

TPACK of Basic Education Teachers: Basis for Extension Program Development

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Abstract — Basic education across globe is rapidly changing in many ways especially the availability and easy way to access to digital information and communication technologies. Yet, basic education teachers and their predominant classroom practices rather remained traditional which seamlessly remained content focused, teachers’ directed, didactic instruction focused on content delivery, and rule-centered of the pedagogy. Thus, this study aimed to determine the Technological Pedagogical and Content Knowledge of Basic Education Teachers of Katipunan, Zamboanga del Norte. The mixed quantitative and qualitative method of research was used with the aid of the survey questionnaires. Findings revealed that most of the teachers were acquainted in the TCK, TPK and TPACK. They were technologically inclined and were familiar with incorporating technology in instruction and in their school-related jobs. However, the availability of ICT laboratories, electricity, internet access and gadgets were so limited and became the major hindrances in associating technology in their classes. There were few teachers who were also illiterate in operating technology making them hesitant in using it. Hence, as partner institution, JRMSU-Katipunan Campus through the College of Education will conduct programs (seminar, workshop related to TPACK) to teachers. Government may provide sufficient computer laboratories, allocate adequate budget relative to technological advancement and must formulate teachers’ development program geared towards acquiring relevant technological pedagogical content knowledge and skills.

Keywords — *TPACK, Basic Education, Technology, Educational System, ICT*

I. Introduction

The educational change brought about by technology, economic, and cultural forces in the early twenty first century was speedily transforming the educational system globally. These changes were substantially pronounced in the developed nations but their effect was also apparent in the developing countries like the Philippines. Basic education across the world is rapidly changing in many ways especially the availability and easy way to access to digital information and communication technologies. However, basic education teachers and their predominant classroom practices rather remained traditional in this era of rapid change which seamlessly remained content focused, teachers’ directed, didactic instruction focused on content delivery, and rule-centered of the pedagogy.

Hans and Akhter (2016) cited by Galleto et. al (2018) asserted that teachers entering the educational workforce consistently reported minimal preparatory experiences without technological integrated lessons or formal digital literacy development in educational setting. They

further pointed out that, since teachers tend to teach as they were taught, the instructional workforces were reasonably not prepared to meet the increasingly digital demands of the twenty first century knowledge landscape. It was identified that these workforces were not able to meet the digital skill expectations of prospective employers and students as well. In this connection, the curriculum, teaching methodologies, tools and materials, teachers, students, and the school community all need to evolve and change to meet the demands of today's world, in which technology is undeniably important, (Simmons 2021). Hence, Handal et al. (2013) cited by Galleto et al. (2018) stressed that teachers' integration of technological skills into teaching and learning needs to be appraised.

Accordingly, upholding high-quality teaching standards in schools is important to ensuring that students are exposed to a curriculum that takes into account instructional affordances brought by novel technologies (Cavanagh et al. in Handal et al., 2013 cited by Galleto et al. 2018) and identifying current teachers' information and communication technology learning and teaching skills has strategic value for planning professional development programs at both the school and systemic level (Handal et al., 2013 as cited by Galleto et al. 2018). Hans and Akhter (2016) added that pupils today are no longer the target audience what educational system was designed to teach but internet instant messaging, video games, video conferencing and networking formed a substantial part of the native language of digital natives or net generation. Integrating Technology in the learning process is very important in today's digital era so that educators do not only have a component of content and pedagogical knowledge but also be have to be supported by the ability to integrate both components with technology, (Agustin, R. R., liliyasi, S., Sinaga, P., & Rochintaniawati, D. 2019). Moreover, traditional education system barely engaged the minds and aptitude of digital natives in the twenty-first century classrooms.

Given the rapid technological advances, this study is seen as critical to assist basic education teachers of Katipunan, Zamboanga del Norte and policy makers in basic education of the Department of Education and other concerned agencies. The study examined the nature of technological pedagogical content knowledge (TPCK) of basic education teachers. Goos and Bennison (2008) supported that investigating teachers' skills with respect to the use of technology for learning and teaching are crucial. In the end, the study expects to formulate teachers' development program geared towards acquiring relevant technological pedagogical content knowledge and skills. Saravanakumar AR, Paavizhi, K., and Palanisamy, P., (2019), said there may be a need for Instructors and an institutional level, to select and clarify work truths where technology and skills interact while understanding and communicating how technological resources and strategies can engage students and improve student learning.

