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Technological, Pedagogical, and Content Knowledge Performance of Public Elementary School Teachers in the BCaMT District of Rizal

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Abstrak

This research investigates the Technological, Pedagogical, and Content Knowledge (TPACK) of public elementary school educators in Rizal, Philippines, and explores the relationship between TPACK and teacher performance, as assessed by the Individual Performance Commitment and Review Form (IPCR). It provides a thorough analysis of how the integration of technology, pedagogy, and content knowledge influences teacher effectiveness in various educational contexts.

Researchers utilized a descriptive research design to gather data from 208 educators in Very Large, Large, Medium, and Small Schools in Rizal. Multiple rounds of random sampling were conducted to select the participants. A structured questionnaire checklist was developed to assess teachers' performance on the IPCR and their comprehension of TPACK. Experts in education reviewed the questionnaire to ensure its validity. Data analysis involved calculating mean scores, standard deviations, and Pearson's correlation coefficient (r).

The findings revealed that educators in Very Large Schools demonstrated higher levels of Pedagogical Knowledge and Content Knowledge, while those in Small Schools showed improvements in Content Knowledge, Pedagogy, and Learning Environment. The study identified significant positive correlations between various components of TPACK and overall teacher performance, particularly between Content Knowledge and Pedagogy ($r = 0.271$, $p = 0.000$). However, no significant correlations were found between Curriculum Planning and Assessment & Reporting.

This study enhances our understanding of the impact of TPACK on teacher performance across schools of varying sizes. It also discusses the advantages and disadvantages of technology use in urban and rural educational settings.

The findings are valuable for school leaders, policymakers, and stakeholders in education as they provide insights for developing professional development programs aimed at improving teachers' technological integration and instructional effectiveness.

Keywords: *Content Knowledge, Pedagogical, Technological, and Performance of Public Elementary School Teachers*

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INTRODUCTION

Teachers need to use technology that helps them teach, fits with the curriculum, and meets the needs of their students as basic education moves online. The Technological Pedagogical Content Knowledge (TPACK) framework can help you understand what a teacher needs to know to be a good teacher in a classroom with a lot of technology. New research shows that teachers should use digital tools in their regular lessons and be able to use new technologies like AI, multimedia resources, and online tests. Also, they need to stick to the lessons and curriculum's goals and values. TPACK is more important now because it helps us figure out how ready teachers are to go back to school after the pandemic. This is especially important for K–12 schools because the way teachers teach can make a big difference in how well students learn the basics (Ng et al., 2023; Yue et al., 2024; Lucas et al., 2024).

Recent studies show that TPACK is not a fixed set of information. You can get better by practicing, learning in the right place, and using technology. Research indicates that educators in primary and elementary institutions utilize technology in markedly distinct manners, contingent upon usability, training efficacy, and preparedness. A systematic review of primary mathematics education revealed that TPACK research predominantly focuses on lesson design, teacher knowledge assessment, and professional development, highlighting the ongoing necessity for context-sensitive teacher support (Li et al., 2025). Post-pandemic primary education data indicates significant disparities in TPACK and attitudes towards technology integration between well-resourced and under-resourced environments (Li, 2025). Recent research indicates that organized technology integration courses, preservice training programs, and customized TPACK learning profiles markedly enhance teachers' preparedness to proficiently integrate technology into their teaching (Wu & Zhou, 2025; Cheng et al., 2024; Chang et al., 2025).

At the same time, the assessment of TPACK continues to evolve. Recent measurement-oriented studies emphasize that teacher competence in digital environments must be examined with instruments that are valid, contextually relevant, and sensitive to emerging technological demands. A systematic review of TPACK instruments used with preservice teachers highlights the continued expansion of measurement approaches, but also points to the need for stronger alignment between instruments and specific teaching contexts (Gonscherowski & Rott, 2025). Related studies have shown that digital proficiency significantly predicts AI-TPACK competence, while teacher self-efficacy for AI-related competence has likewise become an important area of measurement development (Hava & Babayiğit, 2025; Chiu et al., 2025). These developments suggest that while TPACK remains conceptually robust, its application must be localized and empirically grounded if it is to inform teacher development meaningfully.

