers' level of ICT competency and students' performance respectively.

Qualitative data was drawn from the research instrument, interview guide, and focus group discussion guide. Descriptive design was used to describe the level of ICT competency, performance level of the students, and the innovative practices of the teachers. Correlational design was used to determine the relationship between the teachers' ICT competency level and the students' performance in Physics.

3.1. Respondents of the study

The Department of Education, Camarines Sur Divisions is composed of five districts namely, District I, District II, District III, District IV, and District V. Each district is represented by two schools; there were ten identified schools in the Division of Camarines who were the primary respondents of this study. The ten (10) schools were identified based on the number of populations and they are all recipient of the DepEd Computerization Program (DCP). The respondents of this study were composed of 10 immediate Supervisors, 23 Physics teachers, and 920 Grade-8 students from 23 sections handled by the 23 Physics teachers. The immediate Supervisor and peer of the teacher respondents were included as respondents for the triangulation of the data from the teachers.

3.2. Research instruments

The research instruments used in this study were the focus group discussion guide, self-evaluation, peer-evaluation, immediate supervisor questionnaire for the ICT competency, checklist for the gains & challenges, interview guide questionnaire for the innovative practices, and the achievement test for students' performance in Physics. The set of questionnaires were distributed to all the respondents.

The self-evaluation questionnaire for teachers was divided into three parts accordingly; Part I is on the school's and respondent's profile in terms of ICT facilities and resources, teachers' educational attainment, and trainings attended by the teacher.

Part II is on the teachers' level of ICT competency that is based on the DepEd ICT Competency Standards for Teachers. Part III is the checklist about the different gains and challenges encountered by the teachers in using ICT in their teaching. The peer-evaluation and immediate supervisor questionnaire only includes the Part II of the self-evaluation questionnaire. An interview questionnaire was used to gather the different innovative practices of the teachers in teaching Physics-8. The focus group discussion guide questionnaire was used to explore the insights and ideas of teachers in the use of ICT. The achievement test in Physics that is based on the learning competencies for Physics-8 indicated in the K-12 Science Curriculum Guide provided by the DepEd was used as the research instrument in gathering of data from the students. The test was composed of fifty items.

To evaluate the validity of the self-evaluation questionnaire for teachers, and the test items for students, these were shown to the jurors composed of six (6) experts in ICT and in Physics, two (2) of them are currently handling ICT and education media technology subjects in college, three (3) Physics teachers who are M.A. and Ph.D. holders in Physics who are currently handling high school and college Physics classes for not less than five (5) years, and one (1) of the jurors is the I.T. Officer of the Department of Education in the Division of Camarines Sur. The suggestions and recommendations of the experts were considered in the revision of the questionnaires.

The achievement test was first administered to twenty-eight (28) Grade-9 students who were not the respondents of the study and who were done taking Physics-8 subject during their Grade-8 level. This group of students are from Computer Science High School of Bicolandia where the researcher is presently teaching. The students' answers to the seventy (70) items were subjected to item analysis. To test the Internal Consistency Reliability of this test, the Kuder and Richardson Formula 20 was used. The computed (ρ_{KR20}) coefficient value is 0.70, these are considered good and few items can be improved. The value of $\rho_{KR20} = 0.70$ shows that the test has high reliability. The students' answers to the first set of seventy (70) items were subjected to item analysis.

3.3. Data gathering procedure

Upon completing the research proposal, the researcher requested permission from the Schools Division Superintendent, and the School Heads of the secondary schools to allow her to conduct the study. A letter of request was submitted for approval to facilitate the formal data gathering.

The researcher administered achievement test to the students, answer sheets was provided by the to facilitate the checking of the Achievement Test and to minimize the cost of printing.

The self-evaluation, peer-evaluation and immediate-supervisor questionnaires were administered to the respondent teachers and supervisors. After answering these questionnaires, an interview about their answers in the self-evaluation and innovative practices for Physics teachers followed. Focus group discussion was also undertaken by the researcher to support the data gathered from the teachers for further discussion and justification.

3.4. Statistical treatment

Descriptive statistics like frequency counting, percentage, and weighted mean was utilized to quantify the teachers' level of ICT competency and the performance level of students in Physics-8. In data gathering and tallying, simple frequency distribution and percentage were utilized. Item analysis was used to determine the items that were included in the final draft of the achievement test.

Pearson r correlation was used to test the statistical relationship of the teachers' level of ICT competency and the performance level of students in Physics-8. The Pearson r assesses whether the two variables are statistically related.

To test the significance, a risk level must be set. In most social research, the "rule of thumb" is to set the alpha level at .05. In this study the degrees of freedom is 21. The r-critical value of the Pearson's Product-Moment Correlation Coefficient at 0.05 level of significance for a non-directional (two-tailed) with the degrees of freedom 21 is 0.433. If the computed value of r is greater than or equal (\geq) to the tabled r-value a significant relationship exists between the teachers' level of ICT competency and the performance level of students in Physics-8.

4. Results and Discussion

4.1. Teachers' competency in the use of ICT

The teachers' competency was rated by the teachers along ICT, pedagogy, organization & administration, assessment & evaluation, and teachers' professional development. Their assessment of competency determined their level of competence from 1 (Low), 2 (Basic), 3 (Proficient), and 4 (Advanced). As perceived by the respondents, there

is a need for a teacher to be competent in the use of ICT, given that all industries /sectors worldwide are benefiting from the rapid developments in ICT; specifically, in education sector. Nowadays students are becoming more inclined and habitual users of ICT. If the teachers will not be competent in the use of the existing technology, they will be left behind in this digital age. Thus, the National Competency-Based Teacher Standards (NCBTS) should be supported by ICT competency standards. The Department of Education (DepEd) came up with this ICT Competency Standards for Teachers (ICT-CST) that embraces the changes ICT will affect on teaching and learning process. This framework adapted a positive outlook and perceived ICT as an opportunity to develop their pedagogy and professionalism in line with global trends in education shifting from being the traditional provider of knowledge to becoming the facilitator of learning and trying to become habitual users of ICT.