The study is designed to explore the technological pedagogical and content knowledge (TPACK) among basic education teachers of Katipunan, Zamboanga del Norte. More specifically, the study seeks to address the following research questions:

1. What is the nature of the basic education teachers’

1.1 Technological Content Knowledge;

1.2 Technological Pedagogical Knowledge; and

1.3 Technological Pedagogical Content Knowledge?

2. How do the schools’ instructional, curricular, and organizational factors affect the integration of content, pedagogy and technology in basic education in the context of the TPACK model?

Literature Review

The knowledge needed for teachers to use technology strategically in basic education instruction is a topic that has recently gained much attention (Mishra & Koehler, 2006). TPACK, described by Mishra and Koehler (2006), “represents a thoughtful interweaving of all three key sources of knowledge, namely: technology, pedagogy, and content.” The TPACK framework describes good teaching with technology by including the components of content, pedagogy, and technology. Shulman’s (1986) idea of pedagogical content knowledge (PCK) is the basis for this framework with the inclusion of the domain of educational technology. Technological pedagogical content knowledge (TPACK) provides a useful framework for understanding teacher perceptions and practices of technology integration into curriculum and pedagogy. To integrate technology into their pedagogy and curriculum successfully, teachers must develop confidence in their abilities to integrate technology in the classroom because the integration of technology affects how students learn in the classroom.

TPACK for teaching with technology means that teachers should know how particular concept might be taught with technology so that students understand the concept (Niess, 2005). After Mishra and Koehler (2006) introduced their TPACK model, the framework has been widely adopted for the planning of teacher information and communication technology (ICT) education (Cox & Graham, 2009) and used as a theoretical underpinning for the development of surveys to measure teachers’ TPACK. In terms of measurement, all of the instruments were focused on teachers’ self-report and their perception on use of technology. Also, conducting research about development and measuring of TPACK is an important and hard challenge. Since TPACK is a complicated construct and comprises many components, measuring the effectiveness of TPACK depends on the relationships of these components with each other (Koehler et al., 2011).

As a result of the complexity of TPACK, getting reliable and valid results after assessing the TPACK is an important process. Researchers encounter some problems while they are

measuring the TPACK of teachers. They face different problems in each different measurement tool of TPACK. Two main problems occurring during the measurement process are understanding the effects of teachers' domain knowledge on their current teaching practices and reliability, validity concerns of TPACK measurement methods (Abbitt, 2011). So, researchers try different methods to measure TPACK because of its dynamic characteristic. The definition of TPACK concept looks like settled but it continues to be studied. Hence, most of the studies focused on the definition of TPACK and developing instruments to measure it (Koh, Chai, & Tsai, 2010). Moreover, many TPACK studies are conducted with pre-service teachers. Similarly, to a general trend in TPACK studies in international arena, most of the studies focused on adapting surveys or developing new ones to measure TPACK (Yurdakul et al., 2012).

It is for this reason that this study is going to be conducted to determine the technological pedagogical content knowledge among the basic education teachers in Katipunan, Zamboanga del Norte. In so doing, the proponent of the study could craft possible recommendations as basis to aligning TPACK among the basic education teachers of the area with their technologically literate pupils and students.

II. Methodology

This study employed the quantitative and qualitative mixed method of research. Survey method of quantitative research with the aid of a questionnaire checklist was used to find out the nature and magnitude of the basic education teachers' technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge. Written interview was also conducted to provide qualitative data to qualify the link of the schools' instructional, curricular, and organizational factors to the integration of content, pedagogy, and technology in teaching in the context of the TPCK model. The study involved the basic education teachers in Katipunan, Zamboanga del Norte. The questionnaire of the study consists of two parts. The first section involves three scales, namely TCK, TPK, and TPCK, comprising a total of 30 items. The second section involves open-ended responses on the factors (instructional, curricular, and organizational) to capture qualitative information about why basic education teachers might find difficulty enacting their TPCK skills in the classroom. Frequency count and percent was used to quantify the teachers' technological content knowledge, technological pedagogical knowledge, and technological pedagogical content knowledge. Percent was calculated by getting the frequency of each category divided by the total number of cases.

III. Results and Discussion

The findings from the survey analysis are presented in this section. Majority of the respondents obtained the highest frequency of 178 and it is within the indicator of “I can connect with other colleagues and professional associations through online forums, Facebook, etc”. In Technological Content Knowledge, the least frequency obtained is 60 within the indicator “I can create own newsgroup, blog, or discussion site on the internet. The indicator, “I can compute grades using the spreadsheets.” ranked second which gained a frequency of 174. On the other hand, “TCK indicator, “I can use program that relates to my lessons.” got 3rd rank which garnered 153 respondents who are literate in operating programs that helped them making their lesson plans. The frequency of the indicator, “I can create a multimedia presentation (e.g., PowerPoint) is 127 which places on the fourth rank. Looking further on table, 5th in rank is the indicator “I can create charts/graphs using spreadsheets”, which gained a frequency of 126 meaning the basic education teachers are most likely literate in doing school works in the multi-media.

