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Technological Pedagogical Content Knowledge: It's Familiarity, Utilization, and Acceptance to Elementary Mathematics Teachers

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Abstract:- The purpose of this study is to determine how the utilization of ICT-based tools enhances the skills of teachers, particularly in the context of pedagogy. The quantitative descriptive-correlation research design with cluster sampling was employed to satisfy the objectives of the study. The Pearson Correlation and Likert scale were employed to determine the level of Technology Acceptance and Technological Pedagogical Content Knowledge of Elementary Mathematics teachers. From the quantitative analysis of the data, findings showed that the popular software choices among Elementary Mathematics teachers across various categories are H5P for authoring softwares, while EndNote is the preferred reference management tool. Microsoft Office (Word) for desktop publishing, Video LAN Client for tutorial software, Kahoot 360 for educational games and zoom for video conferencing software. Elementary Mathematics teachers have a predominantly very low mean level of utilization for various software applications across different categories. It was also revealed that the level of elementary Mathematics teachers in Technology Acceptance of ICT usefulness is strongly acceptable. Furthermore, the level of Technology Acceptance of Ease of use disclosed that the respondents express an acceptance of its Ease of use in ICT utilization. Meanwhile, the overall level of Technological Pedagogical Content Knowledge (TPCK) of the teachers is very high. On the other hand, the relationships between the level of utilization of ICT-Based tools and other software applications are classified as very weak. However, there is a weak relationship between Technology Acceptance level in terms of the usefulness of ICT and ease of use of ICT and TPCK. This correlation is not significant. Thus, the levels of Technology Acceptance in terms of usefulness and ease of use of ICT are closely related to the utilization of ICT in teaching. A strong TPCK foundation can help teachers maximize the potential of ICT in their classrooms, while the perceived usefulness and ease of use of ICT can contribute to the growth of TPCK. Provision of comprehensive training to elementary Mathematics teachers may address the perception of respondents on the usefulness of ICT and, administrator's empowerment to effectively utilize ICT-based tools in their classrooms, ultimately enhancing teachers' teaching pedagogy.

Keywords:- *Utilization, Information and Communication Technology, Technological Pedagogical Content Knowledge, Technology Acceptance.*

I. INTRODUCTION

The challenges and opportunities faced by Philippine teachers, particularly those teaching Mathematics in elementary schools, in adapting to the K-12 curriculum and the integration of Information and Communication Technology (ICT) in education is the aim of this study. The transition from the K-10 to the K-12 curriculum, which started in the school year 2012-2013, caused uncertainty and unease among teachers, particularly those from Generation X (ages 43-63). While some teachers retired early due to difficulty in adapting, others embraced the changes positively but still struggled with implementing competency-based curricula aligned with international standards [24]. This is the impact of the K-12 Curriculum to the teachers.

The Technological Challenges for teachers today, especially those from Generation X is the integration of ICT into their teaching practices. Despite being the first generation to be exposed to personal computing, many of these teachers lack in-depth knowledge and skills in utilizing modern ICT tools for teaching [20]. This technological gap is exacerbated by the need for teachers to keep up with the digital literacy and problem-solving competencies of 21st-century learners, referred to as "Digital Natives" [52].

The effective use of ICT tools can help teachers develop critical thinking skills, which are essential for problem-solving and adapting to new teaching environments. However, many teachers still rely on traditional uses of technology, such as distributing handouts or preparing tests, rather than engaging in transformative ICT-based teaching methods. Critical thinking is essential for adapting ICT into the classroom, and teachers must be trained to use ICT in more creative and productive ways to create engaging learning experiences [21].

It is necessary to emphasize the importance of targeted professional development programs to equip teachers with the necessary skills for effective ICT utilization. Teachers often feel a conflict between their traditional teaching roles and the demands of a technology-enhanced learning environment.

Ongoing professional development can help bridge this gap, making teachers more confident in integrating ICT in their lessons [42].

The concept of "smart classrooms"—which are technology-rich learning environments—is promoted as a key to addressing the evolving needs of both teachers and learners [35]. The Department of Education's MATATAG agenda and the Schools Division of Baguio City's Smart Learning Communities initiative aim to foster such environments, where ICT tools and resources facilitate effective pedagogy and individualized learning [15].

II. FRAMEWORK OF THE STUDY

This section delves into the relationship between various types of software, ICT utilization, and the integration of technology in education, particularly focusing on teachers' ability to adapt and leverage digital tools for instructional purposes. Here's a breakdown of the key topics discussed:

A. Software Applications and Tools

Application software refers to programs designed to perform specific tasks for users, such as word processing, graphic design, and video editing. They can be categorized as either general-purpose (e.g., Microsoft Word, Excel) or specialized applications (e.g., accounting software, design tools). These tools serve as crucial resources for users, facilitating the completion of various tasks efficiently. While both tools and applications are types of software, tools tend to be narrower in scope, performing specific functions (e.g., Notepad, WinZip), whereas applications offer a broader set of features for diverse tasks. The distinction between applications and tools lies in the complexity and range of tasks they are designed to handle.

B. ICT Utilization

ICT utilization refers to the effective use of technology in the classroom to meet instructional goals. It involves teachers leveraging various ICT tools for critical thinking, problem-solving, and information analysis. Teachers must be adept at navigating and troubleshooting digital tools to enhance their teaching strategies and learners' experiences. Unified Communication and cloud adoption are examples of strategies for enhancing collaboration among educators and improving flexibility and scalability in education.

Effective ICT utilization goes beyond just using technology. It requires teachers to engage in critical thinking to analyze and assess information, evaluate online resources, and discern credible sources. Collaborative learning with ICT tools can help teachers engage with diverse perspectives and develop well-informed opinions on the use of technology. Teachers are encouraged to relate ICT tools to real-world scenarios, ensuring the relevance and application of their ICT skills. This not only enhances teaching strategies but also helps teachers understand the tangible impact of technology in their educational practices.

C. Technological Pedagogical Content Knowledge (TPCK)

Technological Pedagogical Content Knowledge (TPCK) framework integrates technology, pedagogy, and content knowledge to create an effective teaching environment. Teachers are encouraged to consider not only what they teach (content) and how they teach (pedagogy), but also how technology can enhance both of these elements. TPCK promotes an integrated approach to teaching, helping educators identify the most effective pedagogical methods and tools to deliver content and meet instructional goals.

Technology is seen as a supportive layer that enhances both content delivery and pedagogical strategies. Teachers need to understand how to use technology to facilitate learning in ways that align with their content and teaching methods. For teachers to be effective in using technology, they must integrate content knowledge and pedagogical practices with technological tools, ensuring that technology is used to support, rather than replace, traditional teaching approaches. Experienced teachers may find it easier to integrate TPCK, as they already have a solid grasp of pedagogy and content. However, novice teachers may find this integration challenging and may need additional support and training to develop their technological skills and integrate them with their teaching methods.

D. Administrative Information Communication Technology Training (AICTT)

Administrative ICT Training (AICTT) focuses on improving administrative processes within educational institutions by leveraging ICT tools for administrative tasks. This training aims to enhance efficiency, accuracy, and productivity in the management of classroom and institutional tasks. AICTT helps administrators understand the technological needs of teachers, ensuring that teachers receive the right support, resources, and infrastructure to successfully integrate ICT in the classroom. By improving administrators' ICT skills, AICTT ensures that educational technology initiatives are effectively planned and implemented, leading to better support for teachers in their use of technology. This ultimately enhances the overall educational experience for learners by facilitating more effective teaching and learning strategies.

With the development of the statement of the problem, the Paradigm of the Study has been conceptualized (Figure 1). The figure represents the problems that this study aspires to resolve. Generally, there are four concerns about Mathematics teachers that this study wants to deal with. (1.) The technology skills of Mathematics teachers in the utilization of ICT- Based tools. (2.) The technological knowledge and the pedagogical content knowledge of the mathematics teacher. (3.) The utilization of technology in the technological pedagogical content knowledge in teaching Mathematics. (4.) The ICT professional development training provided by the school administrators.

Technology skills refer to teachers' ability to apply their knowledge effectively and efficiently in practical situations. It involves using technology tools, software, or hardware to perform tasks or solve problems. Technology skills are

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developed through practice, hands-on experience, and continuous learning. Teachers' technology skills can vary significantly, just like any other demographic group [9]. These teachers have experienced the rapid advancement of technology throughout their lives. As a result, some teachers may be very tech-savvy, while others might have more limited knowledge and discomfort with technology.

Technology Knowledge (TK) and Technological Pedagogical Content Knowledge (TPCK) are recognizable concepts. This refers to teachers understanding of how to teach a particular subject matter to their learners effectively. It also confines the potential and delivers content in purposeful and accessible ways to teachers, understanding common misconceptions learners may have, and being aware of effective instructional strategies for a given subject. The utilization of technology and TPCK is where the significance lies. When teachers have a strong knowledge of both technology and pedagogical content knowledge, they can create more dynamic and effective learning experiences for their learners. Utilizing technology into their teaching allows them to enhance engagement, personalize learning, and provide access to a wide range of resources and tools.

Teachers' technology skills coupled with the ICT training provided by the school administration can result in a high level of productivity in the enhancement of teachers' technology skills. But, then teachers' utilization of educational software application on Authoring System, Reference Software, Desktop Publishing, Tutorial Software, Educational Games, Video Conferencing Software that enhance teachers ICT skills may vary depending on their level of technology acceptance.

Technology Acceptance Model of Teo (2012) was modified to measure the level of Technology Acceptance of the respondents in terms of usefulness of ICT acceptance and ease of use of ICT acceptance using Likert Scale. It will be determined by rating scale through a questionnaire. The level will be based on the outcome of the questionnaire defined in terms of technology acceptance. The level descriptions are Strongly Acceptable, Acceptable, Slightly Acceptable, and Unacceptable.

The Technology Acceptance focuses on the factors that influence elementary teachers teaching Mathematics intention to use a particular technology. In the area of ICT, usefulness refers to the perceived benefits and value that a teacher believes they can gain from using ICT in their teaching. It is also the enlargement of ICT knowledge where the teachers that utilizing this tool would enhance the performance of elementary teachers teaching Mathematics.