The DepEd ICT Competency Standards for Teachers was used to determine the level of ICT competency of the teacher respondents. This is based upon the core values of Filipino teachers, on the National Competency-Based Teacher Standards (NCBTS) and on the principles of effective teaching and learning which is divided into seven (7) domains. These domains represent the desired features of the teaching and learning process namely: (a) ICT (that will be integrated in all domains); (b) Pedagogy (Diversity of Learners and Curriculum); (c) Organization and Administration (Learning Environment and Community Linkages); (d) Assessment and Evaluation (Planning, Assessing and Reporting); (e) Teacher Professional Development (Personal Growth and Professional Development); and (f) Social, Ethical, Legal and Human Issues (Social Regard for Learning). These areas integrate a series of elements of desired teaching performance statements identified as observable indicators of the quality of teachers' performance. It defines what the teacher is competent to do, and it is the touchstone that ensures the continuing response to the changing needs of the teaching-learning process. The teachers are being trained to continue and deepen their personal and professional development. Therefore, these elements would identify areas of strength, weakness as well as those that need to be developed.

It also contains the levels of Developmental Continuum of Practice that is expected from the teachers to do. There are four level such as (1) Low; (2) Basic, (3) Proficient, and (4) Advanced. In the Low Level, a teacher is not aware about ICT, he/she is not using ICT in the teaching and learning process. In the Basic Level, a teacher needs to be aware of the uses of ICT for teaching and learning while in Proficient Level a teacher is expected to be a more fluent, critical and reflective user and must be able to demonstrate appropriate and efficient use of ICT beyond basic forms. On the Advanced

Level, a teacher must be able to further explore the range of possibilities for use of ICT across the curriculum and design student learning activities that integrate ICT tools that consider students' different learning styles. This includes adopting emerging technologies [4]. In this study, these were used to determine to the teachers' current level of ICT competency that was the basis of the enhancement program to be proposed.

Putting all together and comparing all the ratings of the teachers, their peers and immediate supervisors it can be seen in Table 1 that the teachers are proficient in the use of ICT with a weighted mean of 2.52 which is calculated considering the number of teachers (23), their peers (23), and their immediate supervisors (10).

It can be noted that the weighted mean (2.52) is the lower limit in the range of proficient level. It is possible to say that teachers are not fully proficient which is reflected on the result of the focus group discussion which indicates that the teachers are not that fully proficient because of the given reasons: (a) they are just practicing the basic use of ICT such as the use of power point presentation, animations, and videos, (b) they are just preparing simple ICT-based instructional materials, and (c) they are just able to download videos, surf the internet, and put some effects in the presentations. They also enumerated the following factors that prevent them from becoming fully proficient: (a) no ICT-based trainings attended, (b) teachers are hesitant to adapt the new technology for teaching, (c) lack of ICT facilities, (d) lack of self-motivation to use ICT, (e) attitude of the ICT facilities in-charge, (f) poor internet connection, (g) lack of ICT knowledge and skills, (h) lack of time to prepare ICT-based instructional materials, and the (i) lack of technical support.

When the teachers were asked if they consider themselves proficient in the use of ICT, one of the teachers responded, *"Yes, but not that fully competent and proficient because I only download ready-made PowerPoint Presentations, I only make use of the basics in ICT like making my own simple PowerPoint Presentation and downloading videos"*.

Table 1 also shows that the teachers have basic level in the pedagogy, and organization and administration domain with a mean value of 2.34 and 2.20 respectively. It can be noted that the respondents only use technology for classroom activities and presentations. They also select and develop instructional materials using various online and offline sources. Some of the teachers posted the presentations online to be accessed by the students. They also let their students download videos and prepare their own slide presentations related to their topic. One of the respondents asked her students to compose a jingle and create a video presentation and uploaded it in YouTube.

TABLE 1: Teachers' Level of Competency in the use of ICT.

Domains	Self	Peer	Immediate Supervisor	Teachers' ICT Competency	Competency Level
1. ICT	2.52	2.39	2.91	2.54	Proficient
2. Pedagogy	2.22	2.35	2.61	2.34	Basic
3. Org. & Admin.	2.09	2.22	2.39	2.22	Basic
4. Assessment & Evaluation	2.52	2.61	2.78	2.60	Proficient
5. Teacher Professional Development	2.83	2.74	2.91	2.81	Proficient
6. Social, Ethical, Legal & Human Issues	2.61	2.48	2.91	2.61	Proficient
Weighted Mean	2.46 (Basic)	2.46 (Basic)	2.75 (Proficient)	2.52	Proficient

In general, the teachers considered themselves basic users of ICT. They suggested the following activities that must be done to enable them to become fully proficient and be an advanced user of ICT in the teaching and learning process: (1) ICT-based trainings must be conducted, (2) sufficient ICT facilities must be provided, (3) technical support must be strengthened, (4) speed and reliable internet connection in school must be provided, and (5) teachers' must be self-motivated to learn, use, and create ICT-based materials for instructional purposes. As cited in the study of Chemwei, he enumerated several factors that contributes to the low level of ICT integration in teacher preparation. These are the following; (1) teacher-educator's age; (2) availability of ICT resources; (3) lack of ICT skills to integrate ICTs in teaching; (4) appropriate software; (5) lack of prior experience to use ICT; (6) lack of Internet facilities; (7) low motivation; (8) lack of time to prepare ICT media; and (9) lack of confidence among teacher-educators [5].

Their initial levels of competency in the different domains determine their practices in the use of ICT in their teaching. It also determines how the teachers will innovate and effectively use ICT in the teaching and learning process.

4.2. Innovative practices of teachers in the use of ICT in teaching physics

The over-all teachers' level of competency is not fully proficient as claimed and supported by the teachers' responses during the focus group discussion. It can be noted

that although teachers are not fully proficient and despite of several innovations in using ICT as of today, they are still performing some ICT-based innovative practice. An interview and focus group discussion guide questionnaire were used to determine the different innovative practices of teachers in the use of ICT in teaching Physics. Table 2 shows the ICT-based innovative practices of the teachers in teaching Physics which were categorized into three themes such as (1) lesson preparation, (2) lesson implementation, and (c) collaboration.

TABLE 2: Innovative Practices of Teachers in Teaching Physics.

