TPACK Proficiency of Rodriguez National High School Teachers

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Abstract

This study examines the Technological Pedagogical Content Knowledge (TPACK) proficiency of Rodriguez National High School (RNHS) teachers, focusing on how demographic characteristics like age, years of service, and educational background affect teachers' capacity to incorporate technology into pedagogy and content. The study employed a descriptive-correlational research methodology, surveying educators from various subject areas and utilizing standardized tools to assess their TPACK proficiency. The findings show that overall TPACK levels range from moderate to high, with notable variations associated with educational background but not age or years of service. The need for focused training programs for those without a degree in education was highlighted by the higher TPACK competency of teachers with degrees linked to education. To improve TPACK competency and facilitate successful technology integration in the classroom, recommendations include mentorship programs, access to technology resources, and frequent professional development.

KEYWORDS: TPACK, Proficiency, Teachers

1. Introduction

Technological Pedagogical Content Knowledge (TPACK) is a framework that helps educators understand the intersection of three critical domains: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Developed by Mishra and Koehler (2006), the TPACK framework provides a lens through which teachers can evaluate how to integrate technology into their teaching in a meaningful way. The model emphasizes that effective technology integration goes beyond technical skills and involves an understanding of how technology can enhance both content delivery and pedagogical strategies. TPACK has gained prominence as educators face the challenge of incorporating technology into their teaching while maintaining pedagogical effectiveness and content mastery (Mishra & Koehler, 2006).

TPACK=Technological Pedagogical Content Knowledge
CK=Content Knowledge
PK=Pedagogical Knowledge
TK=Technological Knowledge

In the TPACK framework, Content Knowledge (CK) refers to the teacher's expertise in the subject matter being taught, while Pedagogical Knowledge (PK) focuses on the teacher's understanding of instructional strategies, classroom management, and assessment techniques. Technological Knowledge (TK) encompasses familiarity with digital tools and technologies. The central tenet of TPACK is that technology integration is most effective when there is a harmonious interaction between all three knowledge domains. Teachers must understand how to blend technology with pedagogy and content to create meaningful learning experiences for students.

Over time, TPACK has been widely adopted in educational research and teacher preparation programs, with studies emphasizing its importance in developing educators' abilities to effectively incorporate technology into their teaching practices. Researchers have found that teachers with a strong grasp of TPACK are more adept at choosing and using technology tools that align with both the content they teach and the pedagogical strategies they employ (Mishra & Koehler, 2006; Koehler & Mishra, 2021). Furthermore, TPACK has been linked to improved student outcomes, as teachers are better able to create engaging, technology-rich learning environments (Chai, Koh, & Tsai, 2023).

This study explores the TPACK proficiency of teachers at Rodriguez National High School (RNHS), with a focus on understanding the integration of technology, pedagogy, and content in the educational practices of the institution. As digital tools and resources continue to evolve, teachers at RNHS must be equipped with the necessary skills to adapt and enhance their teaching practices (Angeli & Valanides, 2009). The research aims to assess the current level of TPACK proficiency among RNHS teachers, identify areas of strength, and highlight areas for improvement to ensure a more effective and engaging learning environment for students.

1.1. Background of the Study

Technology integration into teaching and learning has become a crucial factor in shaping the modern educational landscape. As the world increasingly moves toward digital solutions, educators are tasked with utilizing technology in ways that enhance pedagogical methods and enrich content delivery. One framework that has garnered significant attention in the field of education is Technological Pedagogical Content Knowledge (TPACK), which emphasizes the harmonious integration of three essential knowledge areas: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK).

The TPACK framework, first developed by Mishra and Koehler (2006), aims to guide educators in navigating the complexities of using technology effectively while ensuring the quality and relevance of teaching content. The challenge lies not only in mastering technology tools but also in understanding how to merge these tools with pedagogy and subject matter expertise. Teachers with a high level of TPACK proficiency can create dynamic learning environments that cater to diverse learning styles and foster more engaging, student-centered learning experiences.

