Effectiveness of Technological Pedagogical Content Knowledge (TPACK) Implementation Among Alternative Learning System (ALS) Implementers in Zamboanga City

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ABSTRACT:

While the Technological Pedagogical Content Knowledge (TPACK) framework is well-established in formal education, its application and effectiveness in non-formal settings such as the Alternative Learning System (ALS) remain understudied, particularly in the Philippine context. Most existing research focuses on classroom teachers, leaving a gap in understanding how ALS implementers—who serve diverse, marginalized, and out-of-school populations—integrate technology into their unique instructional environments. This study investigated the level of TPACK implementation and its effectiveness among 20 ALS implementers in Districts 1 and 2 of Zamboanga City, Philippines, using a descriptive-correlational design and total enumeration sampling. Data were gathered using a validated and reliable adapted questionnaire, analyzed via descriptive statistics, t-tests, ANOVA, and Pearson correlation. Results revealed that implementers possess "Well-Implemented" to "Very Well-Implemented" levels of TPACK across all components, though Technological Pedagogical Knowledge (TPK) was the lowest, indicating challenges in merging technology and instruction. TPACK application was rated "Effective" overall, but learner outcomes showed the weakest performance. Significant differences were found based on educational attainment, years of experience, and type of ALS program implemented, while sex, age, and district showed no significant influence. A strong positive correlation was found between TPACK levels and effectiveness measures. This study fills a critical regional gap by providing empirical evidence on TPACK in non-formal education, confirming that higher TPACK competencies lead to better teaching quality and resource utilization. It highlights the need for targeted professional development to strengthen TPK, improve learner outcomes, and tailor support to the specific needs of ALS programs and implementers.

Keywords: Technological Pedagogical Content Knowledge (TPACK), Alternative Learning System (ALS), Non-formal Education, Descriptive-correlational, Zamboanga City, Philippines

Introduction

With rapid advancements in technology, the role of teachers in the 21st century has become increasingly complex. Educators are expected to possess deep content mastery, sound teaching strategies, and the ability to integrate technology effectively to meet diverse learning needs.

Technological Pedagogical Content Knowledge (TPACK), introduced by Mishra and Koehler (2006), represents the intersection of three core knowledge domains: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK), along with their overlapping components. This framework emphasizes that effective technology integration requires more than just technical skills—it demands understanding how to use tools to improve instruction and learning outcomes.

Although TPACK has been widely researched in formal basic and higher education settings, there is limited empirical evidence regarding its application in non-formal education programs such as the Alternative Learning System (ALS). ALS serves out-of-school youth, adults, and marginalized groups who often have irregular attendance, varied learning paces, and limited access to learning resources. While a few studies have examined technology use in ALS, most focus on access and availability rather than the actual knowledge and competencies of implementers. Furthermore, there is scarce data from the Zamboanga Peninsula region, leaving a gap in understanding how TPACK influences program effectiveness in this specific context.

This study addresses that gap by evaluating the extent of TPACK implementation among ALS implementers and measuring its relationship with teaching practices, resource utilization, and learner outcomes. Unlike previous studies that treat technology as a separate variable, this research applies the integrated TPACK model to assess how well these teachers combine knowledge domains to deliver quality education in non-formal settings.

Recent studies support the relevance of this framework. Yulianti et al. (2021) noted that while teachers may have basic technical skills, successful integration requires understanding how technology transforms content and instruction. Similarly, Ali et al. (2023) found that many educators struggle with the intersectional components of TPACK—specifically Technological Pedagogical Knowledge—even when they possess strong separate skills. This study builds on these findings by examining whether the same challenges exist among ALS implementers, who operate under different operational constraints.

General Objective

To determine the effectiveness of TPACK implementation among Alternative Learning System (ALS) implementers. Specifically, it aims:

1. To assess the level of implementation of TPACK among ALS implementers in terms of Technological Knowledge, Pedagogical Knowledge, Content Knowledge, Technological Content Knowledge, Pedagogical Content Knowledge, and Technological Pedagogical Knowledge.
2. To evaluate the level of effectiveness of TPACK implementation in terms of learner outcomes, teaching practices, resource utilization, and professional development.
3. To determine significant differences in TPACK levels and effectiveness when grouped by sex, age, district, educational attainment, years of experience, and type of ALS program.
4. To establish the relationship between TPACK implementation and its effectiveness.