Common Themes	Innovative Practices
1. Lesson Preparation	-Use of social media as learning interaction -Other effort of the teacher
2. Lesson Implementation	-Integrating ICT on inquiry based teaching -Use of mobile phone as storage media
3. Collaboration	-Online community of practice

There were five innovative practices which include the (1) use of social media as learning interaction, (2) other effort of the teacher, (3) integrating ICT on inquiry based teaching, (4) use of mobile phone as storage media, and (5) online community of practice.

At present, there are billion users of social media networking sites, specifically the Facebook. Some of the teachers are using social media as platform for learning interaction. They can interact and communicate with other people around the world. In the school setting, almost all the teachers and students have Facebook accounts but only few teachers are using social media as a means for learning interaction. Three of the teachers are posting their activities on-line (FB group chat) to be accessed by the students, which also serves as their assignment. One of the activities mentioned by the teachers is about the Newton’s Three Laws of Motion. They will search and enumerate situations that are governed by the three laws. In the group chat, students are free to interact with their classmates and teacher regarding the posted activities. It also serves as storage for files (word presentations, spread sheets, videos, graphics, and animation) and links suggested by the teachers where they can easily access reliable information about the topics and lesson presented.

Currently, almost all the information, concepts, ideas, and materials in Science are readily available in the web. It can be easily accessed both by the teachers and students. As part of the teachers’ effort in the lesson preparation, given the current

scenario in their school of not having internet connection, teachers are innovative in providing their own internet connection to be able to surf the web for the different supplementary materials to be used in their teaching. Eight (8) teachers spent their own money to purchase broadband device and electronic loads just to have an internet connection to be able to visit reliable websites for the suggested activities, situations, problems, and materials related to the present lesson because some of the books that are available in their library are out dated.

During the lesson implementation, there are three teachers who are integrating ICT on inquiry based teaching. Three teachers are providing the students with guide questions related to the topics and encourage them to surf the internet to access information. Students will explore the web to find relevant information. With the help of the guide questions provided by the teachers, students will use their critical judgment as to the reliability of the websites they are visiting. In this way, teachers are becoming innovative because they develop their literacy skills most especially in gathering information, not just copy pasting all the information, but a thorough judgment of the information available in the website. Through this, students will also learn how to properly cite references which is an essential skill to address some legal issues like plagiarism and copyright. The teachers stressed that when they let their students do these web-based activities, students become more excited to do the activities and they are happy once they complete the task given to them. It is fulfilling on the part of the teacher because the students can create their own ICT-based output that enhances their ICT literacy and skills.

One of the teachers mentioned that she is letting her students use their mobile phones as storage media device where they can save e-books, PDF files, videos and other references in Science during the discussion. According to some of the teachers, one of the major problems they are currently encountering in teaching in general is the unavailability of Learner's Materials in Science. These materials are readily available in the web and it can be easily downloaded. Using mobile phone as storage device of the different resources and references in Science, these can be downloaded thus posing as an immediate solution to this current problem. Teachers will be more innovative and efficient given that almost all the students have the soft copy of the learning materials because as of today students are habitual users of mobile phones. In just a single click they can easily access and explore the web.

Some of the teachers are utilizing social media groups to exchange ideas with other professionals online. They are building networks with other professionals to collaborate, create and manage complex projects. This is one of the indicators that distinguished the teacher as proficient in pedagogy domain. Two of the teachers mentioned that they build network with other professionals by joining group/social media to gain ideas on effective strategies and approaches in teaching. Some of the teachers are interacting with other professionals through blogs, and comments like for instance in the DepEd Tambayan, teachers are asking other teachers about the availability of modules, teachers' guide, and other relevant materials. They are exchanging their insights about certain topics and the availability of some learning materials. Through this, teachers are becoming innovative because they are sharing their insights, experiences, and learning materials to other professionals and this greatly help the teaching and learning process even if they are only interacting virtually.

Commonly, almost all the teachers are just downloading ready-made power point presentations available in the web. Only few teachers are preparing their own power point presentation as an instructional material. They include words, graphics, and videos in the presentation. Science animations, computer aided instructional materials and simulations are also utilized by the teachers to support the teaching and learning process. Some of the teachers let their students create their own power point presentations and videos related to their topic. Some of these are posted online. Guide questions are also provided by the teachers when they ask the students to do some research about their lesson to be discussed in the class. They use the power point presentations, animations, simulations and video presentations in the motivation part, lesson proper and in evaluating students' performance and understanding of a certain topic.

Considering these practices, these are just the basic utilization of ICT in the teaching and learning process. The DepEd ICT Competency Standards for Teachers enumerated some of the advanced innovative practices and these are the following: (1) The teacher creates model of ICT learning processes, (2) the teachers continuously learn and use ICT to create applications, software and professional knowledge communities, (3) the teacher facilitate students' use of technology and assure the equitable access to technology resources for all students, (4) the teacher uses computers and other technologies to effectively communicate and collect information on student learning using a variety of methods for assessment and evaluation, and (5) the teacher model self-directed attitude towards continuously learning, using, and experimenting ICT to create instructional materials and models [4]. These practices are anchored on the

developmental continuum of practice geared towards the realization of the DepEd goal that a teacher needs to be aware of the uses of ICT for teaching and learning, be able to further explore the range of possibilities for use of ICT across the curriculum and design student learning activities that integrate ICT tools that consider students' different learning styles, and this includes adopting the emerging technologies.

4.3. Teachers' ICT competency and students' performance in physics

This study aimed to determine if the teachers' ICT competency level will significantly affect the students' mastery level in Physics-8. Using the Pearson r correlation, the teachers' ICT competency level is correlated with students' performance in Physics-8. Table 3 shows the Teachers' ICT Competency and Students' Performance in Physics.

There were only 10 teachers who were in the proficient level, while in the basic level there were 13 teachers. It was also shown that the students handled of those 13 teachers who were in the basic level have low mastery.

It could be possible that somehow, the teachers' ICT competency level affects the students' performance in Physics. Maybe, those teachers who were not that competent in utilizing ICT are hesitant to use ICT-based instructional materials thus resulting to students' low mastery level.

One of the possible reasons to this are the ways how ICT is used in the teaching and learning process. When the teachers were asked on how they used ICT in their teaching, they stressed that they are only using ICT for presentations of lesson, using simple PowerPoint presentations, videos, animations and simulations readily available in the web. Students are merely passive learners during the lesson proper and they are not exposed to concrete concepts where they can actually/individually manipulate the animation and simulations presented by the teachers. It can also be noted in Table 3 that there were 5 teachers (T1, T4, T5, T6, and T9) who were proficient in the use of ICT but then their students' mastery level in Physics is low mastery.