Recent studies consistently highlight the crucial role of Technological Pedagogical Content Knowledge (TPACK) in effective technology integration within education. Mishra and Koehler (2024) emphasized the importance of integrating technology, pedagogy, and content knowledge in teacher training, advocating for updated, hands-on strategies in professional development programs. Angeli and Valanides (2023) stressed that a balanced approach to TPACK is essential for successful technology integration, with teacher education focusing not just on technical skills but also on aligning pedagogy with content. Chai, Koh, and Tsai (2023) revealed that secondary teachers' TPACK development varies by subject area, with teachers in fields like mathematics emphasizing content-specific technologies, while those in humanities focus on pedagogical methods. TPACK is vital for online and hybrid teaching, with teachers needing to adapt their technology and pedagogical knowledge for digital learning environments according to Baran and Correia (2023). Niess (2022) showed that pre-service teachers benefit significantly from mentorship and practical classroom experiences to develop their TPACK, while Sahin (2022) suggested that TPACK development is a gradual process that requires both theoretical knowledge and hands-on practice. Lee and Tsai (2022) highlighted that science teachers with high TPACK competence are better able to engage students through technology-enhanced instructional activities. Vannatta and Fordham (2021) demonstrated that teachers with higher TPACK proficiency are more successful in integrating digital tools into their teaching, and Koehler and Mishra (2021) argued that TPACK is essential for teacher educators to model effective technology integration. However, Goktas, Yildirim, and Yildirim (2021) revealed challenges in assessing TPACK proficiency among higher education instructors, urging the development of comprehensive assessment tools.

TPACK Proficiency may be attributed to several factors such as age, length of service and educational background. Age plays a significant role in teachers' technology integration skills, with younger and older teachers often demonstrating different levels of TPACK proficiency. Younger teachers, typically more familiar with digital tools, may have a natural affinity for technology, allowing them to use it in innovative ways and integrate it seamlessly into their teaching practices (Mishra & Koehler, 2006). Their familiarity with technology gives them an advantage in adopting digital tools quickly, positively influencing their TPACK development (Inan & Lowther, 2010). Moreover, younger teachers, with more exposure to technology during their schooling, tend to exhibit higher TPACK levels early in their careers (Koh & Chai, 2016; Puentedura, 2014). However, older teachers, while initially less familiar with technology, can still develop strong TPACK through experience and professional development (Sargent & Chambers, 2015). As older teachers accumulate more experience, they tend to become more confident in integrating technology into their pedagogy, achieving similar TPACK proficiency as younger teachers over time (Chai, Koh, & Tsai, 2010; Goktas, Yildirim, & Yildirim, 2009). Despite being more cautious with technology initially, older teachers show significant improvements in technology integration with appropriate support and practice (Vannatta & Fordham, 2004; Angeli & Valanides, 2009). Studies also suggest that the combination of age and experience leads to more effective technology integration, as older teachers, through professional development, can eventually match the technology proficiency of younger teachers (Sargent & Chambers, 2015). Additionally, teachers' dispositions towards technology integration tend to vary by age, with younger teachers more likely to spontaneously adopt technology and engage in transformative practices, while older teachers take a more cautious approach but improve with experience and support (Koh & Chai, 2016).

