DEVELOPING AND APPLYING TPACK FOR A BLENDED LEARNING ENVIRONMENT: A RURAL HIGHER EDUCATION EXPERIENCE IN THE PHILIPPINES

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Abstract

This study presents the development and application of Technological Pedagogical and Content Knowledge (TPACK) for blended learning environment (BLE) to a university located in rural area of the Philippines with limited technological resources for online learning. Each element of TPACK model was used as a guide in the development of teaching plan for a blended learning environment. A randomized pretest and posttest quasi-experimental research design was used in this experiment to determine the significant difference on the posttest sores of the experimental and control group regarding their achievement test in Computer Fundamentals. Participants of the study consisted 90 freshmen Bachelor of Science in Information Technology students, 45 students each comprising the experimental and control group. An item-analyzed multiple-choice achievement test floated before and after the experiment. Result revealed that successful integration of technology in a technology-deprived university using TPACK model for BLE was evident. Regarding student learning, results revealed that both the experimental and control group slightly increased their mean score using the blended learning approach and traditional teaching inside the classroom. Hence, it is recommended to continuously focus on PCK to further improve the TPACK model for BLE for school in rural areas.

Keywords: TPACK, Blended Learning, ICT in rural setting, education

I. INTRODUCTION

Technology in education pours its strength not only to the process of teaching and learning but also to the continuous improvement of education. Unfortunately, rural areas of developing countries are always affected by technological advancement. Thus various ICT models are continuously developed by researchers to integrate technology to financially and technologically deprived places. Roy (2012) created a model for rural areas in India called "Model for ICT rural education" Rural Kiosk Machine (RKM) was installed in rural community center/school that served as a server of all information, which was accessed by the community (farmer and non-farmer), teacher and children in India.

The Same approach was used in the "Model for ICT Project Rural Pakistan" (Sattar, 2010). The RKM contained textual, audio and video information on agriculture, health and education. While Bass (2010) developed ICT Maturity Model, which was used in five public universities in Ethiopia. However, the latter still lacks an answer to

the problem on how poor students from developing countries would be able to cope with the rapid development of technological tools and devices applied inside the classroom.

The TPACK model of Mishra and Koehler in 2006 (Ronau, Rakes & Niess, 2012) based on Lee Shulman's pedagogical content knowledge (PCK) and enhanced by including technology (Koehler & Mishra, 2009) provide teachers a guide to effectively use technology in teaching integrating the three bodies of knowledge namely content, pedagogy and technology. The result of the study of Tokmak, Incikabi & Ozgelen (2013) served a concrete evidence of Koehler & Mishra's (2009) concept of the complexity and ill-structured nature of teaching in a particular subject, wherein, TPACK plays a major role in integrating technology into the teaching process.

The various academic institution still coping with the challenge of adapting education technologies here in the Philippines, Isabela State University located in the second largest province in the country regarding the land area having agriculture as staple industry continuously conducting research to adapt available education technologies in academic circa. However, the most challenging part of adapting technologies is finding accessible ways to integrate technologies in school with limited internet accessibility. Hence, a TPACK model for BLE customized for rural areas was developed by the author to assess the effectivity of the model.

Using the TPACK model, this study aimed to determine how effective the integration of technology in a technology-deprived university using TPACK model for BLE. This study also presented the development and application of Technological Pedagogical and Content Knowledge (TPACK) for blended learning environment (BLE) to a university located in rural area of the Philippines with limited technological resources for online learning.

II. METHODOLOGY

The author developed the TPACK for blended learning environment customized for a rural university.

2.1 Research Design

This study used a randomized pretest and posttest quasi-experimental research design. The participants were divided into two groups: experimental group and control group. The experimental group was taught using TPACK blended learning approach while the control group was taught using the traditional method of teaching. The traditional pedagogy in teaching inside the classroom was applied to both groups, which includes all classroom activities used in the study. A pretest and posttest achievement test was given to both groups. One section of the class was equally divided into two.

2.2 Research Locale

TPACK experiment was conducted at the Isabela State University (ISU) San Mateo campus, the smallest campus in the ISU system. The campus was selected to be the locale of the pilot testing of TPACK because of its distance and accessibility to internet and inadequacies of educational technologies used by the students.

2.3 Participants

The participants were selected using simple random sampling. Ninety (90) 1st year Bachelor of Science in Information Technology students enrolled in *Computer Fundamental*, forty-five (45) students each comprising the experimental and control group.