Possibly, the use of ICT in teaching is not translated into learning because students were passive learners and simply audiences during the discussion. The concepts and ideas in Science remain abstract to them because they were not given the chance to explore, and manipulate ICT tools used by the teachers.

The over-all mastery level of the Grade-8 students in Physics in the Division of Camarines Sur is Low Mastery. It implies that the use of ICT in teaching is not the only factor that affects the students' performance. Some factors that may affect

TABLE 3: Teachers' ICT Competency and Students' Performance in Physics.

Teachers	Teachers' ICT Competency	Interpretation	Students' Performance	Interpretation
1	3.33	Proficient	15.76	Low Mastery
2	3.28	Proficient	23.42	Average Mastery
3	3.11	Proficient	23.46	Average Mastery
4	3.00	Proficient	14.53	Low Mastery
5	2.83	Proficient	13.84	Low Mastery
6	2.83	Proficient	13.53	Low Mastery
7	2.78	Proficient	19.4	Average Mastery
8	2.67	Proficient	21.73	Average Mastery
9	2.67	Proficient	13.64	Low Mastery
10	2.56	Proficient	23.02	Average Mastery
11	2.50	Basic	12.79	Low Mastery
12	2.50	Basic	13.68	Low Mastery
13	2.50	Basic	16.48	Low Mastery
14	2.50	Basic	14.45	Low Mastery
15	2.39	Basic	16.89	Low Mastery
16	2.39	Basic	12.96	Low Mastery
17	2.39	Basic	16.54	Low Mastery
18	2.33	Basic	16.96	Low Mastery
19	2.33	Basic	14.43	Low Mastery
20	2.17	Basic	12.5	Low Mastery
21	2.17	Basic	12.97	Low Mastery
22	1.89	Basic	14.74	Low Mastery
23	1.78	Basic	13.46	Low Mastery
@ 5% Level of Significance:				
Tabulated r-value = 0.4330				
Computer r-value = 0.4719				
Interpretation: Moderate Positive Correlation Significant				

the students' performance in Physics are the following: (1) teachers' major field of specification and mastery of the subject matter, (2) the learning environment, and (3) the teachers' methods, strategies and approaches in teaching.

Pearson correlation was used to determine the relationship between the teachers' ICT competency level and the performance level of students in Physics-8. It can be noted that the computed r -value is 0.4719 and the tabulated r -value is 0.4330 at 5% level of significance. It can be noted that the computed r -value (0.4719) is greater than the tabulated r -value (0.4330). The computed r -value indicates that there is a moderate positive correlation between the teachers' ICT competency level and the performance level of students in Physics-8. The relationship is found to be significant. As highlighted by the teachers that ICT is useful in teaching, because ICT facilitates the teaching and learning process; students become more interested and attentive to the lesson; and the retention of learning is higher.

This is in accordance with the study conducted by Nacario, Lea, Pura, Formalejo, and Garcia which revealed that the use of ICT-Based instructional materials, computer simulations, Virtual Chemistry Laboratory (VCL) and Technology-Mediated Lessons significantly improved the students' performance and conceptual understanding, increase the students' interests and positively affect the attitude of students towards learning Science subjects [7]-[11]. Their study provided a clear manifestation that using ICT-Based instructional materials in teaching Science significantly affect the students' performance, interests and attitudes towards Science.

It was also emphasized in the study of Clement that there is a need to use ICT in education because of the enumerated advantages of utilizing However, in this study a slight correlation was revealed because the ways and means of the teachers in using ICT in the teaching process do not translate into effective learning of scientific ideas and concepts maybe because students were only passive learners during the entire discussion. Thus, teachers must be highly competent in using ICT specifically in the effective utilization of ICT tools in the teaching and learning process. Teachers should be fully proficient and effectively use ICT in their teaching even though the teachers' ICT competency level is not statistically related to students' performance in Physics.

This claim was reflected on the teachers' responses when asked about the importance of being competent in the use of ICT in teaching. They stressed that it is important that a Physics teacher be competent in the use of ICT because nowadays we are on the 21st century, the digital age wherein almost everything rely on the existing technology. As they use ICT in their teaching, it facilitates the teaching and learning process, some difficult topics are easily explained and understood using animation, simulations and videos.

It is possible to say that aside from the basic level usage of ICT in the teaching and learning process, there were some factors that affect the result of this study that led

to students' low mastery level. These include (a) major field of specification of the teachers, (b) learning environment, (c) teachers' methods, strategies and approaches in teaching.

It can be noted that there were only 7 teachers who were major in Physics, Bio-Physics, and Physical Science. Most of the respondents of this study are Biology majors (10 teachers) and the rest were General Science (4 teachers), Biochemistry (1 teacher), and Business Education (1 teacher) majors. Teachers were required to teach the four major Sciences such as Earth Science, Biology, Chemistry and Physics because of the spiral progression approach in the K-12 curriculum, even if they do not have mastery of the subject matter in each area. Teachers are encountering difficulties to teach subjects that are not aligned to their major field of specification. Somehow, this might affect students' mastery level.

On the learning environment, since most of the school respondents are considered big schools, their environment is not conducive for learning, approximately 50-60 students are crowded in one small classroom. Some of the classrooms do not have electrical power supply and are not properly ventilated, thus, even if the teacher is using ICT in their teaching, it is not translated into learning because their environment is not conducive for learning.

The teachers' methods, strategies, and approaches in teaching might as well affect the students' performance. Some of the teachers are limited to lecture method (writing copying notes on the board), discussion (more on teachers' input), and reading books which are very traditional ways and means of teaching. Some of the teachers are hesitant to innovate their methods, strategies, and approaches to teaching. Or else when they use ICT in their teaching, it is only the teacher who is manipulating the computer not the students. There were only few teachers who were letting their students surf the web for the relevant information that will enable them to explore.