Teachers' length of service plays a vital role in their ability to integrate technology effectively, as more experienced teachers tend to develop stronger TPACK over time through accumulated experience and professional development. Experienced teachers often demonstrate greater confidence in using technology in their classrooms, as they have had more opportunities to adapt and integrate digital tools with content and pedagogy, enhancing their overall TPACK proficiency (Ertmer & Ottenbreit-Leftwich, 2010). Research by Archambault and Crippen (2009) suggests that teachers with more years of experience generally show higher TPACK levels, as their extensive exposure to integrating technology in teaching leads to a deeper understanding of how to combine content, pedagogy, and technology. Sargent and Chambers (2015) further support this by finding that teachers with 6-10 years of experience exhibit stronger TPACK than novice teachers due to the more sophisticated understanding they develop over time. Mishra and Koehler (2006) emphasized the importance of experience in helping teachers refine their ability to blend technology with pedagogy and content. Baylor and Ritchie (2002) also noted that experience plays a significant role in improving teachers' confidence and competence with technology, which enhances their ability to use it effectively in the classroom. In a similar vein, Cox (2008) highlighted how the integration of ICT in teacher education allows for the development of TPACK, which is particularly fostered by years of hands-on teaching experience. Koehler and Mishra (2009) reiterated that as teachers gain more experience, they develop a more sophisticated understanding of TPACK, enabling more effective technology integration. Vannatta and Fordham (2004) observed that experienced teachers tend to integrate technology more seamlessly into their teaching practices, building confidence over time. Tondeur et al. (2017) found that experienced teachers show more confidence and experience when integrating technology into their teaching strategies, further suggesting that their TPACK improves through continued practice. Chai, Koh, and Tsai (2014) underscored that teachers with more years of service typically demonstrate stronger TPACK due to their cumulative exposure to technology integration, which ultimately results in more effective teaching.

Teachers' formal education and training play a pivotal role in shaping their proficiency in Technological Pedagogical Content Knowledge (TPACK), with those possessing a background in educational technology or pedagogy being more adept at integrating technology into their teaching practices. Studies have shown that teachers with formal training in educational technology are better equipped to incorporate digital tools effectively into their teaching (Chai, Koh, & Tsai, 2010), and those with an educational background in technology often feel more confident and competent in using digital tools in the classroom (Niess, 2005). Angeli and Valanides (2009) further emphasized that professional development programs focusing on TPACK significantly enhance teachers' technological integration skills, regardless of their initial background. Similarly, Chai, Koh, and Tsai (2013) highlighted that teachers with a foundation in educational technology are better able to blend technology, pedagogy, and content effectively, thus improving their TPACK. Koehler and Mishra (2009) also observed that teachers with strong formal education in pedagogy and technology are more capable of integrating digital tools into their teaching, while Baylor and Ritchie (2002) found that teachers with specialized training in technology are better equipped to use digital tools to enhance their teaching. Koehler and Mishra (2008) noted that teachers with formal training in TPACK are generally more proficient in integrating technology into their classrooms, reinforcing the significance of continuous professional development in technology integration. Additionally, research by Tondeur, Van Keer, and van Braak (2017) affirmed that teacher training in TPACK leads to stronger integration of technology, and Darling-Hammond and Bransford (2005) advocated for teacher education programs that combine pedagogy and technology to improve TPACK. Furthermore, Harris and Hofer (2011) found that professional development in TPACK models enhances teachers' ability to combine technology with pedagogy and content. Studies by Abbitt (2011) and Sahin (2011) also supported the idea that structured, ongoing professional development in TPACK frameworks helps teachers use digital tools more effectively in the classroom.

Rodriguez National High School (RNHS) has made strides in embracing technology to improve teaching and learning outcomes. However, the full potential of technology integration is often limited by the varying levels of TPACK proficiency among teachers. This variation can be attributed to differences in age, years in service, and educational backgrounds of the faculty members. Understanding the current state of TPACK proficiency at RNHS is crucial to identifying areas of strength and areas that need development.

This study aims to assess the TPACK proficiency of teachers at RNHS to determine how well they integrate technology into their teaching practices. By identifying gaps in knowledge and areas for improvement, this research seeks to contribute valuable insights that can inform professional development programs to enhance TPACK skills. The findings of this study will help formulate targeted interventions that improve teachers' technical skills and empower them to leverage technology effectively to enhance student learning outcomes.

To achieve the purpose of the study, the research question was formulated as follows:

1. What is the level of teachers' TPACK proficiency in terms of:
    a. age
    b. years in service
    c. educational background
2. Is there a significant difference in the result of TPAC along with age, years of service, and educational background?
3. What recommendations can be proposed to improve based on the result?

2. Research Methodology

The focus of the study is to determine the TPACK proficiency of the Rodriguez National High School teachers. The aims of this study were (a) to determine the level of teachers' TPACK proficiency in terms of age, years in service, and educational background; (b) to analyse the significant difference in the result of TPACK level along with age, years in service, and educational background; and (c) to proposed recommendations based on the result of the study.