In contrast the ease of use of ICT is another important factor in the Technology Acceptance. If elementary teachers teaching Mathematics are convinced that using ICT is easy and straightforward, they are more likely to utilize it in their teaching pedagogy. A higher level of perceived ease of use of technology can contribute to increased technology acceptance and utilization.

However, it is important to note that not all teachers may possess a deep understanding of technology or know how to effectively incorporate it into their pedagogy. Some teachers may have received limited technology training during their formal education or have had limited exposure to certain digital tools.

To bridge this gap, capacity building and training programs by school administrators can play a crucial role. Providing opportunities for teachers to learn about new technologies, understand their potential benefits in the classroom, and gain practical experience in utilizing ICT-Based tools with their technological pedagogical content knowledge can be highly beneficial. Ultimately, the effectiveness of technology utilization in the classroom depends on the individual teacher's willingness to embrace and learn new tools, their technological pedagogical approach, and the support they receive from their educational institutions in terms of training and resources. When these factors align, technology can become a powerful tool in the hands of teachers to enhance learners learning performance.

The software application that teachers utilize to enhance their ICT skills will be determined through data analysis. Data analysis will be used to identify patterns and trends that can help improve ICT utilization approaches.

Authoring software. This software helps teachers in developing their instructional software. Teachers could build electronic flashcards of index cards for teaching learners' specific concepts. Also, teachers could build multimedia content such as reviews, tutorials, lessons, graphics, videos, animations, and interactivity. Authoring software tools are EdApp, Easy generator, H5P, isEazy, Sana, aNewSpring, Chameleon Creator, Echo360, Visme, SmartBuilder [45] [31].

Reference management software. Reference management software plays an important role in helping teachers organize and cite their literature references efficiently [34]. Reference software is an open-source, cross-platform citation and reference management tools (thesaurus, encyclopedia, atlases, and dictionaries). Reference management software tools are Zotero, Mendeley, EndNote, RefWorks, Citavi, PaperPile, JabRef, Papers, Docear [44].

Desktop publishing. A desktop publishing software is used for creating and designing newsletters, handouts, and flyers [39]. Teachers could use the software to inform learners and parents on activities or events that are taking in place in school. Desktop publishing tools are Adobe InDesign, CorelDRAW, Xara Page & Layout Designer, Canva, VistaCreate, Affinity Publisher, QuarkXPress, Microsoft Publisher, VivaDesigner, SwiftPublisher Scribus, Pagination, Venngage, iStudio Publisher, Libre Office Suite, Page Stream, Design Cap, Kofax Power PDF, Conga Composer, Microsoft Office Word [48].

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Desktop publishing software refers to computer programs that are specifically designed for creating and formatting professional – quality documents, such as brochures, flyers, newsletters, and magazines. These software tools provide users with a wide range of features and tools to manipulate text, images, and graphics, allowing for precise layout and design control [44]. This is a software that offers features that are not available in word processing programs [37]. The process yields an impressive and professional-looking document that is legible and attractive. It is a simple but effective tool to enhance the quality and appearance of work and increase productivity.

Tutorial software. Through tutorial software, teachers could teach learners new lessons and give them a platform through which they could learn the lesson at their own pace [35] [39]. Tutorial software tools are iSpring Suite, Open Broadcaster, Camtasia Free Cam, Snagit, Ezvid, Ashampoo Snap 14, Cam Studio, Active Presenter, Webinaria, FlashBack, ScreenPal, Joyoshare VidiKit, Icecream Screen Recorder, Filmora, Screen Flow, Demo Builder, Hippo Video, Panopto, Animoto, Moovly, VLC Media Player [35].

- *Level of Familiarity*

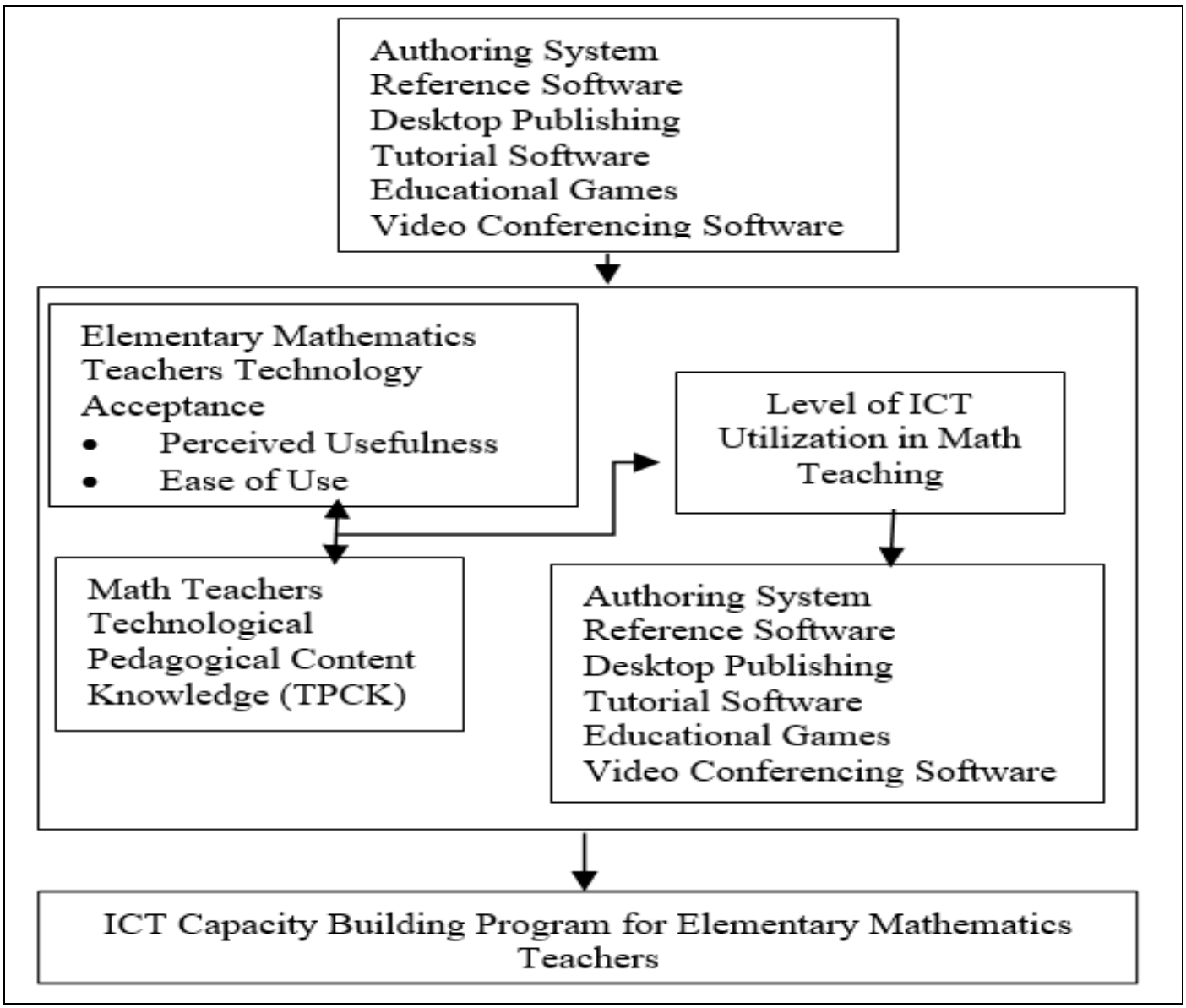

Fig 1 Paradigm of the Study

Educational games. There is several educational gaming software available. Education software companies combined gaming and education into one [20]. Educational games allow teachers to create interactive quizzes and surveys. It promotes questions that require higher-order thinking, such as problem-solving, inference, and synthesis of information [39]. Educational game tools are RapL, Kahoot 360, Trivie, Gamelearn, Quizizz, Quizlet, EdApp, Gametize, Centrical, Simformer [10].

Video conferencing software. Video Conferencing software facilitates virtual classroom interactions. While it is primarily a communication tool, teachers can use it to promote critical thinking [34] through Synchronous Discussions: Real-time discussions allow teachers to engage

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in critical debates and share their thoughts on various topics. Video Conferencing software are Zoom, Microsoft Teams, GoToMeeting, Google Meet, ezTalks Meetings, StarLeaf, Cisco, Skype, WebEx, Blue Jeans [43].

However, it is essential to note that the mere use of these platforms does not guarantee the promotion of critical thinking. Teachers play a meaningful role in designing thoughtful activities, questions, and assignments that stimulate critical thinking among learners. Effective implementation, appropriate content, and well-designed learning experiences are essential factors in utilizing these platforms to develop critical thinking skills in learners.

The level of Information and Communication Technology (ICT) utilization enhancement of the ICT skills of Teachers along Authoring System, Reference Software, Desktop Publishing, Tutorial Software, Educational Games, and Video Conferencing Software will be determined by a rating scale through a questionnaire made modified from Technology Acceptance and Unified Theory of Acceptance and Use of Technology (UTAUT) [5].

The level descriptions will be based on the outcome of the questionnaire defined by the Technology Acceptance advanced via way of means of the Florida Center Instructional Technology (FCIT). The level descriptions are Very Low, Low, High, and Very High.

The Modified Technology Acceptance [41], and altered Technological Pedagogical Content Knowledge (TPCK) [40] will manipulate the level of Technology Acceptance among teachers from their existing Technological Pedagogical Content Knowledge.

According to the modified Technology Acceptance proposed by Teo (2012) and Ng, Shroff, and Lim (2013), our perceptions of technology's ease of use and usefulness influence our attitude toward its adoption and utilization, which subsequently impacts our intention to use it and our actual usage. While Technological Pedagogical Content Knowledge (TPCK) will determine the teachers understanding required for effective technology utilization [33].

The respondents' output on the survey questionnaire regarding professional development undertaken by the administrators, demonstrating their commitment to enhancing the skills and knowledge of elementary teachers teaching Mathematics in the field of Information and Communication – Based tools. By analyzing these survey results, the researcher can better understand the effectiveness of the training programs and identify the areas for improvement, ultimately leading to a more skilled and more improved outcomes in various teaching subject areas. When teachers are proficient in enhancing their technological and pedagogical knowledge they can strengthen the teaching environment.