Moreover, the “I can create a spreadsheet, graph, or chart (e.g., Excel) indicator”, is rated the respondents as ranked 6 which has a frequency of 125. Out of the 217 respondents 100 of them believed that they can use a simulation to model a real-life situation or set of data as shown on the table and it is ranked 7th. The 96 respondents said that they know how to use programs like illustrator as shown on the indicator “I can create a piece of art using application (e.g., Photoshop, Illustrator) which gained a frequency of 96 which is rank 8. Ninth in rank has the frequency of 89 falls under the indicator “I can make a publication, like a newspaper, using a desktop publishing program (e.g., PageMaker, Word). This implies that basic education teachers of Katipunan Zamboanga del Norte are literate in the TCK. A wide range of technologies were used appropriately by the teachers particularly in making their school-related jobs, but on the hand, they still need some mastery of the operations of the technology advancement specially in creating newsgroup, blog, or discussion site on the internet.

Table 1

The Technological Content Knowledge of the Basic Education Teachers of Katipunan Zamboanga del Norte.

	Technological Content Knowledge	Percentage (N=217)	Rank
1	I can create a multimedia presentation (e.g., PowerPoint)	58.5%	4th
2	I can make a publication, like a newspaper, using a desktop publishing program (e.g., PageMaker, Word)	41.1%	9th
3	I can create own newsgroup, blog, or discussion site on the internet	27.6%	10th
4	I can create a piece of art using application (e.g., Photoshop, Illustrator)	44.2%	8th
5	I can compute grades using the spreadsheets.	80.1%	2nd
6	I can create a spreadsheet, graph, or chart (e.g., Excel)	57.6%	6th
7	I can connect with other colleagues and professional associations through online forums, Facebook, etc.	82.0%	1st
8	I can create charts/graphs using spreadsheets	58.0%	5th
9	I can use a simulation to model a real-life situation or set of data	46.0%	7th
10	I can use program that relates to my lessons.	70.5%	3rd

Table 2 shows Technological Pedagogical Knowledge of the basic education teachers of Katipuna Zamboaga del Norte. As presented that most of the respondents got the maximum frequency of 195 falls under the indicator “I can guide students in creating their own multimedia presentations.” On the other hand, the lowest frequency as shown in the table is gained by the indicator “I can use technology to appraise educational websites and software for usefulness and quality.” Second in the rank in the TPK is the indicator “I can use mobile devices (e.g. iPad, smartphone) in teaching.” Which has a frequency of 189. Going on the table also revealed that the indicator “I can use technology to develop students’ research skills.” gained a frequency of 187 which rank 3rd. Fourth in rank is the indicator, “I can teach a concept using an interactive whiteboard”, which has a frequency of 186. Fifth in rank in TPK is under the indicator “I can use technology to provide students with alternative forms of assessment.” which got a frequency of 185. Other respondents also said that they can engage students in collaborative learning through wikis, and it obtained a frequency of 182 and placed on the 6th rank. Further, the table shows that respondents use technology to engage students in critically analyzing online texts or images. for it has a frequency of 181 and it is rank 7th.

However, out of 217 respondents 179 of them attested that they can deal with cyberbullying and cybersafety issues. Teacher are known to be resourceful and flexible that’s why in the indicator “I can create a WebQuest to deliver a curriculum unit” is ranked 9 which rated by the 167

respondents. The result denotes that Basic Education Teachers used technologies to deliver their lessons, but they still have to upgrade their knowledge in technologies and pedagogies to help improve the students learning. Although they are literate in integrating technology in pedagogy but still, they need to rethink innovative ways of using technologies to customize pedagogical purpose.

Table 2

The Technological Pedagogical Knowledge of the Basic Education Teachers of Katipunan Zamboanga del Norte

	Technological Pedagogical Knowledge	Percentage (N=217)	Rank
1	I can use technology to develop students' research skills.	86.1%	3 rd
2	I can teach a concept using an interactive whiteboard.	85.7%	4 th
3	I can create a WebQuest to deliver a curriculum unit.	85.2%	9 th
4	I can use mobile devices (e.g. iPad, smartphone) in teaching.	87.0%	2 nd
5	I can engage students in collaborative learning through wikis.	83.87%	6 th
6	I can guide students in creating their own multimedia presentations.	89.86%	1 st
7	I can deal with cyberbullying and cybersafety issues.	82.48%	8 th
8	I can use technology to provide students with alternative forms of assessment.	76.95%	5 th
9	I can use technology to engage students in critically analyzing online texts or images.	83.41%	7 th
10	I can use technology to appraise educational websites and software for usefulness and quality.	73.27%	10 th