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2.4 Data Gathering

To establish the homogeneity of the two groups, the Prelim Grade in Computer Fundamental was subjected to a t-test. Both the subjects in the experimental and control group do not significantly differ in their mean Prelim grade, which implies that the two groups have the same entry skill in Computer Fundamental before the conduct of the experiment (see Table 1).

Table 1. Mean Score of Prelim Grade of the Experimental and Control Group

Group	Mean	Mean Difference
Experimental	81.78	0.485
Control	81.29	Remark
p-value	0.497	Not Significant

Prelim Grade of both experimental and control group was gathered before the conduct of the experiment to establish the homogeneity of the group. Before the conduct of the study, a pre-achievement test was floated to both experimental and control group as well as the problem-solving skills pre-test. Same achievement test and problem-solving skills survey questionnaire were floated to the participants to gather the posttest result of the study.

2.5 Instrumentation

Two instruments were used in attaining the objectives of the study. The TPACK model developed for BLE designed in rural area school (Table 2) and an item-analyzed multiple-choice achievement test in Computer Fundamental were used. Data from the multiple-choice achieve test were analyzed with SPSS statistical package (16.0 version). Results are expressed as mean, standard deviation (SD) and p-value. A t-test for independent means was used to determine the significant difference between the pretest and posttest result of the data gathered.

Each element of TPACK, which include content knowledge (CK), pedagogical knowledge (PK), Content Pedagogical Knowledge (CPK), technological knowledge (TK), technological content knowledge (TCK) and technological pedagogical knowledge (TPK) was analyzed to derive questions needed for teaching plan in a blended learning environment IN which then applied in the TPACK experiment for the course Computer Fundamental.

2.6 *Execution of Teaching Plan using TPACK*

Each research questions from Table 1 were answered to develop the TPACK and apply it in a blended learning environment.

2.6.1 CK – Content Knowledge

The course content of this study focuses on the foundation of information technology. It is composed of eight (8) chapters namely: (1) introduction to information technology; (2) hardware of personal computer; (3) computer software; (4) operating system; (5) data processing; (6) information system; (7) introduction to internet technologies; and (8) technology and the society.

Courses are discussed based on the real application of its concept to the evolution and continuous change of technology, compare and contrast the value of primitive information technology to the current information technology and its effect on the ever-changing world of technology to the society.

2.6.2 PK – Pedagogical Knowledge

As the initial step in planning the pedagogical knowledge, the first level which is composed of socio-economic status assessment shows that majority of the parents are elementary and high school graduate while only one finished college education. Furthermore, the majority of

parents' occupation is farming and belongs to low-income earners.

Regarding technological skills using gathered demographic profile, results reveal that participants from the experimental group show that 34 out of 45 has no email address, 35 out of 45 do not know how to upload files, 34 out of 45 do not know how to download files. The average frequency internet usage of participants from the experimental group is 2 hours per week and 35 out of 45 access internet from internet café', two access it at home while eight do not access the internet.

Using the socio-economic status and technological skills of participants as well as the status of the campus with no internet connection, online learning environment of the experiment was accessed from internet café 5 kilometers away from the campus.

2.6.3. PCK – Pedagogical Content Knowledge

Lectures were posted online, and course concept was integrated during face-to-face learning. Classic and local novelty game in the Philippines such as Pinoy henyo (Filipino Genius Game), short drama presentation, word hunt using scrambled cut-out letters and concept mapping were used inside the class. A short quiz was given to further assess the learning from the topic.

2.6.4. Technology Knowledge

The technological knowledge level of the students was assessed using a demographic profile instruments that are composed of a socio-economic and technological profile. The socio-economic profile was used to determine the capacity of the student to access and own a computer while technological profile was used to assess their technical know-how in using the basic features and functions of the internet.

The demographic profile result was used as a basis for developing ways to teach students how to learn the basic features of the internet. Since the campus and students have limited access to internet technology, lecture guides were distributed after the demonstration teaching about using the internet, creating emails and steps on uploading/downloading files and registration to online learning. Creation of email and registration to online learning website was given as an assignment and instructed the students to access the internet from internet café.

2.6.5. Technological Content Knowledge

Participants in this study have limited exposure on online learning tool. Thus, basic features of customized online learning were integrated, which include viewing lectures, uploading of assignments and self-assessment quiz. The online learning tool was developed and customized by the researcher based on the features of social networking sites wherein an email address was required to register in the database of the website.