Given the premises and claims about the positive effect of using ICT in the teaching and learning process, it could be possible to say that it is important and vital that a Physics teacher is well competent in the use of ICT because as stated by one of the teachers, "How can we teach such competency and skills to the students if we are not that fully competent in the use of ICT?" simply because as of today, we are on the digital age where almost everything rely on the emerging technologies. This is in response to the DepEd K-12 goals to develop graduates who are holistically developed with 21st century skills namely; (a) Effective communication skills, (b) Learning and innovation skills, (c) Life and career skills, and (d) Information, media and technology skills.

4.4. Gains and challenges met by the teachers in using ICT in teaching physics

As the teachers utilize ICT and performs some innovative practices in the teaching and learning process they may encounter gains and challenges. A checklist was used to determine the different gains and challenges met by the teachers in using ICT in teaching Physics.

Gains. Table 4 shows the top five (5) gains of using ICT in teaching Physics. Based on the perception of the teachers, it can be noted that the teachers recognized that ICT: helped improve students' understanding of Science ideas, increases students' motivation in learning Science ideas, stimulate students' interest to Scientific ideas, facilitates the teaching and learning process, and provides teacher the opportunity to be innovative in delivering the lesson.

TABLE 4: Gains of using ICT in Teaching Physics.

GAINS	Rank
ICT... helped improve students' understanding of Science ideas	1
increase students' motivation in learning Science ideas	2
stimulates students' interest to scientific ideas	3
facilitates the teaching and learning process	4
provides teacher the opportunity to be innovative in delivering the lesson	5

As claimed by many researchers who conducted studies that revealed that the use of ICT in teaching Science subjects increases students' performance, students' interests, scientific understanding and positive augmentation in the pupil's attitude towards Science. These claims were supported by the teachers during the focus group discussion. The teachers emphasized that the use of ICT in teaching helped improve students' understanding of Science ideas because when they are using ICT in their teaching students are given the chance to explore the information available in the web and enhances their knowledge and understanding about Scientific ideas. In addition, the retention of learning becomes higher because of the various ICT-based tools such as graphical illustrations, animations, simulations, and videos that are readily available.

It was also stressed by the teachers that the use of ICT increases motivation and stimulates students' interest to Scientific ideas. Students become more attentive because they are using ICT-based tools in their teaching and the interest of the students

are sustained during the discussion even if the topic may seem boring to them. One of the teachers said that *"ICT is very useful because students become interested, and more attentive to the lesson. Those pictures, animations, and videos I presented to them really catch their attention."*

The teacher also put emphasis that the use of ICT really facilitates the teaching and learning process because of the following reasons: (1) the discussion of a certain topic becomes easier because of the graphical illustrations, (2) lesser effort in explaining certain phenomena because of the videos and simulations, (3) lesser time in preparing lessons because ICT-based instructional materials can be used repeatedly for over a long period of time, (4) lesser stress experienced by the teachers because misbehavior of students are lessen, they are attentive to the presentations presented to them. One of the teacher said that *"It lessens our stress, because instead of explaining the concepts to my students on my own, in the video it is easily explained, it reduces the things the teacher will think about."*

Moreover, ICT provides teacher the opportunity to be innovative in delivering the lesson. Teachers are given the chance to make their own instructional materials that will suit the diverse types of learners and cater to individual differences specially in learning styles. Some of the students are visual learners, while others are auditory learners. The needs to cater to the individual differences of the learners can be addressed using multimedia in the teaching and learning process because when almost all the senses of the learners are utilized the retention of learning becomes higher and helps improve students' understanding and performance. One of the teachers shared her experience about the importance of using ICT in teaching electricity and magnetism. She emphasized that she will not be able to teach what is magnetism without the aid of videos and presentations about electricity and magnetism. She added, *"When I am using ICT, it facilitates the learning of the students because they are able to visualize things that cannot be seen by the naked eye, like the flow of electrons in a wire, they will easily understand that the electrons flow in a wire."*

Challenges Met by the Teachers. It can be noted in Table 5 that the Top 5 most pressing challenges encountered by the teachers are the following; Poor/No Internet Connection, Lack of ICT-related seminars and trainings, Lack of technical support, Lack of time to plan and prepare lessons using ICT, and Unavailability of ICT tools and software like simulations, videos, and animations.

During the interview they also enumerated the following factors that prevented them from becoming fully proficient: (a) poor internet connection, (b) no ICT-based trainings attended, (c) lack of technical support, (d) lack of time to prepare ICT-based

TABLE 5: Challenges Met by the Teachers in using ICT in Teaching Physics.

CHALLENGES	Rank
Poor/No Internet Connection	1
Lack of ICT-related seminars and trainings	2
Lack of technical support	3
Lack of time to plan and prepare lessons using ICT	4
Unavailability of ICT tools and software like simulations, videos, and animations	5

instructional materials, (e) lack of ICT tools and facilities, and (f) teachers' attitude towards adapting the new technology for teaching.

It can be noted that the availability and accessibility to the internet is one of the most challenging problems encountered by the teachers. Since almost all the available ICT tools and software like simulations, videos, animations and computer aided instructional materials can be accessed through the internet. As the time goes by, there are several innovations, inventions and studies that can be accessed through the internet. During the focus group discussion, the teachers emphasized that it is hard to be innovative using ICT because there is no internet connection in their school. Even if they were willing to surf the web, it remains a very challenging task because they do not have enough time to research in the computer shop, and it is expensive when they keep on loading their broadband just for one-day utilization, and sometimes the internet connection is weak. In some schools where internet connections are available, they were still struggling because only few teachers or only the ICT in-charge knows the password. One of the teachers emphasized the importance of having an internet connection. She said *"Since most of the time we only use ready-made instructional materials because we cannot make our own materials and then there are times that we cannot easily understand what is in the module, especially if the subject is not our major field of specification, because as of now in the K-12 curriculum we are using the spiral progression approach. If we cannot search through the web due to the lack/no internet connection, it is very difficult for us to understand complex topics. The books here in our library are obsolete, since the ideas and concepts in Science are evolving (developing) and upgrading, when there's no internet we will be left behind."*

Another challenging problem encountered by the teachers is the lack seminars and trainings in ICT that would further enhance their ICT competency in the use of ICT in the teaching and learning process. The teachers were really struggling on having a low competency on the use of ICT that leads to low confidence of delivering the

ICT-based lesson to the students due to the lack of ICT knowledge and skills. It can be noted that almost 50% of the respondents did not receive ICT trainings in their Pre-Service Teaching and In-Service Teaching. Lack of seminars and trainings on ICT also affect the use of ICT in teaching Science. They are not confident in using ICT in their teaching because their knowledge and skills are limited. One of the teachers also emphasized the importance of having and attending not just a training but a quality training provided by different agencies.