2.1. Research Design

The study employed a descriptive-correlational research design to delve into the TPACK proficiency of Rodriguez National High School teachers. This design enables the researchers to describe the overall of TPACK proficiency among the teachers and examine the relationship between TPACK proficiency and demographic variables such as age, years of service, and educational background.

2.2. Respondents of the Study

The respondents of this study were teachers currently employed at Rodriguez National High School. This includes teachers from various subject areas and grade levels. By surveying all teachers, the researchers aim to obtain a comprehensive understanding of the TPACK proficiency levels within the entire school community.

2.3. Setting of the Study

The study was conducted at Rodriguez National High School, a public secondary school in the Schools Division Office-Camarines Sur. The institution was named after Don Susano Rodriguez, who donated the land where the school was situated.

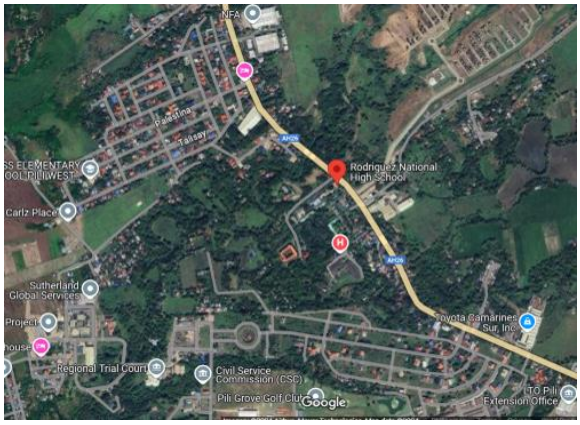

Fig. 1. Location of Rodriguez National High School

2.4. Sampling Techniques

The study employed the combination of Slovin's formula and stratified sampling to obtain the sample size and ensure a representative sample of the teacher population at Rodriguez National High School. This method involves dividing the population into homogeneous subgroups based on specific characteristics, such as subject area. A random sample will then be drawn from

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each stratum, ensuring that each subgroup is adequately represented in the final sample. This approach will allow for a more precise and reliable analysis of the TPACK proficiency levels among different groups of teachers.

2.5. Data Gathering Instrument

The primary data gathering instrument for this study was divided into three parts: (1) the Socio-demographic profile of the teacher; (2) the TPACK survey adopted from Sahin (2011); and (3) proposed recommendations to improve the TPACK proficiency of the teachers. The modified standardized survey instrument was specifically designed to measure teachers' knowledge and skills in the areas of technology, pedagogy, and content knowledge.

2.6. Data Gathering Procedure

The study's objectives were accomplished, and a series of steps was undertaken. Initial approval was sought from the School Principal and teachers of Rodriguez National High School to conduct the research. The total population of teachers, as recorded by the Administrative Officer, served as the foundation for sample size determination. A combination of Slovin's formula and stratified sampling was utilized to select a representative sample from the teacher population.

Once necessary permissions and request letters were obtained, a modified standardized questionnaire was administered to assess the TPACK level of the teachers. The questionnaires were collected promptly upon completion. To facilitate data analysis, the gathered questionnaires were tabulated. A combination of descriptive and inferential statistical techniques was employed to analyse the data collected from the questionnaires. Likert scale was used to analyse data and summarize the TPACK level of the teachers. Based on the teacher's responses, recommendations were formulated.

2.7. Statistical Treatment of Data

This study investigated teacher TPACK proficiency at Rodriguez National High School. Data collection involved gathering information on teacher demographics (age, years of service, educational background) and assessing their TPACK levels using Likert scale ratings. The research employed a combination of descriptive and inferential statistical methods. Descriptive statistics, such as means and frequencies, provided an overview of TPACK proficiency levels among the teachers.

To determine if significant differences existed in TPACK proficiency across demographic groups, One-Way Analysis of Variance (ANOVA) was utilized. ANOVA is a statistical test that compares the means of a continuous variable (TPACK scores) across three or more categorical groups (age, years of service, and educational background).