Methodology

Research Design

This study employed a descriptive-correlational research design. The descriptive phase quantified the current status of TPACK competencies and their perceived effectiveness, while the correlational phase examined the statistical association between knowledge levels and outcomes. This design is appropriate as it allows observation and analysis of variables in their natural setting without manipulation (Creswell & Creswell, 2018).

Research Locale

The study was conducted in Districts 1 and 2 of Zamboanga City, covering urban and peri-urban communities. These districts were selected because they host the majority of ALS learning centers in the city, serving a diverse population of learners with varying levels of access to technology and educational support.

Population and Sampling Design

Total enumeration sampling was used, including all 20 registered ALS implementers in the two districts. This method was chosen because the population is small and finite, eliminating sampling error and ensuring full representation (Draugalis et al., 2008). The sample size is a limitation, as results cannot be generalized to larger populations or other regions, but it provides a complete picture of the target group.

Table 1 Distribution of Respondents

Profile Category	Classification	Frequency	Percentage
Sex	Male	11	55%
	Female	9	45%
Age	25–30	6	30%
	31–35	2	10%
	36–39	2	10%
	40 and above	10	50%
District	District 1	12	60%
	District 2	8	40%
Educational Attainment	Bachelor's Degree	11	55%
	With MA Units	8	40%
	Master's Degree	1	5%
Years of Experience	3 years & below	10	50%
	4–5 years	1	5%
	9–10 years	1	5%

Profile Category	Classification	Frequency	Percentage
	11–12 years	2	10%
	13 years & above	6	30%
Program Type	Basic Literacy Program	8	40%
	Accreditation & Equivalency	12	60%

Research Instrument

The questionnaire was adapted from the original TPACK instrument developed by Koehler and Mishra (2009), modified to fit the ALS context. It consists of two parts: Part 1 measures TPACK components using a 5-point Likert scale (1 = Not Implemented, 5 = Very Well Implemented); Part 2 measures effectiveness using a similar scale (1 = Not Effective, 5 = Very Effective).

Content validity was established by three experts in educational technology and non-formal education, yielding a Content Validity Index (CVI) of 0.91. Reliability was tested via a pilot study with 8 ALS teachers from another division, resulting in a Cronbach's alpha coefficient of 0.88, indicating high internal consistency (Taber, 2018).

Data Gathering Procedure

Permission was secured from the Schools Division Superintendent and ALS Focal Person. Informed consent was obtained from all participants, ensuring anonymity and voluntary participation. Questionnaires were distributed digitally and physically between January and February 2025. Data were encoded, cleaned, and analyzed using SPSS Version 26.

Statistical Treatment

Descriptive statistics (mean and standard deviation) summarized levels of implementation and effectiveness. T-test and ANOVA determined significant differences between groups. Pearson Product-Moment Correlation measured the strength of relationships. All tests were set at $\alpha = 0.05$.

Results and Discussion

Level of TPACK Implementation

Table 2 Level of TPACK Implementation

Component	Mean	Description	Key Observations
Technological Knowledge	4.07	Well-Implemented	Strong use of basic tools; limited skills in troubleshooting
Pedagogical Knowledge	4.19	Well-Implemented	Effective teaching strategies; needs more inclusive assessment
Content Knowledge	4.23	Very Well-Implemented	Strong mastery of subject matter and curriculum

Component	Mean	Description	Key Observations
Technological Content Knowledge	4.11	Well-Implemented	Good use of tools for content delivery; weak in tech-based assessment
Pedagogical Content Knowledge	4.14	Well-Implemented	Effective lesson adaptation; limited variety in methods
Technological Pedagogical Knowledge	**3.96**	**Well-Implemented**	**Lowest score; challenges in integrating tools into instruction**

The overall high ratings confirm that ALS implementers possess adequate knowledge across all domains. However, the lowest score in Technological Pedagogical Knowledge (TPK) reveals a critical gap. As noted by Ali et al. (2023), having separate knowledge of technology and teaching does not automatically translate to effective integration. This weakness implies that while teachers know what tools exist and how to teach, they struggle to design activities where technology actively improves the learning process. This finding aligns with Karkouti (2021), who observed that digital literacy alone does not ensure pedagogical application.