The 3rd most challenging problem is the lack of technical support from the ICT department. When the teacher encounters technical problems, they are not able to resolve those technical problems because of the lack of ICT specialists in the school who would repair or fix the problem that might hinder the teachers to use the ICT resources such as the projector, laptop/computer, speaker, and printer. One of the teachers suggested having at least five (5) ICT experts in their school who would assist and help them to further enhance their ICT competency, knowledge and skills. One of the teachers mentioned that he asked help from his colleague who is more knowledgeable and more skilled in ICT whenever he is encounters technical problems.

Another challenging problem that is related to lack of technical support is the attitude of the ICT Facilities In-charge. One of the teachers shared her experience when she tried to coordinate with the ICT-in Charge to use the computer laboratory, the following questions were asked by the In-charge, *“Do you really need to use ICT facilities in teaching? Is that included in your curriculum? Where can you integrate ICT in your curriculum? What if these ICT facilities will not function well will you replace it with new one?”* These were the questions that held back the teachers to use the available ICT facilities in their school. There were computer laboratories that were not used for instruction purposes. Most of the computers are stocked due to the fear of breaking these and will be charged to the teachers who used the ICT facilities.

Lack of time to plan and prepare lessons using ICT being the 4th is related to the 5th most pressing challenges encountered by the teachers, the unavailability of ICT tools and software like simulations, videos, and animations in a sense that if the appropriate simulations, videos, animations and instructional materials were readily available in just finger tips of the teachers they don't have to spend much of their time preparing these time-consuming instructional materials. Most of the teachers were downloading ready-made power point presentations in the web because they do not have enough time to prepare due to the additional working load given to them. One of the teachers mentioned that *“We were given additional working load, there were too many subjects to prepare that is why we don't have enough time to make ICT-based instructional materials.”*

One of the teachers also emphasized that she doesn't have enough time to prepare because she has a special child to attend to.

Another challenge in using ICT is the teachers' negative attitude towards adapting the new technology for teaching. There were teachers who were hesitant to adapt the new technology for teaching due to the lack of self-motivation to use ICT, lack of ICT knowledge and skills, lack of self-confidence, and probably because of their age. According to one of the teachers, as of now some of the teachers are anchored and practicing the traditional way of teaching because it is also tiring on the part of the teacher to prepare such ICT-based instructional material that is why they only prefer to stick to their traditional way of teaching (reading books, chalk and board lecture). This claim was supported by one of the teachers who said that: *"I am a slow learner because of my age, I am getting old."*

Lack of self-encouragement was also emphasized, *"If we will just wait for the trainings that will be provided by the Department of Education, nothing will happen, but if we have that self-encouragement to attend, there are few ICT related trainings, it is up to you if you really want to learn."* This is a positive rather than negative attitude towards ICT. Teachers who have positive attitudes towards ICT itself will be positively disposed towards using it in the classroom.

Mumtaz conducted a review of related studies concerning the different Factors Affecting Teachers' Use of Information and Communications Technology [12]. Many early studies investigated why teachers do not use computers in their teaching (Rosen & Weil, 1995; Winnans & Brown, 1992; Dupagne & Krendl, 1992; Hadley & Sheingold, 1993). Not surprisingly they found a list of inhibitors: (a) lack of teaching experience with ICT; (b) lack of on-site support for teachers using technology; (c) lack of help supervising children when using computers; (d) lack of ICT specialist teachers to teach students computer skills; (e) lack or availability of computer; (f) lack of time required to successfully integrate technology into the curriculum; (g) lack of financial support. This is also supported by the study of Chemwei also enumerated several factors that contributes to the low level of ICT integration in teacher preparation [6].

Moreover, the respondents enumerated other challenges they encountered in the use of ICT and these are the following: (1) Science subjects are not given the priority to use the laboratory room, (2) setting up the ICT-based facilities and devices is time consuming, (3) lack of mastery about the subject matter (ex. Biology teachers are teaching Physics), (4) lack of ICT-enabled classrooms, (5) lack of power supply in some classrooms, and (6) some parents are complaining that the students are always asking money to be used in surfing the internet.

Despite of these challenges encountered by the teachers, they are doing some initiatives to overcome such difficulties namely; (1) they are providing their own laptop, projector, and internet, (2) they are letting the students do the ICT-based activities in groups due to insufficient ICT facilities, (3) they are coordinating with the I.T. experts in their school, (4) they are trying their best to deliver the lesson even if the subject is not aligned to their major field of specification, (5) they collaborate and share ICT-based instructional materials with other teachers, (6) they explain to the parents that there is really a need that sometimes students are asked to surf the internet to further understand the topics, and (7) some of the teachers are enrolling in the graduate school to enhance their knowledge about the subject matter and at the same time enhance their ICT competency.

4.5. Enhancement program to enhance the ICT competency of the teachers

After determining that the competency level of the Grade-8 Physics Teachers in the Division of Camarines Sur is Proficient with a weighted mean of 2.52 that is just near the lower limit of the Proficient Level and far from the Advanced Level ranging from 3.51-4.00. According to the teachers, they are not that fully proficient to use ICT in teaching Physics. They emphasized that some of their practices are only on the basic level which reflect on the result of the survey which reveals that the teachers are in the basic level on both pedagogy (2.20) and organization & administration domain (2.60). It implies that even though the teachers are using ICT in their teaching it doesn't necessarily mean that they are proficient in using ICT especially in pedagogy domain because the effectiveness of using ICT is not translated into the learning of the students. Some of the students who were handled by the teachers who were in the proficient level have low mastery level. However, teachers perceived that the use of ICT helped improve students' understanding, increased students' motivation, stimulate students' interest in scientific ideas, facilitates the teaching and learning process, and provides teachers the opportunity to be innovative in delivering the lesson.