Table 3 presents the Technological Pedagogical and Content Knowledge of the basic education teachers of Katipunan Zamboanga del Norte. It is shown that majority of the respondents obtained the highest frequency of 208 and it is within the indicator of “I assist students to enhance and develop their multiple intelligences”. It is seen also that the indicator “I demonstrate lessons through learning objects (e.g., animations, simulations, online applications)” got the least frequency gained which is 148. On the other hand, the indicator “ I elaborate and present lessons in a varied way.” is second in rank with a frequency of 205 followed with the indicator “ I integrate lessons with other Key Learning Areas (e.g., English, Arts, Science, History, etc.)” having the frequency of 204 and placed on the 3rd rank then next is the indicator “ I promote substantive student communication in variety of lessons (e.g., class discussion on multiple methods in acquiring learnings)” gaining a frequency of 193 falls on 4th rank.

Moreover, the indicator “I incorporate authentic tasks in the learning of lessons” is rank 5 having a frequency of 187 and followed by the indicator “I collect, analyze and interpret data to make informed judgements.” placed on the 6th rank obtaining a frequency of 167. The indicator of

TPACK which is “I supplement students’ learning through digital tools (e.g., audio/video, recording, etc.)” is placed on 7th rank having the frequency of 163 and followed by the indicator “I identify trends and patterns to predict possibilities.” with a frequency of 160 which garnered the 8th rank and lastly the indicator “I engage students in collaborative group activities through aid of ICT.” Is 9th in rank having the frequency of 159. It implies that Basic Education Teachers demonstrated on how a particular technology enhances their teaching and learning and they are literate looking for varied ways in using technology in all aspects that will suit to the context and its purpose.

Table 3

The Technological Pedagogical Content Knowledge of the Basic Education Teachers of Katipunan Zamboanga del Norte

	Technological Pedagogical Content Knowledge	Percentage (N=217)	Rank
1	I supplement students’ learning through digital tools (e.g., audio/video, recording, etc.)	75.11%	7 th
2	I collect, analyze and interpret data to make informed judgements.	76.95%	6 th
3	I identify trends and patterns to predict possibilities.	73.73%	8 th
4	I elaborate and present lessons in a varied way.	94.47%	2 nd
5	I integrate lessons with other Key Learning Areas (e.g., English, Arts, Science, History, etc.)	94.0%	3 rd
6	I assist students to enhance and develop their multiple intelligences	95.85%	1 st
7	I demonstrate lessons through learning objects (e.g., animations, simulations, online applications)	68.20%	10 th
8	I incorporate authentic tasks in the learning of lessons	86.17%	5 th
9	I promote substantive student communication in variety of lessons (e.g., class discussion on multiple methods in acquiring learnings)	88.94%	4 th
10	I engage students in collaborative group activities through aid of ICT.	89.86%	9 th

Table 4

Significant Difference among TCK, TPK and TPACK

Source of Variation	Ss	df	MS	F	p-level	F crit
Between Groups	20, 536.22	2	10, 268.11	13.59	0.00011	3.40283
Within Groups	18, 135.78	24	755.66			
Total	38,672	26				

* *significant*

The F-computed value of 13.59 exceeded the F-Critical Value of 3.40283 which leads to the rejection of the null hypothesis. This implies that there is a significant difference among TCK, TPK and TPACK of the Basic Education Teachers of Katipunan Zamboanga del Norte.

The respondents were interviewed and the consolidated answers are presented as follows:

There were several instructional difficulties associated with teaching and learning issues emerging from integrating content, technology, and pedagogy in the classroom. In the rise of modernization, several applications came to surface to suffice the need of convenience. However, although these have been introduced to us for many years, over and over again, teachers find it difficult to directly integrate it to their daily lessons. In fact, the respondents of the study enumerated various deterrents to begin with. The use of excel, PowerPoint and the like became a trend in almost all professional teaching areas.

However, there were respondents mentioned that one of their difficulties in assimilating these means is their lack of knowledge in operating and using these applications. Also, video presentation, pictures, and the use of multimedia presentation is regulated, because of the lack of gadgets and internet connection as well. There were areas wherein internet connectivity is perhaps limited or deteriorating, it hinders teachers to integrate what is sought in the digital world. Editing charts, inputting mathematical signs, and explaining concepts, are hindrances as they stepped into the course of pedagogical approach through the use of technology. It is undeniable that modernization has paved its way to us in a most vast way. However, there were respondent finds this pragmatic, and said that exposure to gadgets of these students during class hours can actually hinder their holistic development, and more often than not they are prone to damages.