This functionality intentionally taught the student to learn how to use email and appreciate the importance of email in online communication. The uploading feature of online learning tool also replicated the email's uploading/downloading feature that also helped the students to be familiarized on the most important function of teaching and learning process online. Students online activities were monitored using the database of the online learning tool.

2.6.6. Technological Pedagogical Knowledge

The technological pedagogical knowledge (TPK) composed of for phases that include technical skills, course content and learning outcome, customized online learning tool, and technical and financial accessibility. The result of PK and TK were used in the development process of TPK.

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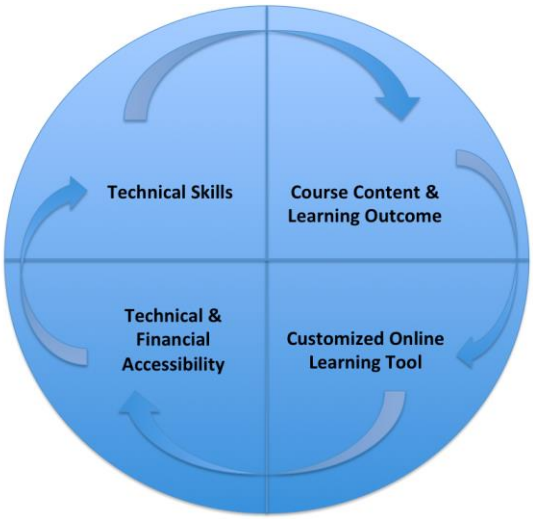

Figure 2. Development Process of TPK

III. RESULTS AND DISCUSSIONS

As shown in Table 3, results revealed that both experimental and control group slightly increased their mean score using the blended learning approach and traditional teaching and learning in the classroom. However, with the computed t-test value of 1.590 having an associated probability value of 0.115, the result implies that there is no significant difference between the experimental and control group after the experiment as compared to the control group exposed to the traditional approach of teaching. Further analysis showed that the technological knowledge of participants before the implementation of TPACK greatly affects their performance..

As said by Abelle (1973), "Instructional technology may be viewed as the whole range of communications media available to supplement the traditional approach to the teaching-learning process" (p.610). Instructional technology (IT) was also defined by Seels and Richey (1994) as "the theory and practice of the design, development, utilization, management and evaluation of processes and resources for learning"(p.1). In 2000, Fardanesh uttered a simplified definition and referred instructional technology as "the knowledge of skillful execution of instruction" (p.3). According to Smaldino, Russell, Heinich, and Molenda (2005), "An instructional system consists of a set of interrelated components that work together, efficiently and reliably, within a particular framework to provide learning activities necessary to accomplish a learning goal" (p.21). In this study, the term instructional technology refers to both traditional (not electronic) and modern (electronic) technologies which organize instruction to provide a strong foundation for an efficient learning experience and to deliver information in a well-structured manner to endure learning.

According to Lusty (1969), educational technology derived just after educators realized the need for solutions for 'here-and-now problems' rather than seeking for the perfect method of all for teaching. In Özhelvacı's (2003) view, an effective teaching lies beneath addressing to all five sense organs of the students. The more the teacher manages to address students' senses the better learning occurs. Therefore the key to this success is the instructional technology. According to İşman (2002), technology contributes to education by fostering faster distribution of information,

Table 3. Pre and Post Achievement Test Scores of the Experimental and Control Group

Group	Pre-Test				Post – Test				
	Mean	SD	Computed t-Test	p-value	Mean	SD	Computed t-Test	p-value	Remarks
Experimental	19.18	4.141	0.293	0.770	22.78	4.306	1.590	0.115	Not Significant
Control	18.93	3.774			21.31	4.446			

providing individual learning situations, promoting permanent learning, representing a ground for project works and giving an opportunity for global education.

Although blended learning can be an advantage in the delivery of teaching and learning processes, still the technological and literacy skills need to be considered before implementing and integrating technology as a teaching tool most especially in rural areas.