Data analysis involved data cleaning, organization, and computation of descriptive statistics. One-way ANOVA was performed for each demographic variable, with Levene's test used to check for equal variances. To ensure robustness, the non-parametric Kruskal-Wallis test was also conducted.

TPACK Category	Score Range
Low	1.00 - 2.49
Moderate	2.50 - 3.50
High	3.51 - 5.00

3. Summary of Findings

3.1. TPACK levels of Teachers per subgroup

Table 1 provides the demographic characteristics of English and Filipino teachers (EFTs) and their corresponding Technological Pedagogical Content Knowledge (TPACK) levels. The majority of respondents were aged between 30-39 years, suggesting a relatively young and dynamic workforce. There was a noticeable decline in the number of respondents in the older age group (40+). This indicates a trend of younger individuals entering the teaching profession. The data suggests a diverse range of experience levels among EFTs. While there were some teachers with less than 3 years of experience, a significant number had 6-8 years and 12 years or more of service. This indicates a balance of both novice and experienced educators. The most common

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degree among respondents was a Bachelor of Secondary Education (BSEd) in General Education. This aligns with the typical educational qualification required for teaching positions in the Philippines.

The average TPACK scores across various categories were generally moderate to high, indicating a reasonable level of technological integration in teaching practices. However, there were variations among different demographic groups. For instance, teachers with 9-11 years of experience exhibited the highest average TPACK scores, suggesting that longer tenure might be associated with greater technological proficiency. This aligns with the findings that as teachers gain more experience, they develop greater confidence and proficiency in integrating technology into their teaching practices (Ertmer & Ottenbreit-Leftwich, 2010), with experienced teachers demonstrating higher TPACK scores due to more opportunities to blend technology with pedagogy and content (Archambault & Crippen, 2009), and teachers with 6-10 years of service exhibiting stronger TPACK compared to novices as they build a more sophisticated understanding of integrating technology (Sargent & Chambers, 2015).

Table 1. English and Filipino Teacher (EFT)

Demographic Variable	Category	Number of Respondent	TK (Avg)	PK (Avg)	CK (Avg)	TPK (Avg)	PCK (Avg)	TCK (Avg)	TPACK (Avg)
Age	<30	1	3.87	3.84	2.67	4.00	4.15	3.50	3.60
	30 - 39	6	4.15	4.09	3.89	4.00	4.19	3.75	4.07
	40+	3	3.80	3.67	3.61	3.58	3.71	3.50	3.40
Years in Service	Less than 3 years	2	4.10	3.84	3.92	3.75	4.00	3.50	3.90
	3 – 5 years	1	3.87	3.84	2.67	4.00	4.15	3.50	3.60
	6 – 8 years	1	3.87	3.84	2.67	4.00	4.15	3.50	3.60
	9 – 11 years	2	4.50	4.50	4.50	4.50	4.50	4.50	4.50
	12 years – above	4	3.81	3.75	3.67	3.67	3.79	3.38	3.55
Bachelor's Degree	BSEd (Gen. Educ)	10	4.02	3.94	3.68	3.88	3.63	3.65	3.82
	Other courses	0							

Table 2. Science and Mathematics Teachers (SciMath)

Demographic Variable	Category	Number of Respondent	TK (Avg)	PK (Avg)	CK (Avg)	TPK (Avg)	PCK (Avg)	TCK (Avg)	TPACK (Avg)
Age	<30	3	3.91	3.95	3.56	4.00	4.05	3.50	3.87
	30 - 39	2	3.07	3.25	3.34	3.50	3.21	3.13	3.00
	40+	5	3.47	3.75	4.20	3.65	4.00	3.40	3.40
Years in Service	Less than 3 years	0							
	3 – 5 years	1	3.87	3.84	2.67	4.00	4.15	3.50	3.60
	6 – 8 years	3	3.85	3.77	3.89	3.67	3.47	3.42	3.33
	9 – 11 years	0							
	12 years – above	6	3.30	3.66	40	3.71	4.00	3.33	3.50
Bachelor's Degree	BSEd (Gen. Educ)	9	3.10	3.38	3.48	3.36	3.51	2.97	3.09
	Other courses	1	3.87	3.30	4.00	3.00	3.00	3.00	3.00