True enough that technology teaches us to be creative and resourceful. It offers various alternatives and initiatives. However, with all these being available at our seats, we tend to not exercise our literacy to it. There were actually respondents who conceded to the fact that they were not computer literate, and have lacked knowledge on utilizing it. In fact, they find it difficult to integrate ICT to all subject areas, and admits that teachers are not well equipped to handle this advancement. Many researchers are not aware of freely available online tools and guides (Magulod et al., 2020). It is a sad commentary to hear that despite of the millions of budgets allocated to improve the educational system we have at present, there are still areas where materials

such as computer and internet connectivity are lacking. Even if there are any, these would not cater the growing number of students we have today. Teachers also identified that there is indeed difficulty also in transferring this lore to the students, because they are not familiar to it and are not exposed to these advancements we have at present. However, few educators attempt their way in integrating technology in their class discussions. There were able to integrate technology in their water cycle discussions. Physical education and folkdances were also introduced through this means. Prepositional phrases and identifying action words are also discussed by means of applications available in the internet and computers.

This study unveils that there is an urgent need to address the lack of facilities, internet connection, materials, and more importantly trainings that will enable our educators to effectively transmit inputs to the students with the use of technology. In the survey conducted earlier this year, there were few teachers who admitted having no knowledge about the manipulation of computers, projectors and applications that are made available for their convenience. Yet, there were respondents who find difficulty in using pf Photoshop and illustrator. On the other hand, there were respondents that have mentioned that internet connectivity is one of hindrances in their attempt to integrate technology in their daily discussions. Despite the continuous development of technology, in far flung areas where electricity is not supplied, this integration would not be realized. Respondents also conceded that there is no electricity in their area, and that hinders their will to adapt the simulation of technology to their teaching approach. Lacks of facilities have drastically affected also this integration. In fact, respondents said that there are indeed inadequate classroom and facilities. However, in this study, there were respondents who declared of their willingness to use their own resources in order to have an interactive discussion among their students.

On the other hand, there were also curricular issues concerning the way ICT was articulated in the classroom. The technological knowledge acquired by the teachers in Katipunan, Zamboanga del Norte was unsurprisingly abundant. It was found out that most of the respondents, are well-acquainted with the use of various applications offered by the advancement of technology, along with the utilization and manipulation of the computers and other gadgets. These relatively high numbers perceived that they do not find any rigors in integrating this lore to their students. However, it was also discovered that out of these respondents, there were also who are not able to operate computers, projectors, and some other advanced teaching materials that could make their discussion convenient. Also, few of them mentioned of not having personal computers to enable them in introducing this technological elevation. Respondents also find difficulties in integrating technology to their daily discussion because of the unavailability of the internet connection, perhaps little of them blatantly assert that connectivity plays vital role in presenting this technological knowledge to their students. Computer laboratories are not also available in their respective schools, in fact, few of them answered that availability of ICT laboratories is one of the hindrances in associating technology to their classes. Technology give rise to different application inventors, these applications were useful into our daily lives, especially to ease the burden of a

teacher. However, the study has shown that there were also teachers who find it difficult in using applications such as photoshop, excel, word, and spreadsheet.

And more importantly, disheartening it may sound, whilst there is willingness to learn regarding these technological advancements, one of the respondents believed how interactive it would be assimilating these modern interventions, still in a far-flung area where there is not electricity provided, these initiatives will not be realized.

IV. Conclusion

This research examined the TPACK of the Basic Education Teachers of Katipunan Zamboanga del Norte. Findings revealed that majority of the respondents were familiar in the Technological Content Knowledge, Technological Pedagogical Knowledge and Technological Pedagogical Content Knowledge. Thus, they were computer literate and are technology enthusiasts, they have the knowledge on the proper selection and utilization of technologies into their classes. Suitable strategies and methods in integrating technologies in their school-related jobs and in delivering lessons were applied by the teachers. However, most of the respondents answered that availability of ICT laboratories is one of the major burdens in associating technology to their classes. Electricity, Internet Access and gadgets are so limited in their places. There were lacks of government support in the concept of technology integration. There were few teachers who are also illiterate in operating the latest technology making them reluctant in using it.

In this sense, government may provide sufficient computer laboratories, allocate adequate budget relative to technological advancement and must formulate teachers' development program geared towards acquiring relevant technological pedagogical content knowledge and skills. Teachers must advice to go on multiple professional developments on TPACK and recognize the benefits of TPACK in teaching and should have to adapt TPACK model in their classes to enhance, improve and upgrade instruction.

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