Figure 3 (page 129 of the original manuscript) is a process map constructed by the researcher as a guide in implementing Capacity Building Program for elementary teachers teaching Mathematics. Primarily, before implementing a capacity building for elementary teachers teaching Mathematics, expenditure needs to be considered aligning it to the regulatory bodies such as DepEd, DOF, DBM, COA, APP, and PPMP. In strategic planning, it is not only the core processes that are involved but also there is the presence of support processes that composed of budget and finance, the ICT services, administrative aides who are the personnel and records. Some external stakeholders who are NGO's, Alumni Association, and private entities who are willing to carry out Capacity - building for the professional growth and development of elementary teachers teaching Mathematics. When all are ready the review and improvement office in the form of PPA and PPMP will evaluate if the capacity building program is the right training, satisfies the customer needs and is a cost- saving measures. Then the capacity building program can push through. It is only then that the program training design activity will materialize (Figure 4, page 132 of the original research manuscript). The program training design is a recommendation from the researcher to be implemented to upskill the ICT-based tools of elementary teachers teaching Mathematics (Appendix G, pages 130-134 of the original research manuscript).

E. Statement of the Problem

The primary objective of this study is to examine the impact of Information and Communication Technology (ICT) utilization on Elementary teachers teaching Mathematics ICT proficiency. Additionally, the study seeks to determine the particular technological knowledge possessed by Elementary teachers teaching Mathematics, along with their understanding of how to effectively utilize and integrate this knowledge into their pedagogical approach and content delivery. Considering, all these the study also aims to resolve what Capacity Building the administrators provided to address the ICT skills enhancement of teachers. It aspires to answer the specific questions:

- *What is the familiarity of elementary Mathematics teachers on the following software applications to enhance their ICT skills:*

  - *Authoring softwares;*
  - *Reference management softwares;*
  - *Desktop publishings;*
  - *Tutorial softwares;*
  - *Educational games;*
  - *Video Conferencing softwares?*

- *What is the level of utilization of elementary Mathematics teachers on the following software applications?*

  - *Authoring softwares;*
  - *Reference management softwares;*
  - *Desktop publishing;*
  - *Tutorial softwares;*
  - *Educational games; and*
  - *Video Conferencing softwares*

➢ *What is the level of technology acceptance of elementary Mathematics teachers along:*

- *Usefulness of the software applications*
- *Ease of use of the software applications*

➢ *What is the level of technological pedagogical content knowledge (TPCK) of elementary Mathematics teachers?*

➢ *What is the relationship between the following variables and the elementary Mathematics teachers in utilization of ICT-based tools?*

- *Level of technology acceptance in terms of usefulness of ICT*
- *Level of technology acceptance in terms of Ease of use of ICT*
- *TPCK*

➢ *What capacity-building program may be prepared to enhance the ICT capacity of elementary Mathematics teachers?*

F. Hypotheses of the Study

- There is a significant relationship between elementary Mathematics teachers perceived ICT usefulness and their ICT utilization in teaching.

- There is a significant relationship between elementary Mathematics teachers perceived ease of the use of ICT and their ICT utilization.

- There is a significant relationship between elementary Mathematics teachers TPCK and their ICT utilization.

III. METHODOLOGY

This section of the study consists of the research design, population and locale of the study, and data gathering instrument. It also includes data collection procedure as well as treatment of the data.

➢ *Research Design*

A quantitative descriptive - correlation research design was employed to attain the objectives raised in this study. Quantitative data allows for objective measurement and analysis, which can enhance the reliability and validity of research findings. Quantitative research designs are often more efficient in terms of data collection and analysis compared to qualitative approaches.

➢ *Population and Locale of the Study*

The respondents were elementary teachers teaching Mathematics in schools Division of Baguio City which composed of 4 large schools with one hundred thirty-five (135) target population [16]. This study employed cluster sampling for its geographical practicality, efficiency, and suitability for situations where the target population is naturally grouped or geographically dispersed.

Also, Slovin's Formula was employed to determine the number of sample size. A total of one hundred (100) elementary Mathematics teachers were randomly selected. Moreover, the transformation of schools in Baguio into a Smart Classroom is being accelerated.

➢ *Respondents Profile*

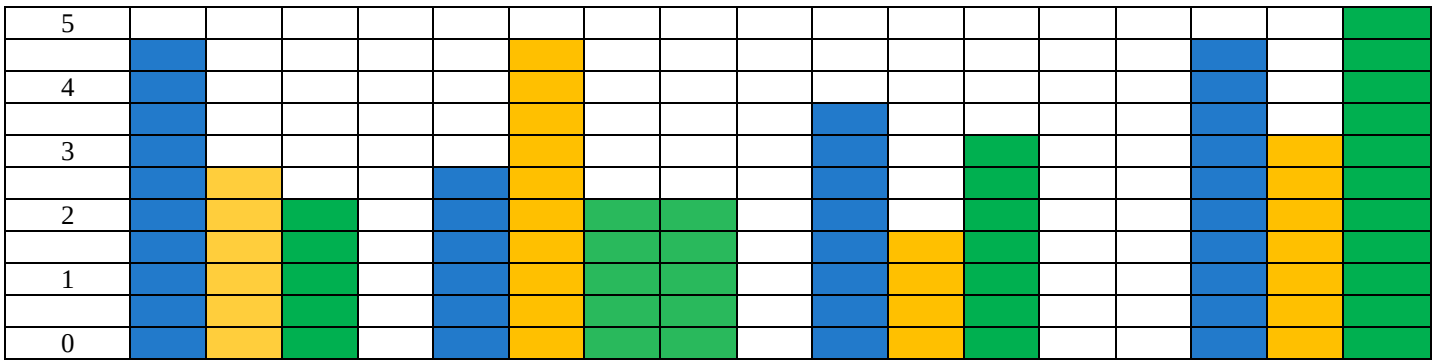

Fig 1 Respondents Profile

➢ *Data Collection Instrument*

The researcher utilized a survey questionnaire to gather data for the study, which included predetermined questions based on the research problem statement. A researcher-based questionnaire was developed for the statement of the problem (SOP) one and two. Technology Acceptance [5] and Technological Pedagogical Content Knowledge (TPCK) [40] were adapted for the survey questionnaire for SOP three to five. The survey questionnaires were validated by two (2) experts in ICT. In choosing experts, the following criteria were considered: validators should have the same area of interest as the content of questionnaire, professional expertise, relevant ICT experience, has valid or related educational certificates, and proven knowledgeable in ICT.

A Grammar Checker Free and AI Chat were utilized for the clarity of the survey questionnaire. To ensure readability and reliability test and re-test were utilized.

➢ *Data Collection Procedure*

Primarily, the researcher sought permission from the Division Office in Baguio City to conduct the study and administer the questionnaires (Appendix A of the original manuscript). Upon approval along with the endorsement letter from the Schools Division Superintendent (SDS), the researcher disseminated the letter containing consent from the SDS to the selected schools. After which, the data gathering instrument was administered to the identified respondents (Appendix B and C of the original manuscript). The researcher assured the respondents that all data collected will be treated with strict confidentiality. The survey questionnaires were distributed to the respondents through both email and hard copies personally delivered.

➢ *Treatment of the Data*

After collecting all responses from the 100 teachers, the data were sorted, collated and recorded into data files through Real Statistics tool. To analyze the familiarity level of the respondents on software applications, a 4-point scale of familiarity was utilized, as follows:

- *4- Point Scale:*

Scale	Adjective Rating	Descriptive Equivalent
4	Always	Very familiar (VF)
3	Often	Familiar (F)
2	Sometimes	Somewhat Familiar (SF)
1	Never	Not Familiar (NF)

Meanwhile, to obtain the utilization level of respondents on the software applications, a 4-Point Likert Scale was formulated as follows:

- *4 – Point Likert Scale:*

Scale	Mean	Rating	Descriptive Equivalent
4	3.25 – 4.00	Always Utilized	Very High (VH)
3	2.50 – 3.24	Often Utilized	High (V)
2	1.75 - 2.49	Sometimes Utilized	Low (L)
1	1.00 - 1.74	Never	Very Low (VL)

To uncover the level of technology acceptance of the respondents, another 4-Point Likert Scale was used, 4 as the highest and 1 as the lowest, as follows:

Usefulness of the software applications

- *4 – Point Likert Scale:*

Scale	Mean	Descriptive Equivalent	Acceptable Rating
4	3.25 – 4.00	Very High (VH)	Strongly Acceptable (SA)
3	2.50 – 3.24	High (H)	Acceptable (A)
2	1.75 - 2.49	Low (L)	Slightly Acceptable (SAc)
1	1.00 - 1.74	Very Low (VL)	Unacceptable (U)

Ease of Use of the Software Applications

- *4 – Point Likert Scale:*

Scale	Mean	Descriptive Equivalent	Rating
4	3.25 – 4.00	Very High (VH)	Strongly Agree (SA)
3	2.50 – 3.24	High (H)	Agree(A)
2	1.75 - 2.49	Low (L)	Slightly Agree (SAg)
1	1.00 - 1.74	Very Low (VL)	Do not agree (D)

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As for the level of TPCK of the teachers, the same 4-Point Likert Scale was utilized and are descriptively recorded as follows:

- *4 - Point Likert Scale*

Scale	Adjective Rating	Descriptive Equivalent
4	Often	Very High
3	Sometimes	High
2	Seldom	Low
1	Never	Very Low

Finally, for the relationship between the level of technology acceptance in terms of usefulness of ICT, level of acceptance in terms of ease of use of ICT and TPCK in the utilization of ICT-based tools Pearson Product Moment Correlation (PPMC) was employed. With a Pearson Product Moment Correlation (PPMC) at a 0.05 level of significance, a reliability coefficient of 0.75 was achieved. The formula is as follows;

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where,

r = Pearson correlation coefficient
x = Values in the first set of data
y = Values in the second set of data
n = Total number of values.