You need to show that you can help the area around the Philippines in some way. Recent research has initiated an exploration of educators' digital competencies and their readiness for TPACK; however, the results are still unclear across different educational types and levels. Valdez and Mendoza (2024) validated ICT competence beliefs among preschool educators in Hong Kong and the Philippines, while Peñaojas and Palomar (2025) examined TPACK, efficacy beliefs, and blended teaching readiness among preservice science educators. In a separate study in the Philippines, Lugo (2025) found that there were gaps in skills and problems with using technology in provincial technical-vocational education, particularly highlighting the need for

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targeted professional development and support for educators in these settings. In conclusion, these studies demonstrate that research in the Philippines has begun to identify critical skills necessary for educators to effectively employ digital tools and technology. But we don't know enough about the public elementary school teachers who work in certain areas. The gap is very important in places like Rizal, where teachers must manage various responsibilities at school, stay updated with new technology, and still provide their students with a solid basic education.

This study examines the technological, pedagogical, and content knowledge of public elementary school teachers in Rizal, Philippines, considering these factors. The primary objective is to obtain empirical data regarding teachers' TPACK to assess their preparedness for integrating technology in the classroom and identify areas for further learning. This research enhances the global body of knowledge on TPACK by analyzing public elementary school teachers in a particular region of the Philippines. It also helps with a problem that can come up when you want to teach in real life. The results could help improve teacher training programs, create action plans for learning in schools, and make policies at the division level that encourage elementary school students to use technology more. The study aims to improve the quality of education in Philippine public schools by making it more relevant to students' lives, enhancing the learning environment, and ensuring better alignment with the curriculum (Li et al., 2025; Wu & Zhou, 2025; Valdez & Mendoza, 2024).

Materials and Methods

Method of Research

This study employed a descriptive research design to evaluate the level of Technological, Pedagogical, and Content Knowledge (TPACK) among public elementary school teachers in Rizal, Philippines, as well as their performance as indicated by their Individual Performance Commitment and Review Form (IPCR). Descriptive research seeks to collect data that characterize existing conditions, followed by organizing, tabulating, and analyzing this data to present a comprehensive overview of the phenomena being studied (Fraenkel & Wallen, 2012). This method was selected because it enables the gathering of detailed information about the teachers' competencies across the six TPACK components and their performance in various instructional areas, all while maintaining the integrity of the natural setting.

Setting of the Study

The study took place in several public elementary schools located in the Baras, Cardona, Morong, and Teresa districts. The Department of Education (DepEd), Division of Rizal, runs all of these schools. They run K–12 programs and give students a variety of places to learn. The districts put teacher development first by offering free seminars and training on how to use technology in the classroom and how to improve their knowledge of the subjects they teach. There are many events each year that can help you grow professionally, such as Nutrition Month, Literacy Week, World Environmental Day, and National Science and Technology Week. This study looked at how well teachers in these districts did their jobs, focusing on how well they taught English, Science, and Math, as well as how they used technology.

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Respondents of the Study

There were 208 public elementary school teachers from the Baras, Cardona, Morong, and Teresa (BCaMT) districts in Rizal who took part in this study. Slovin's Formula was used to choose them so that they would be a good sample. The selection criteria mandated that participants possess a teaching load in English, Science, and Mathematics, in addition to a minimum of five years of teaching experience. A multi-stage sampling method was used, and simple random sampling was used for the last step of the selection process. To make sure that the target population was represented fairly, the fishbowl method was used to randomly choose teachers.

Instrument of the Study

The study utilized a structured questionnaire checklist to gather data on educators' levels of Technological Pedagogical Content Knowledge (TPACK) and their performance, as assessed through the Individual Performance Commitment and Review (IPCR). The questionnaire consisted of eight sections, each concentrating on a specific aspect of TPACK. The primary aim was to evaluate how effectively teachers performed their roles. The sections included:

Section 1: Learning about Technology (TK)

Section 2: How to Teach (PK)

Section 3: Understanding the Subject Matter (CK)

Section 4: Learning about Technology and Pedagogy (TPK)

Section 5: Understanding Technological Content (TCK)

Section 6: Knowing What to Teach (PCK)

Section 7: Integrating Technology in the Classroom (TPACK)

Section 8: IPCR Evaluation of Teachers

Each section featured nine items, rated on a scale from 1 to 5, where 5 signified "Very Much Proficient" and 1 signified "Not Proficient." The IPCR employed a similar rating scale, with 5 representing "Excellent" and 1 representing "Poor."