The study aimed to address the long-time discussed the issue in the integration of technology in a university located in rural areas with lack of technological resources by using TPACK. The students' learning was also measured to determine if there will be a significant different between the pretest and posttest of experimental and control group after the implementation of TPACK experiment. The findings of Learning Networks in Norway 2004-2009 (Nore, Engelien & Johannesen (2010) in using TPACK model supported the findings of the study, regarding smooth development and implementation of blended learning in a technology-deprived university located in rural areas of the Philippines. The authors emphasized that the active involvement of the school administration, students, parents, and community will have a successful implementation of ICT. The scope of content knowledge (CK) guides the development of suited online learning tool. On the other hand, the assessment of the socio-economic and technological status of the participants in the experiment as well as the assessment of learning environment as the main task of pedagogical knowledge (PK) provided the researcher a clear view of the appropriate teaching methodology and approach to teaching the students.

As a result of PK assessment, the pedagogical content knowledge (PCK) was able to combine online learning concepts and successfully integrate classroom learning activities which students became active and collaborative learners in all learning activities. Due to traditional classroom activities integrated into the TPACK, the students' prior knowledge became a driving force to enhance their skills by using online learning technologies. Using the PK assessment regarding technological skills of students, the development of technology knowledge (TK) was carefully analyzed to ensure that no students would be left behind upon the implementation of an online learning tool.

The learning modules provided to the students during the online learning orientation promoted self-paced learning while the students are accessing the online learning tool from internet cafés. Furthermore, technological content knowledge (TCK) successfully attained the objective of TPACK model, it did not only teach the course content, but the students learn more than the course by realizing the importance of technology integration in learning the course (Koehler & Mishra, 2009). The results of PK and TK were able to produce technological pedagogical knowledge (TPK) development process provided a valuable approach in executing the TPACK teaching plan.

Although TPACK had shown successful implementation of blended learning in a school located in a rural area with lack of technological resources. Result revealed that both the experimental and control group slightly increased their mean score using TPACK blended learning and traditional approach to teaching. Furthermore, the result implies that there is no significant difference between the experimental and control group after the TPACK experiment as compared to the control group exposed to the traditional approach of teaching.

The equal level of achievement of both groups conforms to the findings of Maag (2004) and Stanley (2006) that integrating online quiz to the experimental

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group have no significant difference from those who are doing assignments at home and taking quizzes inside the classroom. Findings also confirm the findings of Odell, Abitt, Amos and Davis (1999) that online course has an equal learning outcome as compared to traditional course as a result of post-test scores on a multiple-choice test while McNamara et al. (2008) also argued that purely face-to-face instruction and blended learning as well as fully online learning approaches have no significant effect on student learning outcome. Hence, this study opens further research on the improvement of the students' learning using technology by applying TPACK model for BLE customized for school in the rural area.

Teachers that used technology frequently reported that the traditional technologies mostly provided good control over English Language teaching and improved vocabulary development and that the modern technologies provided the interactive environment and improved English skills, while both types of technology increased the motivation of students. However, even in the absence of TPACK still, the academic performance of the students would increase. This concludes that technology use in language classes are effective but the use of traditional teaching methodologies and approached should not be left behind.

IV. CONCLUSIONS

Using TPACK model in a technologically deprived educational setting resulted into improved but similar student performance exposed to traditional instruction. The TPACK model however exposed the students to another form of learning, a blended approach using ICT which improved students ICT skills. Proven in many literatures (Mores, 2010; Lumadi, 2013; Almasaeid, 2014), use of blended-learning or technologically-enhanced instruction improves significantly students' performance. Therefore, schools need to prioritize procurement or provision of ICT infrastructure for optimal effect to students' performance.

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APPENDIX

Elements	Questions
CK	What is the coverage of the course? What is the applicability of the course based on the level of the student?
PK	What is the socio-economic profile of the students? Who are involved in the implementation of blended learning? What is the status of the learning environment? What is the applicable teaching strategy to the student and existing learning environment? What is the expected learning outcome of the course? How will learning be assessed?
PCK	What is the applicable educational software suited to the student? What are the types of activities that will be used to achieve the learning outcome? How will technology and course content be merged inside the classroom?
TK	What is the technological knowledge level of the student? How will the student learn the educational software that will be used in the course? How do students value the importance of information technology in the learning process?
TCK	What are the appropriate features of the online learning technology suited in achieving the learning outcome? How will the learner be monitored using the online learning technology? How did the technology influence the course content and vice-versa?
TPK	How will online learning technology be used in a technology-deprived school? What is the impact of online learning technology to the students inside and outside the classroom?