Results from the Pearsons r was interpreted by Correlation interpretation of Mukaka (2012), as follows;

Correlation Interpretation by Mukaka, 2012:

$\pm$ 0.80 to $\pm$ 1.00 – Very Strong (VS)
$\pm$ 0.60 to $\pm$ 0.79 – Strong (S)
$\pm$ 0.40 to $\pm$ 0.59 – Moderate (M)
$\pm$ 0.20 to $\pm$ 0.39 – Weak (W)
$\pm$ 0.01 to $\pm$ 0.19 – Very Weak (VW)
0 – No Relationship (NR).

IV. RESULTS AND DISCUSSION

➢ *Familiarity of Elementary Mathematics Teachers on Software Applications to Enhance their ICT Skills*

Table 1 illustrates the distribution of respondents regarding their familiarity on software applications to improve their ICT skills. The overall familiarity of respondents leans toward Desktop Publishing software applications. This implied that the respondents are more acquainted with the desktop publishing features than the other educational software features. It also shows that since they are more familiar with the desktop publishing software, they tend to utilize these features always whenever the respondents design and layout lesson plans, create worksheets, and construct power point in their teaching profession.

- *4- Point Scale:*

Scale	Adjective Rating	Descriptive Equivalent
4	Always	Very familiar (VF)
3	Often	Familiar (F)
2	Sometimes	Somewhat Familiar (SF)
1	Never	Not Familiar (NF)

Table 1 Familiarity of elementary Mathematics teachers on software applications to enhance their ICT skills.

Software Applications	Familiarity	
	Weighted Mean	DE
A. Authoring Softwares		
EdApp	3	F
Sana	1	NF
Easygenerator	1	NF
aNewSpring	1	NF
H5P	3	F
Chameleon Creator	2	SF
isEazy	2	SF
SmartBuilder	2	SF
Visme	1	NF
B. Reference Management Softwares		
Zoreto	2	SF

Table 1. Continued……

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Software Application	Familiarity	
	Weighted Mean	DE
Papers	3	F
EndNote	4	VF
PaperPile	3	F
RefWorks	3	F
Citavi	1	NF
JabRef	1	NF
Mendeley	1	NF
Docear	1	NF
C. Desktop Publishing		
Adobe InDesign	3	F
iStudio Publisher	2	SF
CorelDRAW	2	SF
Venngage	1	NF
VistaCreate	1	NF
QuarkXPress	1	NF
Pagination	2	SF
LibreOffice Suite	1	NF
VivaDesigner	1	NF
Xara Page & Layout Designer	1	NF
Canva	3	F
Affinity Publisher	2	SF
Microsoft Publisher	3	F
Scribus	2	SF
Design Cap	2	SF
Conga Composer	2	SF
Kofax Power PDF	2	SF
PageStream	2	SF
Microsoft Office (Word)	4	VF
D. Tutorial Softwares		
iSpring Suite	1	NF
Camtasia Free Cam	1	NF
Ezvid	1	NF
Cam Studio	1	NF
Webinaria	1	NF
Screenpal	1	NF
Icecream Screen Recorder	1	NF
Snagit	1	NF
ScreeenFlow	1	NF
Panopto	1	NF
Moovly	1	NF
Open Broadcaster	1	NF
Ashampoo Snap 14	1	NF
ScreenPal	1	NF
FlashBack	1	NF
Joyoshare VidiKit	1	NF
Filmora	3	F
Hippo Video	1	NF
Animoto	2	SF
Video LAN Client	3	F
E. Educational Games		
Rapl	1	NF
Table 1. Continued…….		
Software Application	Familiarity	
	Weighted Mean	DE
Trivie	1	NF
Quizizz	3	F
EdApp	2	SF

Centrical	2	SF
Kahoot 360	3	F
Game learn	1	NF
Quizlet	2	SF
Gametize	1	NF
Simformer	1	NF
F. Video Conferencing Softwares		
Zoom	4	VF
GoToMeeting	2	SF
ezTalks Meetings	2	SF
Cisco	1	NF
WebEx	1	NF
Microsoft Teams	3	F
Google Meet	4	VF
StarLeaf	2	SF
Skype	3	F
Blue Jeans	1	NF

➢ *Desktop Publishing Software*

Based on the findings, all the tools in desktop publishing are being used to some extent. However, certain tools like Venngage, Vista Create, VivaDesigner, QuarkXPress, Pagination, LibreOffice Suite, VivaDesigner, Xara Page & Layout Designer, Affinity Publisher, and PageStream are less utilized. Meanwhile, Affinity Publisher and iStudio Publisher have an equal number of users, while Adobe InDesign has the highest number of users, followed by Microsoft Office. Canva and Microsoft Publisher on the other hand are the most commonly used tools for being utilized sometimes. When it comes to "often utilization" in desktop publishing, CorelDRAW, Scribus, and Kofax Power have an equal number of rating. Canva and Microsoft Publisher are closely ranked, but Microsoft Office received the highest score for always being utilized in desktop publishing software.

The findings coincides with Featherly's study (2003) on Desktop Publishing indicating that Elementary teachers teaching Mathematics utilize this software to enhance creative projects like children's Math books. The integration of graphics and text on a single page makes it convenient for teachers to use. Despite ongoing development, Desktop Publishing Software remains affordable, useful, and superior to other software options.

Moreover, Desktop Publishing proves valuable in providing teaching and learning strategies for various learners, including learners with special needs or Special Needs Students (SNS) [53]. It was also mentioned by Mugo, Njagi, and Chemwei (2017) and Lee, Chung, and K. Wei (2022) from their studies on Technological Preferences, Levels of Utilization that Desktop Publishing is convenient to utilize because of its accessibility , user-friendly interface, file format compatibility, advanced features, and collaboration capabilities. Some elementary Mathematics teachers are looking for these kind of characteristics.

➢ *Video Conferencing Software*

Video Conferencing software applications ranked second being utilized by 34.7% of the elementary teachers teaching Mathematics. This implied that most of the elementary teachers teaching Mathematics have been utilizing the software applications. It also means that the user of video conferencing have increased its familiarity because of the pandemic.

Video conferencing is a means of delivering lessons, small-group and one – on – one learning and tutorials, conferences, and more. Video conferencing allows learners and teachers to connect using the same technologies to support video meetings. Typically, this requires video conferencing software, a device such as a mobile phone or laptop from which to run the software, and an internet connection.

Findings show that elementary Mathematics teachers do not utilize Cisco, WebEx, and Blue Jeans for Video Conferencing Software. However, GoTo Meeting has three users for sometimes utilization, while Google Meet boasts 16 users. Zoom and Skype share an equal number of users. As for Microsoft Teams it is the most heavily used software with Video Conferencing Software rated with "sometimes utilization". For "often utilization", StarLeaf has four users, followed by GoToMeeting. Skype closely rivals Microsoft Teams with 21 users, making Zoom and Google Meet the top choice in this category. Regarding "always utilization", GoTo Meeting, ezTalks Meeting, and StarLeaf each have one user. Microsoft Teams follows as the second choice, trailed by Skype and Google Meet. Meanwhile, Zoom earns the highest score with "always utilization" for video conferencing software.

The research conducted by Nagata (2017) and Samarraie (2019) on Video Conferencing's application in distance learning have similarities to the findings of this study. Their work focused on the application, implications, and usage of this technology in the realm of education at a distance. It confirmed that video conferencing has become a prevalent technological tool used by teachers. It also enabled educators to deliver classes remotely, particularly in circumstances where physical attendance at school is not feasible, such as during a pandemic or due to geographical constraints. Additionally, elementary Mathematics teachers utilize video conferencing to facilitate collaborative projects

among students, fostering teamwork and cross-cultural exchange regardless of their physical locations [46].

The findings depicted in Table 1 indicate that H5P is commonly used by the respondents in Authoring Software. It was notable that Endnote is the preferred tool for Reference Management software. In Desktop Publishing, Microsoft Office (Word) stands out with 96 out of 100 users, suggesting a high level of mastery among teachers. Video Lan Client emerges as the most utilized tool for Tutorial Software. Moreover, Kahoot 360 for Educational Games was obviously popular while Zoom in Video Conferencing among the respondents. These features seem to cater well to the specific needs of elementary Mathematics teachers, making them the preferred choices of features for enhancing the teaching experience and effective communication.

However, Table 1 revealed that there are features that are not familiar to the elementary teachers as follows: under Authoring Software, Sana, Easygenerator, aNewSpring, and Visme; for Reference Management Software: Citavi, JabRef, Mendeley, and Docear; for tutorial Software: iSpring Suite, Camtasia Free Cam, Ezvid, Panopto, Moovly, and Hippo Video; for Educational Games: RapL, Trivie, Game Learn,Gametize and Simformer; and for Video Conferencing Software: Cisco, WebEx, and Blue Jeans. Based on the survey questionnaire most respondents do not have ICT Training and some only have school - based training. This implied that these respondents have a limited encounter with educational software applications. Also, generally, the respondents belong to Generation X. Generation X usually have a balanced tradition and facilitation. They have a unique perspective on ICT, as they struggle between pedagogy and technology. They value technology's importance but also they recognize the value of interpersonal skills and human connections.

Furthermore, based on the survey most of the respondents are new elementary teachers teaching Mathematics. This indicates that they are not exposed to the utilization of educational software applications. They have not yet explored the different educational software applications putting aside the unavailability of software applications.

- *Tutorial Software*

Tutorial Software applications follows, with 13.56% utilization rate. The overall weighted mean familiarity with tutorial software applications is 1.2. Video Lan Client together with Filmora acquired 3 for familiarity making them the first among the features on Tutorial software applications. Animoto (2) got the second highest weighted mean in this category. Icecream Screen Recorder, Animoto, Cam Studio, ScreenPal, Snagit,ScreenFlow,FlashBack , Joyoshare VidiKit, Webinaria, Open Broadcaster, Ashampoo Snap 14, and ScreenPal which all have the same weighted mean (1) on familiarity.

Tutorial software virtual manipulative, whether accessed online or through tablets, laptop or desktop offer step-by-step guidance to teachers understanding mathematical procedures and concepts [3]. In additional, these software tools provide Elementary teachers teaching Mathematics with comprehensive reports, complementing the tutorial software itself. According to Petegem (2022) and Anderson-Pence, et. al [3], tutorial manipulative can be defined as interactive, web-based visual representations of dynamic objects that facilitate the construction of mathematical knowledge. In simpler terms, these programs allow for the manipulation of objects while representing mathematical concepts, relationships, and procedures.