The tool was tested and validated by ten education experts. A pilot study involving 30 teachers from Cavite City indicated a high level of reliability, evidenced by a Cronbach's alpha coefficient of 0.944. This thorough validation process confirmed that the tool effectively measured both TPACK and teacher performance, establishing its suitability and reliability for the study.

Data Collection Procedure

Five trained research assistants collected data by distributing questionnaires to a specific group of participants. The questionnaires were administered in person to ensure clarity and to obtain accurate answers, especially concerning the IPCR ratings. This method also guaranteed

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that the questions were well understood, leading to more reliable data. The data collection process lasted five days, during which completed questionnaires were collected to secure participation from all teachers.

After the data collection, the completed questionnaires were sent to the University Statistical Center for analysis and calculation.

Analysis of the Data

The data for this study were analyzed using various statistical tools. The mean was used to evaluate the level of Technological Pedagogical Content Knowledge (TPACK) among teachers across its six components. To assess teacher performance, the analysis of their IPCR scores involved both the mean and standard deviation, focusing on areas such as Content Knowledge, Pedagogy, Learning Environment, Curriculum and Planning, Assessment and Reporting, and Plus Factors. Furthermore, Pearson's Correlation Coefficient (r) was applied to examine the significant relationship between the level of TPACK—which includes Technological, Pedagogical, and Content Knowledge—and the teachers' performance as indicated by their IPCR ratings.

Ethical Considerations

The study adhered to ethical guidelines by ensuring that all participants were informed about the study's purpose and their voluntary involvement. Furthermore, the data privacy act was upheld during the collection of IPCR data, and no personally identifiable information was included in the analysis.

RESULTS AND DISCUSSIONS

Level of Technological Pedagogical Content Knowledge of Public Elementary School Teachers

Table 1 shows that Very Large Schools do well in many areas. For example, they got a score of 4.35 in Pedagogical Knowledge, which is Very Much Proficient (VMP). On the other hand, small schools always get lower scores in every area, with an overall mean of 3.95, which is considered Much Proficient (MP). In addition, every type of school, whether it's big, medium, or small, has a level of Much Proficiency (MP) in each of the six parts of TPACK. This means that most of the teachers at these schools are good at what they do, but there is still a lot of room for improvement, especially when it comes to Technological Pedagogical Content Knowledge.

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Table 1
Level of Technological Pedagogical Content Knowledge of Public Elementary School Teachers

Aspects	Very Large Schools		Large Schools		Medium Schools		Small Schools		Overall	
	Mean	**VI**	**Mean**	**VI**	**Mean**	**VI**	**Mean**	**VI**	**Mean**	**VI**
Technology Knowledge	3.81	MP	3.59	MP	4.03	MP	3.84	MP	3.81	MP
Pedagogical Knowledge	4.35	VMP	4.04	MP	4.32	VMP	4.12	MP	4.19	MP
Content Knowledge	4.10	MP	3.83	MP	4.23	VMP	4.12	MP	4.07	MP
Technological Pedagogical Knowledge	4.06	MP	3.70	MP	4.02	MP	3.88	MP	3.90	MP
Technological Content Knowledge	3.86	MP	3.57	MP	3.90	MP	3.85	MP	3.79	MP
Pedagogical Content Knowledge	4.10	MP	3.73	MP	4.14	MP	3.98	MP	3.98	MP
Technological Pedagogical Content Knowledge	4.08	MP	3.69	MP	3.98	MP	3.88	MP	3.90	MP
Grand Mean	**4.05**	**MP**	**3.73**	**MP**	**4.09**	**MP**	**3.95**	**MP**	**3.95**	**MP**

Legend: VMP – Very Much Proficient

MP – Much Proficient

The results show that the teachers at Rizal's public elementary schools are somewhat good at all seven parts of the TPACK framework. The grand mean for the whole thing is 3.95. This trend shows that teachers at both big and small schools know how to use technology and teach well in the classroom. The scores from different types of schools show that this skill can be used in many different situations. The grand mean was highest for Very Large Schools, then for Medium Schools, and finally for Small Schools. The schools with the most students had the lowest average score. This difference shows that the school environment can affect how well teachers use TPACK-related skills and teach, even though all groups had the same level of skill. Some schools may be superior to others due to increased workload, enhanced resources, more stringent regulations for educators, or superior instructional materials.