Table 2 presents a demographic breakdown of Science and Mathematics Teachers (SciMath) and their corresponding Technological Pedagogical Content Knowledge (TPACK) levels. The majority of respondents were in the age group of 40 or older, indicating a relatively experienced workforce. There was a notable absence of respondents in the younger age groups (less than 30 and 30-39), suggesting a potential gap in the pipeline of new SciMath teachers. The data reveals a significant number of teachers with 12 or more years of experience, further emphasizing the presence of seasoned educators. However, there was a lack of representation from teachers with fewer years of service, particularly in the 3-5 year and 9-11 year categories. The most common degree among respondents was a Bachelor of Secondary Education (BSEd) in General Education. This aligns with the typical educational qualification required for teaching Science and Mathematics.

The average TPACK scores across various categories were generally moderate, indicating a reasonable level of technological integration in teaching practices. However, there was a slight variation among different demographic groups. For

instance, teachers with less than 3 years of experience exhibited the highest average TPACK score, suggesting that newer educators might be more inclined to adopt technology in their classrooms.

Table 3. Makabayan

Demographic Variable	Category	Number of Respondent	TK (Avg)	PK (Avg)	CK (Avg)	TPK (Avg)	PCK (Avg)	TCK (Avg)	TPACK (Avg)
Age	<30	1	3.14	4.30	4.33	3.75	4.57	4.00	3.90
	30 - 39	2	4.11	3.67	4.00	4.13	4.43	4.50	4.20
	40+	11	3.15	3.59	3.86	3.36	3.47	3.27	3.35
Years in Service	Less than 3 years	1	3.14	4.30	4.33	3.75	4.57	4.00	3.90
	3 – 5 years	1	2.27	3.17	3.50	2.75	2.28	2.75	2.80
	6 – 8 years	2	4.07	4.09	4.34	3.63	3.57	3.25	3.40
	9 – 11 years	2	3.01	3.42	3.59	3.50	3.50	3.50	3.50
	12 years – above	8	3.30	3.58	3.90	3.53	3.82	3.59	3.59
Bachelor's Degree	BSEd (Gen. Educ)	12	3.18	3.61	3.90	3.54	3.79	3.58	3.57
	Other courses	2	3.91	3.92	4.00	3.25	3.07	3.00	3.20

Table 3 provides a demographic breakdown of Makabayan Teachers (MTs) and their corresponding Technological Pedagogical Content Knowledge (TPACK) levels. The majority of respondents were in the age group of 40 or older, indicating a relatively experienced workforce. There was a notable absence of respondents in the younger age groups (less than 30 and 30-39), suggesting a potential gap in the pipeline of new MTs. The data reveals a significant number of teachers with 12 or more years of experience, further emphasizing the presence of seasoned educators. However, there was a lack of representation from teachers with fewer years of service, particularly in the 3-5 year and 9-11 year categories. The most common degree among respondents was a Bachelor of Secondary Education (BSEd) in General Education. This aligns with the typical educational qualification required for teaching Makabayan subjects.

The average TPACK scores across various categories were generally moderate, indicating a reasonable level of technological integration in teaching practices. However, there were variations among different demographic groups. For instance, teachers with less than 3 years of experience exhibited the highest average TPACK score, suggesting that newer educators might be more inclined to adopt technology in their classrooms.