Results revealed that iSpring Suite,Camtasia Free Cam, Ezvid, Panopto, Moovly, and ScreenPal have not been utilized for Tutorial Software. Further, Snagit, Screenflow, Open Broadcaster, Ashampoo Snap 14, Joyoshare VidiKit, and Hippo Video have all been sometimes utilized in Tutorial Software. Also, Cam Studio ranks second, followed by VLC Media Player with Filmora being the most sometimes utilized software in Tutorial Software. In terms of "often utilization", ScreenPal, Icecream Screen Recorder, and Animoto have only had one user. Cam Studio and Webinaria have had two users for "sometimes utilization". While, Filmora has garnered six users, while VLC Media Player has the highest number of users for often utilization. For always utilization, Filmora and FlaskBack have each had one user, while VLC Media Player has the highest number of users in Tutorial Software.

Anderson-Pence, Tygret, and Crocker (2020) revealed that Tutorial Software lacks effectiveness in fostering student discourse without teacher facilitation. This explains why not all elementary teachers teaching Mathematics are inclined to use this tool. However, given the prevalence of technology in today's generation, most elementary teachers teaching Mathematics have demonstrated that Tutorial Software enhances mathematical discussions when used in conjunction with teacher facilitation [49]. Teachers have adopted Tutorial Software in the form of interactive visual models, leading to increased efficiency in teaching. Besides, Tutorial software allows elementary teachers teaching Mathematics to progress through content at their own pace, which can be especially beneficial for their preferences. Teachers can review material as needed and spend more time on challenging concepts.

- *Educational Games*

Educational Games is the fourth most familiar among the software Applications with 10.09% of the respondents utilizing them. Kahoot 360, Quizizz, Quizlet, Centrical, and EdApp are the top educational games that the respondents are familiar and know how to use it garnering 3, 3, 2, 2 and 2 as weighted mean out of the 100 respondents. This implied that the respondents are not affected by the presence of digital educational games as they are resourceful and adaptable to whatever they have to deliver their lessons [27].

Educational Games is the practice of using game design elements, game mechanics and game thinking in non-game activities to motivate Elementary teachers teaching Mathematics according to Al-Azawi, Al-Faliti, and Al-

Blushi, (2016). It is a teaching method that requires learners to participate in competitions. Educational Games has been an interdisciplinary and prevalent tool for educators to utilize in teaching in the past few years as mentioned by Fazza and Mahgoub (2021). In view of the rapid development of technology, teachers have employ this tool in their teaching profession and have been eager to find new strategies for their pedagogy.

Findings have shown that RapL, Trivie, Gametize, and Simformer have never been used. However, Quizizz ranked second in terms of utilization among Educational Games, followed by Quizlet with infrequent use, and Kahoot with the highest frequency of infrequent use. For "sometime utilization", EdApp and Centrical had an equal number of users, followed by Quizlet in the second rank. Quizziz and Kahoot tied for sometimes use of Educational Software. Quizizz had no users for always utilization, making Kahoot the most commonly used Educational Software. RapL, Trivie, Gametize, and Simformer have never been utilize. Although, Quizlet, got the second rank in the Educational Games. This was followed by Quizziz in the "sometimes utilization" of Educational Games, while Kahoot got the highest score for "sometimes utilization". For "often utilization" EdApp and Game learn got the same number of technology user. Followed by Quizlet which rank second for "often utilization". Quizziz, and Kahoot got tie in terms of "often utilization" of Educational Software. Quizizz and got two user for "always utilization", making Kahoot the highest score for Educational Software.

According to Chen et al. (2019), the finding of their study on Educational Games agreed with the said results.Their findings revealed that while traditional elementary Mathematics teachers who utilized the traditional paper-and-pencil game, did not significantly affect their teaching motivation and attention. The elementary teachers teaching Mathematics, who utilized digital games with more cartoon-style, animated, and interactive features scored significantly higher on learning outcome tests. This implied that the type and quality of the Educational Game may play a significant role in its effectiveness, and that more engaging and interactive games may lead to better learning outcomes.

However, Cheung and Ng (2021) and Al-Azawi, Al-Fatma, and Al-Blushi (2016) both disagree with the results suggesting that Educational Games do not have a significant effect on elementary teachers teaching Mathematics performance. Instead, they argued that Educational Games have numerous benefits for elementary teachers teaching Mathematics, including enhancing the teaching – learning process,providing a multi-sensory, active, and experimental teaching-learning environment, and improving decision-making, problem-solving, creativity, motivation, and engagement in elementary teachers teaching Mathematics. These studies suggest that Educational Games should be employed by elementary teachers teaching Mathematics in their teaching as they bring new learning techniques and improve the teaching-learning process.

- *Reference Management Softwares*

In terms of frequency, Reference Management Software is the fifth most familiar tool with 2.83% of the respondents utilizing them. It was also notable that 56 elementary teachers teaching Mathematics are familiar and know how to utilize them, specifically on the utilization of EndNote (4), which got the highest number of respondents utilizing it. Zotero, Refworks, Papers, and PaperPile were marked 2, 3, 3, and 3 of 100 respondents respectively, indicating those who know how to utilize them. It is observed that RefWorks, Citavi, JabRef, Mendeley, and Docear are "not utilized". Meanwhile, Zotero, Papers, and PaperPile are"sometimes utilized" to the same extent. On the other hand, EndNote has the highest number of "often utilization". Zotero is used sometimes, whereas EndNote has only one user for "sometimes utilization" and Papers have the highest number of "sometimes utilization". Consequently, no one frequently utilizes the Reference Management Software.

The study conducted by Lou and Jin [35] aligns with the findings of this study, indicating that Reference Management Softwares are not widely utilized by teachers. However, these tools are more commonly used by medical workers to accurately manage their medical data. It is important to note that Reference Management Softwares have limitations when it comes to referencing diverse categories of references, data fields, and formatting styles. These limitations become apparent when a wide range of materials, such as journal articles, books, conference proceedings, patents, and more, are considered as citable sources. Ensuring proper formatting using appropriate formats can often lead to errors or incomplete referencing. This implied that most of the respondents are using referencing in their daily lesson log. Contrary to the previous statement, Schwenger, Monica, and Warner [48] discovered that teachers do indeed utilize Reference Management Software. They emphasized that the selection of a reference manager is not solely based on its feature list. Factors such as ease of use, stability, price, and availability also play a significant role. Instead of relying on plain text references, which can make it challenging to access the full text and reformat it into a different citation style, teachers are encouraged to utilize Reference Management Softwares that utilize digital identifiers.

Additionally, teachers find that using Reference Management Software saves them time and frustration when writing papers, gathering references for grant applications or reports, monitoring the literature, and sharing their PowerPoint presentations.

- *Authoring Software*

As to the Authoring software, only few respondents (2%) are familiar with it. As gleaned from the result, the utilization levels of elementary teachers teaching Mathematics regarding Authoring Software. Sana, Easygenerator, aNewSpring and Visme are indicated as "never utilized", whereas Chameleon Creator, and isEazy are "sometimes utilized" (1 mean). Additionally, EdApp, H5P, and SmartBuilder are depicted as being "often utilized". While EdApp as "always utilized". Elementary teachers teaching Mathematics are recognized for their effectiveness

in teaching, yet they face significant workloads. As a result, they must skillfully balance their responsibilities, ensuring productivity without compromising their effectiveness in the classroom. With the utilization of Authoring Softwares, it is easier to be effective since these tools can make it easier to create responsive content and often offer built-in readability and accessibility features. Mathematics teachers then create digital courses quickly without requiring them to have the abilities of a developer.

The aforementioned results align with Rivera (2023) research on teachers' utilization of Authoring Software. They notedthat the relevance and usefulness of Authoring Software in teaching presentations, teachers indicate acceptance of its usage. Similarly, Wilde's (2004) study which suggest that teachers often refrain from using Authoring Software due to its lack of flexibility. Such as higher-order functions of analysis and synthesis are more difficult to support through these activities. However, there has been a reproduction of affordable authoring tools that offer greater flexibility, empowering teachers to create effective teaching materials and learning that could fit to their learners' need. In contrast, Murray, Woolf, and Marshall, (2003) held a differing viewpoint. Their study indicated that Authoring Software fosters greater teacher participation and addresses various areas of concern. These tools can effectively decrease development time, effort, and associated costs which could ease the teachers budget financially. It also helps teachers to simplify and avoid errors in creating their multimedia presentations using the articulate/rise 360, allow you to collage various media including videos, illustrations, animations, games, puzzles and quizzes into packages.

Overall, Table 1 implies that, in general, elementary Mathematics teachers predominantly utilize Desktop Publishing software in their teaching practice. This indicates that the respondents who have the training and encounter with ICT-based tools are comfortable using the software applications, and are confidence in utilizing the software applications while those without training are attempting to improve their skills. Furthermore, those respondents without trainings are willing to invest their time and effort to develop their ICT expertise so that they will effectively utilize ICT-Based tools into their teaching.

- *Elementary Mathematics Teachers Level of Utilization on Software Applications*

Results showed that the overall level of utilization of elementary Mathematics teachers is very low with an overall weighted mean of 1.43. Specifically, the respondents have a very low level of utilization on all authoring softwares as well as the reference management softwares, and Educational Games. However, for desktop publishing, they have a very high level of utilization to Microsoft Office (Word) with average weighted mean of 3.68 and low level of utilization to Microsoft Publisher (2.11) and Canva (2.13). Meanwhile, for the video conferencing softwares, the teachers perceived a high level of utilization for Google Meet (2.51) but low level of utilization for Zoom (2.24).

Furthermore, Table 2 demonstrates the mean level of utilization for various software applications used by elementary Mathematics teachers . The software applications are grouped into categories such as Authoring Softwares, Reference Management Softwares, Desktop Publishing, Tutorial Software, Educational Games, and Video Conferencing Software.