When you look more closely at each area, you can see that teachers are best at teaching the more traditional subjects, especially Content Knowledge and Pedagogical Knowledge. Pedagogical Knowledge was the area that got the best ratings overall. This means that teachers generally know how to plan lessons, choose the best ways to teach, and meet the needs of the classroom. Content Knowledge also stayed pretty strong, especially in schools with a medium size. This means that teachers are very knowledgeable about the subjects they teach. But the lowest scores were in Technology Knowledge and, even more importantly, Technological

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Content Knowledge. This pattern shows that most teachers know how to use technology, but they might not know how to use digital tools in ways that are useful for the lessons they are teaching. In other words, they seem to be more comfortable with separating teaching and content than with using technology in those areas in a deep and consistent way. This difference is important because using devices or apps is not the only part of making technology work well together. It's also about choosing tools that really help people understand, make hard ideas easier to understand, and get students more interested.

The results show that teachers know how to teach well, but they need more help with the parts of their jobs that involve using technology and working with other people. The average scores in Technological Pedagogical Knowledge and Technological Pedagogical Content Knowledge show that technology is not yet fully and effectively a part of education. This means that teachers need to know more than just how to use a computer. They need software that helps them link the tools they use to the subjects they teach and the goals they want to reach. Training should be useful, applicable to the situation, and directly connected to its classroom application. This will show teachers how technology can help them reach some of their teaching goals. Schools with a lot of students don't do as well as schools with fewer students. This means that the support systems need to be changed so that they work for all types of schools. School leaders may need to improve their mentoring, planning, providing resources for teachers, and giving teachers advice on how to teach, especially in areas where teachers have a lot of work to do. This can help TPACK improve, which can help teachers go from just using technology to teaching in a way that is more meaningful, responsive, and effective in public elementary schools.

Mean on the Level of Performance of Elementary School Teachers with Respect to the Different Aspects as Revealed by their IPCR

Table 2 shows that Small Schools do well in most areas, but they do especially well in Pedagogy and Content Knowledge (4.24) and Learning Environment and Diversity of Learners (4.28). Their average score is 4.15, which is Very Satisfactory (VS). Overall, Very Large Schools and Large Schools do about the same in all areas, with mean scores of 3.99 and 3.80, respectively. This means they are doing well. Overall, medium schools do a little worse in all areas, with a mean score of 3.92, which is also considered Satisfactory (S).

Table 2
Mean on the Level of Performance of Elementary School Teachers with Respect to the Different Aspects as Revealed by their IPCR

Aspect	Very Large Schools		Large Schools		Medium Schools		Small Schools		Overall	
	Mean	VI	Mean	VI	Mean	VI	Mean	VI	Mean	VI
Content Knowledge & Pedagogy	4.09	VS	3.80	VS	4.06	VS	4.24	VS	4.07	VS
Learning Environment & Diversity of Learners	4.07	VS	3.75	VS	4.00	VS	4.28	VS	4.05	VS
Curriculum and Planning	3.96	VS	3.69	VS	3.70	VS	4.10	VS	3.89	VS

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Assessment & Reporting	3.86	VS	3.86	VS	3.92	VS	3.98	VS	3.92	VS
Plus Factor	3.97	VS	3.90	VS	3.89	VS	4.14	VS	4.00	VS
Overall	**3.99**	**VS**	**3.80**	**VS**	**3.92**	**VS**	**4.15**	**VS**	**3.98**	**VS**

Table 2 shows that the average IPCR rating for elementary school teachers was 3.98, which means that their overall level of performance was "Very Satisfactory." This shows that teachers did well in all the important areas of their professional practice, no matter what type of school they worked at. The overall mean for Small Schools was the highest at 4.15, followed by Very Large Schools (3.99), Medium Schools (3.92), and Large Schools (3.80). All of these numbers are still considered Very Satisfactory. This pattern shows that teacher performance was generally good in all types of schools, but it was especially good in small schools. This could be because the workloads were easier to handle, the supervision was closer, and the teaching environment was more focused.