Table 4. Senior High School Teachers (SHS)

Demographic Variable	Category	Number of Respondent	TK (Avg)	PK (Avg)	CK (Avg)	TPK (Avg)	PCK (Avg)	TCK (Avg)	TPACK (Avg)
Age	<30	2	3.11	3.17	2.92	2.88	3.79	2.63	2.90
	30 - 39	4	4.22	3.50	4.07	3.81	3.61	3.69	3.54
	40+	8	3.90	3.15	3.42	3.16	3.73	3.19	3.30
Years in Service	Less than 3 years	7	3.81	3.29	3.50	3.21	3.77	3.14	3.17
	3 – 5 years	2	4.87	3.00	4.00	4.25	4.85	5.00	4.40
	6 – 8 years	2	3.85	3.49	3.56	3.5	3.5	3.25	3.59
	9 – 11 years	1	2.74	3.17	2.83	2.25	2.71	2.50	2.20
	12 years – above	2	3.70	3.17	3.5	3.00	3.00	2.25	3.00
Bachelor's Degree	BSEd (Gen. Educ)	11	3.99	3.30	3.69	3.39	3.53	3.36	3.42
	Other courses	3	3.45	3.06	2.94	3.00	4.33	2.83	2.93

Table 4 provides a demographic breakdown of Senior High School Teachers (SHS) and their corresponding Technological Pedagogical Content Knowledge (TPACK) levels. The majority of respondents were in the age group of 40 or older, indicating a relatively experienced workforce. There was a notable absence of respondents in the younger age groups (less than 30 and 30-39), suggesting a potential gap in the pipeline of new SHS teachers. The data reveals a significant number of teachers with 12 or more years of experience, further emphasizing the presence of seasoned educators. However, there was a lack of representation from teachers with fewer years of service, particularly in the 3-5 year and 9-11 year categories. The most common degree among respondents was a Bachelor of Secondary Education (BSEd) in General Education. This aligns with the typical educational qualification required for teaching in Senior High School.

The average TPACK scores across various categories were generally moderate, indicating a reasonable level of technological integration in teaching practices. However, there were variations among different demographic groups. For instance, teachers with less than 3 years of experience exhibited the highest average TPACK score, suggesting that newer educators might be more inclined to adopt technology in their classrooms.

3.2. Significant difference between the TPACK and socio-demographic profiles of teachers.

3.2.1. Age

- ANOVA results: F = 2.269, p = 0.115
- The p-value is greater than 0.05, indicating no statistically significant difference in TPACK scores among the three age groups (below 30, 30–39, and 40+).
- This result is supported by the Kruskal-Wallis test (p = 0.083).

The lack of a significant difference in TPACK scores between the age groups indicates that a teacher's age is not always correlated with their pedagogical and technological expertise. This suggests that teachers, regardless of age, have similar opportunities to develop their TPACK skills, possibly through training or access to resources. It also suggests that both younger and older teachers can adapt to using technology effectively in teaching. This conforms with the findings that younger teachers may be more familiar with digital tools, tend to integrate technology seamlessly into their teaching and adopt it quickly, leading to higher TPACK early in their careers (Mishra & Koehler, 2006; Inan & Lowther, 2010; Koh & Chai, 2016; Puentedura, 2014). On the other hand, older teachers may initially struggle with technology but can develop strong TPACK over time through professional development and experience (Sargent & Chambers, 2015; Chai, Koh, & Tsai, 2010; Goktas, Yildirim, & Yildirim, 2009). While older teachers are more cautious at first, with appropriate support, they improve significantly in integrating technology (Vannatta & Fordham, 2004; Angeli & Valanides, 2009). The combination of age and experience leads to more effective technology integration, with older teachers eventually achieving similar TPACK proficiency as younger teachers through continuous development (Sargent & Chambers, 2015). Dispositions toward technology also differ, with younger teachers more likely to adopt technology spontaneously and engage in transformative practices, while older teachers take a more cautious approach but improve with experience (Koh & Chai, 2016).

3.2.2. Years in Service

- ANOVA results: F = 0.007, p = 0.993
- The p-value is much greater than 0.05, indicating no statistically significant difference in TPACK
- scores among the groups categorized by years of service (<5, 6–10, 10+ years).

This result is supported by the Kruskal-Wallis test (p = 0.962).