The overall mean in Authoring Softwares is very low (1.03).It also follows with the features under it EdApp (1.23), Sana (1.00), Easygenerator (1), aNewSpring (1), H5P (1.05), Chameleon Creator (1.01), isEazy (1.01), SmartBuilder (1.03), and Visme (1.01). These reflected that the respondents have a Very Low mean level of utilization in this software category. Similarly, for the Reference Management Softwares category, Zotero (1.12), Papers (1), EndNote (1.14), PaperPile (1), RefWorks (1), Citavi (1), JabRef (1), Mendeley (1.02), and Docear (1) also have a Very Low mean level of utilization as shown in their overall weighted mean (1.03).

The overall mean for the Desktop Publishing category indicates a very low level of utilization among respondents, with a mean of 1.10. Microsoft Office Word stands out with a very high level of utilization at a mean of 3.68, while Microsoft Publisher and Canva have lower levels of utilization at 2.13 and 2.11, respectively. However, other features in the category have very low levels of utilization, which affect the overall results. Specifically, Adobe InDesign scored 1.52, Kofax Power PDF at 1.37, and iStudio Publisher at 1.10. CorelDRAW, Scribus, and Pagination all scored the same mean of 1.05, with Xara Page & Layout Designer at 1.04 and PageStream at 1.03. Additionally, Venngage, LibreOffice Suite, VivaDesigner, Affinity Publisher, Conga Composer, and VistaCreate all received a mean of 1.02, indicating a very low level of utilization among respondents. Overall, the results show a very low mean level of utilization in this category.

The overall mean for Tutorial Software applications is very low at 1.04. Despite Filmora achieving a mean of 1.51, it still falls into the category of very low utilization. Video Lan Client scored a mean of 1.14, Flaskback at 1.06, Snagit at 1.04, Webinaria at 1.03, and ScreenPal at 1.02. Furthermore, Icecream Screen Recorder, iSpring Suite, Camtasia, Free Cam, Ezvid, Cam Studio, ScreenFlow, Panopto, Moovly, Open Broadcaster, Ashampoo Snap 14, FlashBack, and Joyoshare VidiKit all received a mean of 1, indicating very low levels of utilization. Overall, the results demonstrate a very low mean level of utilization across these Tutorial Software applications.

The results for the Educational Games category show a very low level of utilization, with a mean of 1.09. While Kahoot360 and Quizziz scored mean ratings of 1.46 and 1.26, respectively, Quizlet received a mean of 1.16. EdApp scored 1.07, and Centrical had a mean of 1.01.Other software applications, such as Rapl, Trivie, GameLearn, Gametize, and Simformer, all received a mean rating of 1, indicating a low level of utilization across these educational game platforms.

The overall mean rating for Video Conferencing Software is very low level of utilization, scoring 1.43. Despite Google Meet obtaining a high level of utilization at 2.51. Specifically, Zoom scored 2.24, GoToMeeting at 1.31, ezTalks Meetings at 1.03, Cisco at 1.40, WebEx at 1, Microsoft Teams at 1.51, Google Meet at 2.51, StarLeaf at 1.04, Skype at 1.28, and Blue Jeans at 1. These ratings suggest varying levels of utilization, with Google Meet and Zoom categorized as Very High and High, respectively, while the others fall into the Very Low or Low utilization categories.

Results indicate that the elementary Mathematics teachers have a predominantly low to very low mean level of utilization for various software applications across different categories. This suggests that there is a significant room for improvement in the adoption and utilization of these tools in their teaching practices. By increasing the utilization of these software applications, elementary teachers teaching Mathematics can potentially enhance their teaching methods [36], engage and facilitate better teaching outcomes. It is essential for educational institutions to encourage and support teachers in exploring and adopting new technologies to optimize their teaching processes and create a more dynamic and interactive teaching environment.

In a similar study, it was found that elementary Mathematics teachers predominantly use Desktop Publishing Software in their teaching practice [37]. This implies that these elementary Mathematics teachers have a strong inclination towards writing and the Desktop Publishing Software serves as an additional tool to enhance their emerging literacy skills [25]. The popularity of Desktop Publishing Software among elementary teachers teaching Mathematics can be attributed to the fact that the process of using computers for writing closely resembles the traditional pen and paper approach, particularly when it comes to keyboard utilization [42].

This is further supported by the studies conducted by Sonsini (1995) and Kruse and Rapp (2023) on Desktop Publishing. They found that word processors significantly facilitate the formation of thoughts and their expression at all levels, helping respondents create a smooth flow of words, ideas, and the logical development of paragraphs, as well as enhancing the cohesion of arguments or narratives. Consequently, as per Robinson's findings, the stories created using Desktop Publishing software tend to be both longer and more intricate.

As illustrated in table 2, the respondents utilized Video Conferencing software. This implied that Video Conferencing Software particularly Google Meet and Zoom is commonly employed in their teaching profession. The importance of this tool escalated significantly during the pandemic, as it became a crucial element in online teaching. With the rise of various terms like online education, distance learning, e-learning, remote learning, virtual learning, and educational technology, video conferencing has become an integral part of online teaching and online tutoring [12]. In the context of online classrooms, video conferencing software provides respondents with a virtual classroom experience, allowing them to effectively engage with their learners despite the physical distance.

Table 2 also revealed that respondents in Tutorial Software do not usually utilized the tool when they encounter challenges in teaching Math instead they consult the textbooks. The study of Anderson-Pence, Tygret, and Crocker (2020) also indicated that teachers' utilization of Tutorial Software in their Math teaching did not significantly impact the learners performance.

This suggests that elementary Mathematics teachers may not focus significantly on creating digital content. While authoring tools are predominantly used for developing e-learning content such as online lessons, courses, and videos, the study by Anderson-Pence, Tygret, and Crocker, (2020) does not align with this observation. Their results showed that there are barriers in the access of Tutorial Software. Their findings indicated that elementary Mathematics teachers utilize such tools to streamline and simplify the process of creating online learning content [50].

However, Giannakos, Sampson, and Kidzińsk (2016) and Berry III et al. (2004) have a contrasting view as they believed that authoring tools enhance the effectiveness, efficiency, engagement, and overall quality of the teaching-learning process for elementary Mathematics teachers. By utilizing authoring tools, the respondents can potentially save time and effort in developing their teaching materials.

Table 2 Level of the Utilization of Elementary Mathematics Teachers on Software Applications

SOFTWARE APPLICATIONS	**MEAN**	**DE**
A. Authoring Software		
Table 2. Continued….		
SOFTWARE APPLICATIONS	MEAN	DE
• EdApp	1.23	Very Low
• Sana	1.00	Very Low
• Easygenerator	1.00	Very Low
• aNewSpring	1.00	Very Low
• H5P	1.05	Very Low
• Chameleon Creator	1.01	Very Low
• isEazy	1.01	Very Low
• SmartBuilder	1.03	Very Low

• Visme	1.01	Very Low
Overall	1.03	Very Low
B. Reference Management Softwares		
• Zotero	1.12	Very Low
• Papers	1.00	Very Low
• EndNote	1.14	Very Low
• PaperPile	1.00	Very Low
• RefWorks	1.00	Very Low
• Citavi	1.00	Very Low
• JabRef	1.00	Very Low
• Mendeley	1.02	Very Low
• Docear	1.00	Very Low
Overall	1.03	Very Low
C. Desktop Publishing		
• Adobe InDesign	1.52	Very Low
• iStudio Publisher	1.10	Very Low
• CorelDRAW	1.05	Very Low
• Venngage	1.02	Very Low
• VistaCreate	1.02	Very Low
• VivaDesigner	1.03	Very Low
• QuarkXPress	1.03	Very Low
• Pagination	1.05	Very Low
• LibreOffice Suite	1.02	Very Low
• VivaDesigner	1.02	Very Low
• Xara Page & Layout Designer	1.04	Very Low
• Canva	2.11	Low
• Affinity Publisher	1.02	Very Low
• Microsoft Publisher	2.13	Low
• Scribus	1.05	Very Low
• Design Cap	1.01	Very Low
• Conga Composer	1.02	Very Low
• Kofax Power PDF	1.37	Very Low
• PageStream	1.03	Very Low
• Microsoft Office (word)	3.68	Very High
Overall	1.47	Very Low
D. Tutorial Softwares		
• iSpring Suite	1.00	Very Low
• Camtasia Free Cam	1.00	Very Low
• Ezvid	1.00	Very Low
• Cam Studio	1.00	Very Low
• Webinaria	1.00	Very Low
• Screenpal	1.02	Very Low
• Icecream Screen	1.00	Very Low
Table 2. Continued…		
SOFTWARE APPLICATIONS	MEAN	DE
Recorder		
• Snagit	1.04	Very Low
• ScreeenFlow	1.00	Very Low
• Panopto	1.00	Very Low
• Moovly	1.00	Very Low
• Open Broadcaster	1.00	Very Low
• Ashampoo Snap 14	1.01	Very Low
• ScreenPal	1.00	Very Low
• FlashBack	1.06	Very Low
• Joyoshare VidiKit	1.00	Very Low
• Filmora	1.51	Very Low

• HippoVideo	1.01	Very Low
• Animoto	1.02	Very Low
• Video LAN Client	1.14	Very Low
Overall	1.04	Very Low
E. Educational Games		
• Rapl	1.00	Very Low
• Trivie	1.00	Very Low
• Quizizz	1.26	Very Low
• EdApp	1.07	Very Low
• Centrical	1.01	Very Low
• Kahoot 360	1.00	Very Low
• Game learn	1.00	Very Low
• Quizlet	1.16	Very Low
• Gametize	1.00	Very Low
• Simformer	1.00	Very Low
Overall	1.09	Very Low
F. Video Conferencing Software		
• Zoom	2.24	Low
• GoToMeeting	1.31	Very Low
• ezTalks Meetings	1.03	Very Low
• Cisco	1.40	Very Low
• WebEx	1.00	Very Low
• Microsoft Teams	1.51	Very Low
• Google Meet	2.51	High
• StarLeaf	1.04	Very Low
• Skype	1.28	Very Low
• Blue Jeans	1.00	Very Low
Overall	1.43	Very Low

Statistical Limits:		**Level of Utilization**	
Scale	**Mean**	**Rating**	**Descriptive Equivalent (DE)**
4	3.25 – 4.00	Always Utilized	Very High (VH)
3	2.50 – 3.24	Often Utilized	High (H)
2	1.75 – 2.49	Sometimes Utilized	Low (L)
1	1.00 – 1.74	Never	Very Low (VL)

➢ *Level of Technology Acceptance of Elementary Mathematics Teachers along Usefulness and Ease of use of the Software Applications*

- *Usefulness of the Software Applications*

Based on the data presented the results can be observed that the elementary Mathematics teachers' overall responses revealed that the level of Technology Acceptance on the usefulness of the software applications is strongly acceptable as shown with a mean of 3.39. Results further shows that generally, the respondents expressed that "Applying ICT would increase my job productivity" with the highest mean score of 3.57. Additionally, the table illustrates that ICT-based tools were perceived to streamline their job at 3.46 mean and enhance their job performance at 3.41 mean. Furthermore, results indicate that the respondents have shown improvement in their job efficiency when utilizing ICT-based tools with a mean of 3.35. However, some respondents expressed feeling less efficient when utilizing ICT-based tools as shown in their mean at 3.30. Moreover, a majority of participants did not perceive a significant positive impact on the enhancement of their critical thinking skills, which are crucial for job performance, as reflected with a mean score of 3.28.