The overall mean for the five performance areas was 4.07 for Content Knowledge and Pedagogy, 4.05 for Learning Environment and Diversity of Learners, and 4.00 for Plus Factor. All of these were verbally interpreted as "Very Satisfactory." These results suggest that teachers are generally good at teaching the material, using the right teaching methods, and making learning spaces that work for all kinds of students. On the other hand, Curriculum and Planning had the lowest overall mean score of 3.89, while Assessment and Reporting had a score of 3.92. Both scores were still in the Very Satisfactory range. This means that teachers are doing well in these areas, but they may still need more help with lesson planning, aligning the curriculum, designing assessments, and reporting on how well students are doing.

he results show that elementary school teachers do a good job overall, but there is still room for improvement. Curriculum and Planning and Assessment and Reporting got lower scores, so these areas need more work. The fact that teachers in small schools always get higher ratings could mean that the school environment has an effect on how well teachers do their jobs. This might mean that larger schools need to work on their support systems. These results can help school leaders and administrators plan things like mentoring, instructional coaching, collaborative planning sessions, and professional development programs that teach teachers how to use tests and put the curriculum into action. Public elementary schools can help teachers do a better job by helping them keep their strengths and work on their weaknesses.

Test of relationships between the Level of Technological Pedagogical Content Knowledge and Performance of Public Elementary School Teachers

Table 3 reveals a strong connection between TPACK components and teacher performance (IPCR) in several aspects. Technology Knowledge and Pedagogical Knowledge show the most significant relationships with Content Knowledge and Pedagogy ($r = 0.271$, $p = 0.000$), as well as with the Learning Environment and Diversity of Learners ($r = 0.186$, $p = 0.008$). Conversely, areas such as Curriculum and Planning, Assessment and Reporting, and the Plus Factor exhibit correlations that are not statistically significant (p > 0.05), indicating that TPACK is less relevant to these aspects. The research highlights that the integration of Technology, Pedagogy, and Content Knowledge has a significant impact on teacher performance,

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as evidenced by positive correlations in critical areas, including Content Knowledge and Pedagogy (r = 0.256, p = 0.000) and the Learning Environment (r = 0.237, p = 0.001).

Table 3
Test of relationships between the Level of Technological Pedagogical Content Knowledge and Performance of Public Elementary School Teachers

TPACK	Performance (IPCR)	R	p-Value	Ho	VI
Technology Knowledge	Content Knowledge and Pedagogy	.271	.000	R	S
	Learning Environment and Diversity of Learners	.186	.008	R	S
	Curriculum and Planning	.075	.284	FR	NS
	Assessment and Reporting	.074	.292	FR	NS
	Plus Factor	.039	.584	FR	NS
	Overall	.193	.005	R	S
Pedagogical Knowledge	Content Knowledge and Pedagogy	.233	.001	R	S
	Learning Environment and Diversity of Learners	.242	.000	R	S
	Curriculum and Planning	.032	.645	FR	NS
	Assessment and Reporting	.062	.378	FR	NS
	Plus Factor	.175	.012	R	S
	Overall	.230	.001	R	S
Content Knowledge	Content Knowledge and Pedagogy	.247	.000	R	S
	Learning Environment and Diversity of Learners	.274	.000	R	S
	Curriculum and Planning	.087	.215	FR	NS
	Assessment and Reporting	.113	.108	FR	NS
	Plus Factor	.126	.073	FR	NS
	Overall	.253	.000	R	S
Technological Pedagogical Knowledge	Content Knowledge and Pedagogy	.212	.002	R	S
	Learning Environment and Diversity of Learners	.228	.001	R	S
	Curriculum and Planning	.106	.130	FR	NS
	Assessment and Reporting	.119	.089	FR	NS
	Plus Factor	.195	.005	R	S
	Overall	.258	.000	R	S
Technological Content Knowledge	Content Knowledge and Pedagogy	.204	.003	R	S
	Learning Environment and Diversity of Learners	.172	.014	R	S
	Curriculum and Planning	.094	.178	FR	NS
	Assessment and Reporting	.092	.189	FR	NS
	Plus Factor	.108	.123	FR	NS
	Overall	.200	.004	R	S
	Content Knowledge and Pedagogy	.196	.005	R	S