Years of service also do not significantly impact TPACK scores. This suggests that improved TPACK skills are not entirely dependent on experience. Rather, consistent training and professional development are probably more important in making sure that educators remain current with technology-based teaching strategies. This corresponds with the findings that educators develop greater confidence and competence in integrating technology with pedagogy and content through continuous practice and professional development (Ertmer & Ottenbreit-Leftwich, 2010). Experience deepens their understanding of TPACK, helping them blend technology, pedagogy, and content more effectively (Archambault & Crippen, 2009; Sargent & Chambers, 2015; Mishra & Koehler, 2006). It also increases confidence in using technology (Baylor & Ritchie, 2002), and ICT integration in teacher education fosters TPACK through hands-on experience (Cox, 2008). As teachers gain experience, they integrate technology more seamlessly, demonstrating greater effectiveness in its use (Vannatta & Fordham, 2004; Tondeur et al., 2017; Koehler & Mishra, 2009; Chai, Koh, & Tsai, 2014).

3.2.3. Educational Background

- ANOVA results: F = 6.809, p = 0.012
- The p-value is less than 0.05, indicating a statistically significant difference in TPACK scores between teachers with education-related degrees (mean = 3.638) and non-education degrees (mean = 3.117).
- This result is supported by the Kruskal-Wallis test (p = 0.026).

Scores on TPACK are significantly influenced by educational background. Teachers with degrees in education do better, mainly because pedagogy and technology integration are emphasized in their coursework. Teachers lacking these degrees might require further assistance and instruction to develop their TPACK abilities. This conforms with the findings that teachers with formal training in educational technology are better at using digital tools effectively (Chai, Koh, & Tsai, 2010), and those with a technology background often feel more confident in using these tools (Niess, 2005). Professional development programs focusing

on TPACK enhance teachers' integration skills (Angeli & Valanides, 2009), and teachers with a foundation in educational technology are more adept at blending technology, pedagogy, and content (Chai, Koh, & Tsai, 2013). Strong education in pedagogy and technology improves technology integration (Koehler and Mishra , 2009), while specialized training in technology boosts teaching effectiveness (Baylor and Ritchie, 2002). Continuous professional development in TPACK is crucial for improving technology use in classrooms (Koehler & Mishra, 2008; Tondeur, Van Keer, & van Braak, 2017; Darling-Hammond & Bransford, 2005; Harris & Hofer, 2011), and ongoing training in TPACK frameworks helps teachers use digital tools more effectively (Abbitt, 2011; Sahin, 2011).

4. Conclusions

The findings of the study provide significant information about the Technological Pedagogical Content Knowledge (TPACK) proficiency of teachers at Rodriguez National High School in a range of demographic categories.

4.1. Age

Teachers of different ages (below 30, 30–39, and 40+) do not significantly differ in their TPACK ratings. This suggests that there are similar chances for instructors of all ages to improve their TPACK abilities through professional development or training. Teachers of all ages show that they can successfully use technology in their lessons.

4.2. Years of Service

The TPACK scores of the groups classified by years of service (less than five, six to ten, and ten or more) did not differ significantly. Experience by itself does not directly improve TPACK proficiency, according to this. The growth of teachers' technological and pedagogical skills is probably more dependent on regular access to training and professional development.

4.3. Educational Background

The TPACK scores of teachers with degrees in education and those without degrees in education differ significantly. Teachers with education-related degrees exhibit higher levels of TPACK competency as academic preparation places a strong emphasis on pedagogy and technological integration. Teachers who don’t have education-related degrees need more help and training to improve their TPACK abilities.

5. Recommendations

- Plan frequent, practical training sessions to assist educators in honing their technology-based instruction techniques.
- Provide workshops on the newest tools and developments in educational technology that are either free or reasonably priced.
- Provide necessary equipment for classes, such as projectors, printers, and laptops, ensuring that every teacher in public schools has access to these resources.
- Establish mechanisms such as a resource center, and continuing support from IT experts and tech-savvy educators to provide hands-on and quick troubleshooting and guidance to successfully incorporate technology into their lessons
- Encourage both novice and seasoned educators to participate in workshops and seminars to improve their abilities by providing incentives for involvement to encourage lifelong learning.
- Create training courses especially for teachers without education-related degrees to help them become more proficient with technology and instruction.

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