It was also revealed that some of the challenging problems encountered by the teachers are the lack of seminars and trainings, lack of time to plan and prepare lessons using ICT and the unavailability of sufficient ICT tools and software like simulations, videos, and animations. Thus, there is a need to conduct an ICT-based seminar-workshop that will further enhance their competencies on the use of ICT. As a result, the researcher prepared a program proposal entitled "ICT Competency Enhancement

Program for Physics Teachers.” The program aims to address the advancement of the competency level of the teachers in the use of ICT for a more innovative teaching and learning process.

Based on the findings of this study, Table 6 presents the weaknesses and challenges that should be addressed by the enhancement program proposed. There are specific suggested activities for every challenge/weakness to be addressed. It is expected that when the enhancement activities will be provided to teachers, they would become fully proficient and be advanced user of ICT in the teaching and learning process.

The researcher aims to conduct the series of seminars and workshops on ICT for teachers that will focus more on Pedagogy and Organization & Administration Domain and will enhance the teachers’ competency level of ICT usage into advanced level.

TABLE 6: Weaknesses and Challenges to be Addressed.

FINDINGS (Weaknesses and Challenges)	ENHANCEMENT ACTIVITIES (Activities that can address the weaknesses and challenges)
1. The teachers’ level of ICT competency is not fully proficient. They are on the basic level both in pedagogy and administration & organizational domain	-Advanced Level Seminar-Workshop on Pedagogy and Organization & Administration Domain
2. Teachers are only practicing basic usage of ICT in the teaching and learning process.	
3. The teachers’ level of ICT competency is slightly related to students’ performance in Physics	-Seminar-workshop on varied teaching methodologies using ICT that will enhance students’ performance
4. Lack of ICT-related seminars and trainings, lack of technical support, lack of time to plan and prepare lessons using ICT and unavailability of ICT tools and software like simulations, videos, and animations post challenging tasks related to ICT.	- Training on the use of ICT to create applications, and software - Workshop on develop an ICT based instructional material in Physics and other Sciences. - Exhibit of ICT-Based Instructional Material Output - Try-out ICT-Based Instructional Material made by the teachers - Sharing of the ICT-Based Instructional Material

Seminar-workshop on varied teaching methodologies involving active participation of the learners in the use of ICT will be conducted to expose the teachers to varied teaching methodologies on how to effectively integrate ICT in the pedagogy. These teaching methodologies will enable the teachers to be more innovative in utilizing ICT that will involve the active participation of the students. Experts in integrating ICT in the teaching and learning process will be the resource persons for this seminar-workshop. They will provide the teachers varied teaching methodologies on effective integration of ICT.

Training on the use of ICT to create applications, and software that can be used in the teaching and learning process will also be conducted such as creating web-based quizzes to assess their understanding online, providing them web-based activities that will enable the learners to explore the web, and let the students create their own web-based materials on certain topics.

Workshop on developing ICT based instructional materials, exhibit, try-out, and sharing of the ICT-based instructional materials will also be conducted to enable the teacher to create an ICT-based instructional material in Physics and other Sciences. To monitor the application of the trainings attended by the participants, school visitation, lock sessions, regular sessions (quarterly), sharing of outputs and a conduct of lesson study will be proposed.

This program will also provide experts who will deliver authentic trainings that will suggest and teach ICT-based activities that engage students' active participation in the teaching and learning process. These activities using ICT will include: (a) advanced use of power point presentation, simulations, caricature, and animations, (b) use of ICT facilities such as projector, computers, and white screen, (c) development of copy print out for teachers and students as effective reference, (d) incorporation of pedagogies in ICT, and (e) development of instructional materials for Physics and other Sciences. These activities will further enhance the ICT competency into an advanced level.

The desired result of the program is for the teachers to be able to deepen their skills in the use of ICT for them to be able to develop their own ICT-based instructional materials to be shared among the participants. They are also expected to conduct an echo-seminar in their respective school to disseminate the knowledge and skills they acquired in this enhancement program to help their colleagues enhance their ICT competency level.

5. Conclusion and Recommendation

Based on the study the following conclusions were drawn: (a) the teachers in the Division of Camarines Sur are proficient in the use of ICT; (b) the teachers perform innovative practices that includes the use of mobile phones, use of social media as learning interaction, they provide own internet connection, they are also providing guide questions to the students, and they exchange of ideas with professionals in the web; (c) the teachers' level of competency in the use of ICT is significantly related to the performance of students in Physics-8; (d) the teachers perceived that the use of ICT helps improve students' understanding of Science ideas, increases motivation,

stimulates interest, and facilitates the teaching and learning process however inadequate resources pose challenges to the teachers; and (5) an enhancement program that will enable the teachers to create ICT based instructional material that will further enhance their ICT competency is proposed.

Based from the findings and conclusions of the study, the following were recommended: (a) seminars, trainings and workshops related to ICT should be proposed to help the teachers enhance their ICT competency level; (b) teachers should be encouraged to run through advanced practices on the use of ICT in teaching Physics by exposing them to the different ICT-based methodologies. Advance practices like (i) using instructional materials that will allow students to interact or work on through the use of ICT, (ii) challenge students with online Physics problems, (iii) provide a URL in place of a quote where the student can reflect each day, (iv) utilize online work sheets, (v) keep the learning going on weekends with some stimulating online games related to Physics, and (vi) create online or social media group where the teacher can interact virtually with their students; (c) since the teachers' ICT competency level significantly affect the students' performance level in Physics, teachers should initiate to enhance their level of ICT competency to effectively use ICT in their teaching because it can also be noted that the teachers emphasized some gains and positive feedback when they are using ICT in their teaching; (d) the Division of Camarines Sur may allocate appropriate funds for ICT facilities, tools, and software that can be used to facilitate the teaching and learning process; (e) physics teachers may pursue self-directed learning in the use of ICT for instructional purposes; (f) similar study may be conducted to determine if the teachers' ICT competency level will affect the students' performance in the different field of Science and subjects; (g) further study may be conducted to correlate the teachers' ICT competency level to gender, age, and years in teaching.

Author's Note

The following references were used in the conduct of the study however, due to the limited number of words to be included in this format, some related studies and literature were not included but, in the whole paper these were cited.