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Pedagogical Content Knowledge	Learning Environment and Diversity of Learners	.182	.009	R	S
	Curriculum and Planning	.074	.292	FR	NS
	Assessment and Reporting	.104	.138	FR	NS
	Plus Factor	.137	.052	FR	NS
	Overall	.207	.003	R	S
Technological Pedagogical Content Knowledge	Content Knowledge and Pedagogy	.193	.006	R	S
	Learning Environment and Diversity of Learners	.171	.014	R	S
	Curriculum and Planning	.042	.547	FR	NS
	Assessment and Reporting	.154	.028	R	S
	Plus Factor	.167	.017	R	S
	Overall	.216	.002	R	S
Grand Mean	Content Knowledge and Pedagogy	.256	.000	R	S
	Learning Environment and Diversity of Learners	.237	.001	R	S
	Curriculum and Planning	.084	.230	FR	NS
	Assessment and Reporting	.117	.096	FR	NS
	Plus Factor	.151	.031	R	S
	Overall	**.254**	**.000**	**R**	**S**

Legend: Ho – Decision Null Hypothesis

R – Relationship

Table 3 shows that the level of Technological Pedagogical Content Knowledge (TPACK) of public elementary school teachers is closely related to many parts of their performance as shown in the IPCR. The grand mean of TPACK was significantly correlated with Content Knowledge and Pedagogy ($r = .256$, $p = .000$), Learning Environment and Diversity of Learners ($r = .237$, $p = .001$), Plus Factor ($r = .151$, $p = .031$), and overall performance ($r = .254$, $p = .000$). This means that teachers who have more TPACK usually do better in these areas. The correlation coefficients are low, though, which means that the relationships are positive but not very strong. This means that TPACK is only one of many things that affect how well teachers do their jobs, even though it does help them do their jobs better.

If you look closely at the different TPACK domains, you'll see that they all follow the same pattern. Technology Knowledge, Pedagogical Knowledge, Content Knowledge, Technological Pedagogical Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge, and Technological Pedagogical Content Knowledge showed strong links to Content Knowledge and Pedagogy, Learning Environment and Diversity of Learners, and overall performance. These findings indicate that educators adept in the amalgamation of technology, pedagogy, and content are more likely to demonstrate superior instructional efficacy and more flexible classroom methodologies. One of the most interesting things we found was that Content Knowledge was most closely related to Learning Environment and Diversity of Learners ($r = .274$, $p = .000$). However, Technology Knowledge was most closely related to Content

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Knowledge and Pedagogy (r = .271, p = .000). This pattern shows how TPACK can help teachers do a better job in the classroom, especially when it comes to getting students involved and teaching them.

Conversely, Curriculum and Planning did not significantly impact any of the TPACK domains. On the other hand, Assessment and Reporting only mattered for Technological Pedagogical Content Knowledge. This suggests that TPACK may have a reduced direct impact on tasks defined by procedural, administrative, or system-oriented characteristics. Just because you know how to use technology well doesn't mean you'll do better on planning documents, reporting requirements, or formal tests. The findings indicate that augmenting teacher performance requires more than merely enhancing TPACK. Professional development programs should continue to assist educators in enhancing their technological proficiency in lesson delivery and content mastery. They should also give equal weight to planning the curriculum, learning how to grade, and setting up administrative support systems. This is how schools can help teachers grow in a more balanced way that covers all areas of their work.

Conclusion

The research offers significant insights into the correlation between Technological Pedagogical Content Knowledge (TPACK) and the efficacy of elementary school teachers. The results show that Very Large Schools usually do well in both Content Knowledge and Pedagogical Knowledge. This is probably because they have more tools and chances to improve at what they do. But smaller schools usually do a better job of teaching, testing, and learning. Teachers at these schools probably have better relationships with their students and can better meet their needs because the class sizes are smaller.

TPACK has many parts that are very important for teachers to be effective. For example, how well they know the subject and how to teach it. This shows how important it is to use both technology and good teaching methods to keep students interested and help them learn. Some parts, like Curriculum and Planning and Assessment and Reporting, didn't work well with TPACK, even though the results were good. We need to look more closely at these areas to help both students and teachers do better. The results show that teachers need to learn new things all the time so they can use technology in the classroom. All students should have the same access to technology and learning tools, no matter how big or small the school is. This is especially true when there isn't much to go around.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding the publication of this paper. The research was conducted with full academic integrity and objectivity, and no financial, professional, or personal relationships that could influence the results or interpretation of this study have been disclosed. The authors have no connections to any organizations or individuals that could potentially sway the results of this research. This paper presents all findings and conclusions solely based on the data collected and analyzed during the study.

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