Findings may imply that the teachers generally have a positive perception of ICT-based tools role in improving job productivity and effectiveness. However, it is necessary to note that there may be some variability in the extent to which the teachers believe the directly impact of ICT on the development of critical thinking skills. This may be due to the familiarity of the specific software application [30] and the level of the elementary Mathematics teachers' confidence in using the ICT-based tools [2].

Results in Table 3 of the original research manuscript reveals that 55.5% of elementary Mathematics teachers strongly accept that utilizing ICT-based tools enhances their job adeptness, effectiveness and productivity. Out of the 100 elementary Mathematics teachers approximately 35.16% concur with the given statement, while only 4.33% found it slightly acceptable. Contrarily, 5% of the participants unacceptable score with the idea that ICT tools improve their job effectiveness and productivity. Regarding the usefulness

of ICT acceptance, Results show a strong understanding of ICT- based tools [42] the respondents familiarity with software applications might be limited, which affects their utilization of the tools.

Based on the information in Table 3 (original manuscript), it can be noted that the elementary Mathematics teachers have a strong level of acceptance. As per Table 3, the strong acceptance indicates that they are convinced about the potential advantages of utilizing software applications. The level of utilization mean is 3.39. This signifies a very high level of utilization of ICT in the usefulness and functions of ICT-based tools, as reflected on the respondents acceptance with the statements.

The study of Ghavifekr and Rosdy (2015) on Teaching and Learning Technology affirms with the findings. They mentioned that elementary teachers teaching Mathematics, who were well- equipped with ICT skills strongly accepts that with the emergence of ICT-Based tools their work have been more efficient and productive. Moreover, the findings of Chie, Wu, and Hsu, (2014) on teachers belief and use of technology revealed that professional development training programs for teachers has a great impact in the usefulness of ICT acceptance.

- *Ease of use of the Software Applications*

Results in Table 4 (original research manuscript) demonstrates that the level of technology acceptance along the ease of use of software applications is rated as "high" with a general mean of 2.90 or described as "agree". While the various items were all rated as "high" or interpreted as "agree", the respondents perceived "It is easy for me to become skillful with the integration of ICT" as the highest with mean of 3.01. They also perceive ICT-based tools as flexible and interactive as reflected in a mean score of 2.93.

Additionally, they understand that utilizing ICT-based tools improves their ICT proficiency, indicated by a mean score of 2.90. Overall, the elementary Mathematics teachers is in compliance with level of Technology Acceptance along the Ease of use of ICT – based tools. This signifies that the level of acceptance among respondents regarding the ease of use of the ICT-based tools is "agree", with a score mean of 2.90.

Furthermore results indicates that a majority of elementary Mathematics teachers, comprising 56.2%, "agree" on the Ease of use of the ICT Acceptance. Following this, 14% of them "strongly agree". However, there is a notable percentage (22.6%) of teachers who "slightly agree" on the Ease of use of ICT Acceptance, and 7.2% who "do not agree" belong to Generation X, as indicated by the survey questionnaire. These findings imply that the elementary Mathematics teachers agrees that the ease of use of ICT-based tools affects their perception on the use of ICT-based tools. In their study on "Perceived Usefulness and Perceived Ease of Use in ICT Support and Use for Teachers" according to Eze, Obichukwu, and Kesharwani, (2021), found that elementary Mathematics teachers express acceptance with the Ease of use of ICT tools, a sentiment that aligns with the results of this study. These teachers recognized that ICT not only advances information but also supports learning and aids in acquiring knowledge and skills related to IT devices. Proficiency in ICT-based tools literacy enables teachers to effectively select and utilize necessary information for their teaching purposes. This could come in the form of "Think-pair-share". This gives learners a discussion question, short problem, or issue to consider by pair and then the learners will share during class hours their output.

Further, the findings of Samuel, Onasanya and Olumorin (2018) are also consistent with the results of this study. The general respondents in their study perceived that the ease of utilizing ICT-based tools enhances their work efficiency and productivity, allowing them ample time to address other teaching concerns. Given that education is increasingly intertwined with technology, particularly with teachers engaging with the technology-savvy generation, it is imperative to adapt and keep pace with the evolving era of technology.

However, the study conducted by Daryanto et al. (2019) on the "Effect of Perceived Ease of Use of ICT" presents contrasting findings to this study. Their research indicated that teacher respondents reported spending more time searching for information and listening to educators rather than focusing on their teaching tasks. Additionally, they argued that various factors need to be considered when assessing the ease of use of ICT-based tools.

Moreover, based on the results, the elementary teachers teaching Mathematics perceived acceptance of the ease of use of ICT-based tools influenced their utilization of ICT-based tools. While the respondents expressed that software applications can be useful in teaching Mathematics, at the same time they may perceived its ease of use of ICT –based tools to be difficult to operate. This hindered the respondents from utilizing the software applications since their perception doubted their actions of using the ICT-based tools. It can be further gleaned that the respondents' perception of ease of use plays an important role in the respondents' decision to utilize ICT-based tools for teaching Mathematics.

- *Level of Technological Pedagogical Content Knowledge (TPCK) of Elementary Mathematics Teachers*

Results show that the overall level of Technological Pedagogical Content Knowledge (TPCK) of Elementary teachers teaching Mathematics is very high with an overall mean of 3.37. Notably, all indicators were perceived by the respondents as very high or have been initially rated with "always". This signify their highest regard of the given statements which proves that they "always" select technologies that enhance what they teach, how to teach, and what learners learn; they "always" use interactive media technology to show the idea of content knowledge; they "always" choose effective teaching approaches to guide the teaching content knowledge; they "always" use a variety of teaching approaches to transform subject matter into comprehensible content knowledge involving technology; and they "always" utilize strategies that incorporate content,

technologies and teaching approaches that they learned from trainings.

Specifically, Table 5 (research manuscript) reveals that elementary Mathematics teachers' insight and perceptions regarding their technological pedagogy described in the statements. The first statement has a mean level of knowledge of 3.48, indicating that most participants select technologies that enhance what to teach, how to teach, and what learners learn. The second statement has a mean level of knowledge of 3.42, showing that participants often use interactive media or technology (e.g., PowerPoint) to present their content ideas. The third statement implied that the respondents integrate technologies to enhance their teaching methods and learners' learning experiences with the mean level of knowledge of 3.37. The fourth statement has a mean level of knowledge of 2.36, which means that participants inferred to choose effective teaching approaches to guide their content knowledge. The fifth statement obtained the mean level of knowledge of 3.33, which indicates that respondents use a variety of teaching approaches to make subject matter more comprehensive with the help of technology. The sixth statement implied that participants utilize strategies that incorporate various elements learned from trainings in their teaching having obtained the mean level of knowledge at 3.28.

These may imply that the elementary teachers teaching Mathematics are proficient in combining their knowledge of the subject matter (content knowledge) and their knowledge of pedagogy. This further indicates that the elementary teachers teaching Mathematics are capable of not only knowing what to teach in Mathematics but also knowing how to teach Mathematics. This cannot be known in an overnight, the respondents have accumulated this knowledge through experienced and reflection over the years of their service in education.

The distribution of responses reveals that among elementary teachers teaching Mathematics, 39% of them fall under the Very High (VH) category, which means they always (4) employed technology and pedagogical strategies in their teaching. On the other hand, 47% of the elementary teachers teaching Mathematics belong to High (H) category, suggesting they often (3) utilized technology and pedagogical strategies in their teaching. A smaller percentage of 12.83% of the participants selected scores that indicate they sometimes (2) utilize technology and pedagogical strategies, placing them in the Low (L) category. Lastly, only 1.16% of the elementary teaching Mathematics those scores that indicate they never (1) apply technology and pedagogical strategies in their teaching, categorizing them as Very Low (VL).

This distribution suggests that the majority of elementary teachers teaching Mathematics have a very high level of TPCK, with a significant portion demonstrating a high level of technological integration in their teaching practices. This implies that the majority of Elementary teachers teaching Mathematics are proficient in utilizing technology into their teaching Mathematics. It also implied that the respondents are aware of what makes content easy to learn and comprehend. They also have the knowledge about their learners schemata and utilize this information to innovate appropriate materials suitable for their learners to promote learning.

However, there is still a small percentage of the elementary teachers teaching Mathematics who may need additional support to improve their TPCK [7]. This proficiency likely results in more engaging and effective teaching experiences for the teachers, as they are able to apply their knowledge of Mathematical content, pedagogical approaches, and technological tools in a cohesive manner. The findings align with that the study of Lee, Chung, and Wei (2022) on Technological Pedagogical and Content Knowledge. They mentioned that the development of TPCK has gradually turned into practical strategies and tried to find strategic ways to facilitate teachers to implement technology-assisted teaching.

Moreover, elementary teachers teaching Mathematics perceived themselves as very high because they are aware of that technology allows teachers to tailor their instruction to their individual needs and learning styles [52]. Adaptive learning platforms and online resources can help identify Elementary teachers teaching Mathematics strengths and weaknesses, providing targeted practice and support to ensure that each Elementary teacher teaching Mathematics progresses at their own pace.