Author's Note

I would like to extend my heartfelt gratitude to the Department of Science and Technology (DOST) and Science Education Institute (SEI) for creating the National Consortium

in Graduate Science and Mathematics Education (NCGSME) that provides scholarships, financial support, and for the continuous evaluation of the scholars' academic progress and the development and dissemination of this study. Likewise, I would like to thank Bicol University Graduate School (BUGS) for providing me the necessary skills to finish this study and to the Department of Education, Division of Camarines Sur for allowing me to conduct this study.

References

- [1] Department of Science and Technology- National Research Council of the Philippines retrieved from <http://www.nrcp.dost.gov.ph>
- [2] Hogarth, Sylvia. et. al. ICT in Science Teaching: The effect of ICT Teaching Activities in Science Lessons on Students' Understanding of Science Ideas, 2006.
- [3] DepEd Five Year Information and Communication Technology for Education Strategic Plan (DepEd ICT4E Strategic Plan)
- [4] Nacario, Charlie P., et. al., Readiness and Acceptability of Information and Communication Technology Integration in Basic Education, Asia Pacific Journal of Multidisciplinary Research, Vol 2, No 1, 2014.
- [5] Mateo J.L.R. (2008) Department of Education, Information and Communication Technology Competency Standards for Teachers. Retrieved from <http://www.fit-ed.org/congress2008/contents/MATEO/J%20Mateo%20Presentation%20-%20DepED%20ICT%20Competency%20Standards.pdf>
- [6] Chemwei, Bernard et. al., Assessment of Information and Communication Technology (ICT) Integration in Instruction in Teacher Education Institutions in Kenya, International Journal of Social Science and Humanities Vol. 3, No. 3, pp. 071- 076, March 2014.
- [7] Nacario, C. P. (2014). Lessons in Science and Technology in Integrating UNESCO ICT-Based Instructional Materials. Unpublished Master's Thesis, Bicol University, Legazpi City.
- [8] Lea, A. N. (2009). The Effect of the Use of Computer Simulation on the Students' Conceptual Understanding, Interests in and Attitudes Towards Chemistry. Unpublished Master's Thesis, Bicol University, Legazpi City.
- [9] Pura, K. R. (2012). Development of Lessons Integrating Computer Simulations and Virtual Labs: Effectiveness in Enhancing Physics Learning. Unpublished Master's Thesis, Bicol University, Legazpi City.

- [10] Formalejo, W. P. (2014). Virtual Chemistry Laboratory Mediated Learning in General Chemistry. Unpublished Master's Thesis, Bicol University, Legazpi City.
- [11] Garcia, P. A. (2013). Technology-mediated Lessons in Teaching Motion, Unpublished Master's Thesis, Bicol University, Legazpi City.
- [12] Shazia Mumtaz. Factors Affecting Teachers' Use of Information and Communications Technology: A Review of the Literature, United Kingdom ISSN: 0962-029X (Print) (Online) Journal homepage: <http://www.tandfonline.com/loi/rtp19>, Published online: 20 Dec 2006.

Web sources

- [13] Crisostomo, S. (2000). Filipino students still rate low in math, Science. Retrieved from <http://www.philstar.com/news-feature/>
- [14] National Achievement Test Result-Philippine Basic Education. Retrieve from <http://www.philippinesbasiceducation.us/2013/07/the-national-achievement-test-in.html>
- [15] Starr, L (2011). Integration Technology in the Classroom. Retrieved from http://www.educationworld.com/a_tech/tech/tech146.shtml
- [16] Framework for 21st Century Learning Retrieved from <http://www.p21.org/our-work/p21-framework>
- [17] Map of Camarines Sur. Retrieved from http://www.camarinessur.gov.ph/images/phy_char.jpg
- [18] Division Memorandum Series 2012-160. Retrieved from http://www.deped.gov.ph/sites/default/files/memo/2012/DM_s2012_160.pdf
- [19] National ICT Competency Standards for Teachers. Retrieve from <http://www.ncc.gov.ph/nics/files/NICS-Teachers.pdf>
- [20] DepEd K to 12 Curriculum Guide in Science – version January 18, 2013
- [21] DepEd Memorandum No. 160, s. 2012. DepED- National Education Testing and Research Center: Mastery Level Descriptive Equivalence.

Related studies

- [22] Clement, Che Kum et. al. (2011) Trends and Issues to Integrate ICT in Teaching Learning for the Future World of Education. International Journal of Engineering & Technology IJET-IJENS Vol: 11 No: 03 118603-0202 IJET-IJENS @ June 2011 IJENS.

- [23] Añonuevo, M. L.(2012). Science Teachers' Competence Based on National Teaching Standards. Unpublished Master's Thesis, Bicol University, Legazpi City.
- [24] Al-Zaidiyeen, Naser Jamil et. al., (2010) Teachers' Attitudes and Levels of Technology Use in Classrooms: The Case of Jordan Schools, *International Education Studies* Vol. 3, No. 2; May 2010.
- [25] Alazam, Abu-Obaidah et. al., (2012) Teachers' ICT Skills and ICT Integration in the Classroom: The Case of Vocational and Technical Teachers in Malaysia, *Creative Education* 2012. Vol.3, Supplement, 70-76 Published Online December 2012 in *SciRes* (<http://www.SciRP.org/journal/ce>).
- [26] Jamieson-Proctor, Romina M. et. al., ICT Integration and Teachers' Confidence in Using ICT for Teaching and Learning in Queensland State Schools, *Australian Journal of Educational Technology* 2006,22(4),511-530.
- [27] Añonuevo, A. B. (2013). Proposed Teacher Enhancement Training Program on the Use of ICT in Teaching and Learning. Unpublished Master's Thesis, Bicol University, Legazpi City.

Books

- [28] Asaad, A. S. & Hailaya W. M. (2004). *Measurement and Evaluation: Concept and Principles*. Malabon, Metro Manila: Kerusso Publishing House.
- [29] Guitierrez, D. S. (2007). *Assessment of Learning outcomes*. Malabon, Metro Manila: Kerusso Publishing House.
- [30] Lucas, M. R. and Corpuz, B. (2014). *Facilitating Learning: A Metacognitive Process*.
- [31] Cubao, Quezon City, Metro Manila: Lorimar Publishing, Inc.
- [32] Tabbada E. V. and Buendia M. M. (2015). *Educational Technology 1*. Cubao Quezon City, Manila: Adriana Publishing Co., Inc.