On the contrary, from the point of view of Joo, Park and Lim (2018) it showed that with the rapid development of technology the teachers must blend to digital teaching. Some elementary teachers teaching Mathematics are resistant to change [11] and prefer more traditional teaching pedagogy. They might be uncomfortable with the idea of incorporating technology into their teaching practices, especially if they feel that it may disrupt their established routines or challenge their teaching styles [26].

Elementary teachers teaching Mathematics may face a lack of training or knowledge in utilizing Information and Communication Technology (ICT) tools into their lessons. This can lead to a lack of confidence in their ability to use technology effectively, causing them to be hesitant in incorporating it into their teaching practices.

Additionally, Niess (2005) highlighted the challenges faced by elementary teachers teaching Mathematics in dealing with the technical aspects of using technology such as setting up equipment and troubleshooting issues. These difficulties can be frustrating and can discourage the respondents from relying on technology in their classrooms.

- *The Relationship between Elementary Mathematics Teachers Utilization of ICT-Based Tools, their Level of Technology Acceptance in terms of Usefulness of ICT, their Level of Technology Acceptance in Terms of Ease of Use ICT, and TPCK*

The relationships between the level of utilization of ICT-Based tools and the other software applications are

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mostly classified as "very weak", indicating that there is a minimal or almost no connection between these factors. However, for Reference Management Software there is a weak relationship with the level of Technology Acceptance in terms of Usefulness of ICT (-0.289). In addition, the respondents level of utilization of desktop publishing has also significant relationship to their level of technology acceptance in terms of usefulness of ICT with a correlation coefficient of -0.247 described as weak significant relationship. This implied that there is significant relationships with their level of technology acceptance in terms of usefulness. This suggests that as the level of Technology Acceptance in terms of usefulness decreases, the level of utilization of Reference Management Softwares and Desktop Publishing also decreases.

In addition, the correlation between TA level in terms of the usefulness of ICT and TPCK is a low negative correlation (-0.114), suggesting a very weak relationship between these two aspects. This correlation is not significant. Also, the respondents perception on Technology Acceptance on the usefulness of ICT –based tools do not have a strong influence on their TPCK. This finding indicates that improving respondents understanding on Technology Acceptance of ICT-based tools utilization might not necessarily lead to a significant enhancement in their TPCK. Instead, other factors may contribute more significantly to the development of TPCK among the respondents.

According to Brown (2022) and Joo et al. (2018), studies on Theory of Technology Acceptance Model, found out that the perceived ease of utilization of ICT strongly influenced the perceived usefulness of ICT utilization. This is in harmony with the discovery of this study. Moreover, Abramson, Dawson, and Stevens (2015) findings on their research on Extended Technology Acceptance Model is in consonant with the outcome of this study. They mentioned that TPCK did not directly affect the utilization of ICT. By preference TPCK might have a direct influence on the utilization of ICT. Instead, it could have an indirect impact through various interconnected factors. These factors may include teachers' attitudes, beliefs, confidence, training, and the availability of appropriate technological resources in their educational settings. In other words, TPCK might contribute to the overall readiness and effectiveness of teachers in utilizing ICT into their teaching pedagogy. However, its direct impact on the utilization of ICT might be mediated by these other interconnected factors, which ultimately determine how these and how much technology is employed in the classroom.

The results of Kiyici and Övez (2021) study on examination of technology acceptance and TPCK competencies of Mathematics teachers contradict the finding of this study. They argued that the respondents Technology Acceptance levels were high. They found out also that elementary Math teachers TPCK competency scores were also notably high. This finding aligns with the studies by Dong et. al. (2019) and Kiyici and Ovez (2021). In the former study concluded that elementary teachers teaching Mathematics TA levels were generally favorable, while the latter study specifically focused on primary elementary teachers teaching Mathematics, revealing high TPCK competency levels. Consequently, it can be inferred that mathematics teachers perceive themselves as adequately proficient in both technology acceptance and TPCK competencies.

ICT-Based Tools Seminar Tech Talk: Knowledge Support was proposed by the researcher as a capacity-building program for elementary Mathematics teachers to help them develop their skills in using software applications. This is a school-based seminar to upskill and provide a solution for the respondents concern about authoring software applications (Table 1) results. This program is a low-cost budget since teacher volunteers and stakeholders will implement it. This program expects elementary Mathematics teachers to utilize the software application and boost their confidence, especially in their innovation in their subject area. This program will involve NGO's who are willing to invest their monetary fund to sustain the program.

Overall, elementary Mathematic teachers have a deep understanding of the subject matter they are teaching (content knowledge), as well as the teaching methods and strategies they use (pedagogy), but not on the digital tools and technologies that support their teaching (technology). In the context of the seminar proposal, TPCK can be applied as follows: Technology: The seminar focuses on the utilization of software applications, which is a key aspect of TPCK. Pedagogy: The seminar aims to help teachers enhance new teaching strategies and approaches that incorporate technology, such as using authoring software applications to create interactive lessons and activities. Content Knowledge: The seminar focuses on Mathematics, which is a key area of content knowledge. By providing teachers with the skills and confidence to use technology in their teaching practices, the seminar can help them develop a deeper understanding of Mathematics and improve their teaching outcomes. By combining ICT utilization with TPCK, the seminar proposal aims to provide teachers with a comprehensive framework for technology utilization into their teaching practices, which can ultimately lead to improved learners learning outcomes.

V. SUMMARY

➢ *In Consonance with the Research Findings, the Results are as follows:*

- The respondents find the following software applications familiar: H5P which is widely used in authoring software; EndNote for reference management tool; Microsoft Office (Word) for desktop publishing; Video LAN Client as the most utilized tool for tutorial software; Kahoot as the leading choice for educational games, and Zoom for the video conferencing software.
- The Elementary teachers teaching Mathematics have an overall very low level of utilization of software applications. Specifically, on all Authoring Softwares as well as the Reference Management Softwares, and Educational Games. For Desktop Publishing, the respondents have a very high level of

utilization of Microsoft Office (Word) and low level of utilization to Microsoft Publisher and Canva. They have a low level of utilization of Video LAN Client and very low level of utilization for the rest of the Tutorial Softwares. Lastly, for Video Conferencing Software, they have a high level of utilization of Google Meet and low level of utilization of Zoom.

- The level of Technology Acceptance among the elementary Mathematics teachers in usefulness of the software application is strongly acceptable. The level of acceptance among respondents regarding the ease of use of the ICT-based tools is acceptable.
- The level of Technological Pedagogical Content Knowledge (TPCK) among Elementary teachers teaching Mathematics is very high.
- The relationship between the level of utilization of ICT-Based tools and the other software applications is classified as very weak. However, for Reference Management Software, and Desktop Publishing there is a weak significant relationship on the level of Technology Acceptance in terms of Usefulness of ICT. There is a weak relationship between T A level in terms of usefulness of ICT and TPCK. This correlation is not significant. Thus, hypothesis 5. A, 5. B and 5. C are rejected.
- ICT-Based Tools Seminar Tech Talk: Knowledge Support was proposed by the researcher as a capacity-building program for elementary Mathematics teachers.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. *Conclusions*

➢ *Based on the Results and Discussion, the Following Conclusions are drawn:*

- The elementary Mathematics teachers are familiar with some software application but do not usually utilize them. ICT usage habits play a significant role in respondents lives in determining whether to choose to utilize technology in their teaching.
- The utilization of software applications is influenced by Technology Acceptance, as teachers are more likely to use them if they perceive them as user-friendly and easy to use.
- A higher level of perceived usefulness of ICT can lead to increased utilization and adoption of ICT-based tools in the classroom. Respondents perception on the ease of use of ICT-based tools affect their ICT-based tools utilization.
- The elementary Mathematics teachers level of technology acceptance elevates their understanding of technology and knowing the right software application and how to use the software application to deliver their lesson.
- The perceived usefulness and ease of use of ICT-based tool does not necessarily lead to an increase in TPCK among elementary teachers teaching Mathematics in this study, so it depends on the teacher if they will utilize the ICT-based tools.
- The ICT – Based Tools Seminar TECH TALK: KNOWLEDGE SUPPORT can fill in the ICT-based tools gap of elementary Mathematics teachers.

B. *Recommendations*

➢ *In Consideration of the Preliminary Findings and Conclusions, the Researcher Offers the Following Recommendations:*

- The ICT School-based coordinators may focus on the maximization of Authoring Software Applications through School Learning Action Cell (SLAC).
- Workshops may be organized featuring expert speakers on desktop publishing software applications to be facilitated by the ICT school- based coordinator together with the Master Teachers to cater to the less point received from the survey on desktop publishing.
- The ICT school-based coordinators may design a short term, hands-on training program specifically tailored for Elementary teachers teaching Mathematics focusing on the practical applications and user-friendliness of ICT-based tools.
- A seminar on TPCK sustainability during Learning Action Cell (LAC) to be organized by the ICT school based coordinators promoting the best practices of proficient elementary Math teachers.
- Emphasize maximizing the utilization of ICT-Based tools in classroom despite the weak relationship of TAM and TPCK for enhancing learning opportunities, developing 21st-century skills, fostering global connectivity, and supporting the sustainability of professional development to be initiated by the ICT school based coordinators.
- The ICT – Based Tools Seminar TECH TALK: KNOWLEDGE SUPPORT can be implemented by the ICT school based committee for the enhancement of elementary teachers teaching Mathematics professional growth.
- The ICT school based committee may craft a monitoring and evaluation design for the use of ICT-Based tools. This promotes in identifying software applications that need further attention and improvement.
- Establish a school clear guidelines and policies by developing acomprehensive plan outlining the appropriate use of ICT, online safety measures, including internet safety, and responsible online behavior to be conducted by the ICT coordinator.
- School based ICT coordinator and members may start to invest in quality software application in partnership with stakeholders or NGO's to acquire subscription-based software applications that cater to diverse teaching needs and provide teachers with access to up-to-date technology.
- Future study on ICT-based utilization can be conducted across various districts of Baguio City highlighting the potential benefits and challenges faced by different educational districts.

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