Implications of this gap: Without strong TPK, technology remains supplementary rather than transformative. Teachers may use tools for presentation but not for differentiation, collaboration, or formative assessment—limiting the potential benefits of digital resources, especially for learners with diverse backgrounds (Rincón-Flores et al., 2024).

Level of Effectiveness

Table 3 Level of Effectiveness

Indicator	Mean	Description	Key Observations
Learner Outcomes	3.96	Effective	Good engagement and understanding; **lowest in problem-solving and assessment results**
Teaching Practices	4.07	Effective	More interactive lessons; limited tech-based differentiation
Resource Utilization	4.15	Effective	Efficient use of open educational resources
Professional Development	4.08	Effective	Increased confidence in using technology

Learner outcomes received the lowest rating. This is consistent with the findings of Maghsudi et al. (2021), who explain that while technology boosts interest and engagement, improving higher-order thinking and assessment performance requires more intentional design. The delay in seeing results may also be due to external factors: irregular attendance, varied prior

knowledge, and limited time with learners—all common in ALS. To improve this, training should focus on designing technology-enhanced activities that target specific competencies rather than just delivery.

Differences by Respondent Profile

Table 4 Significant Differences

Variable	Significant?	Affected Domains	Interpretation
Sex / Age / District	No	None	TPACK levels are consistent across these groups
Educational Attainment	Yes	Pedagogical Knowledge	Degree holders have stronger theoretical teaching foundation
Years of Experience	Yes	TK, PK, CK, TPK, Teaching Practices	Competencies improve with time and practice
Program Type	**Yes**	**PK, TPK, all Effectiveness indicators**	**Higher scores in Accreditation & Equivalency program**

The significant difference by program type highlights that TPACK needs are context-dependent. The Accreditation and Equivalency program serves older learners aiming for certification, requiring more structured lessons and higher-order skills. In contrast, the Basic Literacy Program focuses on foundational skills, where technology use is often simpler. This suggests that professional development should be differentiated—modules for literacy teachers should focus on basic tools and engagement, while those for equivalency teachers should focus on assessment and content delivery (Borela, 2020).

Relationship Between TPACK and Effectiveness

Table 5 Correlation Analysis

TPACK Component	Correlation Strength	Significance
Technological Knowledge	Strong Positive	$p < 0.01$
Pedagogical Knowledge	Moderate to Strong Positive	$p < 0.01$
Content Knowledge	Moderate Positive	$p < 0.05$
Technological Pedagogical Knowledge	**Very Strong Positive**	**$p < 0.01$**

The strongest correlation found between Technological Pedagogical Knowledge and effectiveness confirms that this is the most critical competency. This supports the original TPACK framework (Mishra & Koehler, 2006) and recent studies by Ping (2020) and Suprihatiningrum (2023), which emphasize that integration is the key to improving outcomes. This validates the importance of focusing professional development not just on separate skills, but on how they work together.

Conclusions

Based on the findings, the following conclusions are drawn:

1. ALS implementers demonstrate adequate to strong TPACK competencies, but Technological Pedagogical Knowledge is the weakest area, limiting full integration of technology into instruction.

2. TPACK implementation is effective overall, but learner outcomes show the least improvement, influenced by instructional design and learner characteristics.

3. Educational attainment, years of experience, and program type significantly affect TPACK levels and effectiveness, while sex, age, and district do not.

4. Higher TPACK levels strongly correlate with better results, confirming its value as a framework for improving ALS quality.

Limitations of the Study:

1. Small sample size (N=20): Results are specific to the two districts and cannot be generalized to all ALS implementers in the region.
2. Self-reported data: Responses may be subject to response bias.
3. Cross-sectional design: Captures a snapshot in time; long-term changes were not observed.

Practical Implications

The findings provide actionable insights for policy and practice:

For DepEd ALS Division: Validates the need to adopt the TPACK framework in teacher training standards.

For Implementers: Identifies specific areas for self-improvement, especially in integrating technology with instruction.

For Future Research: Provides baseline data for larger-scale studies in other divisions.

Recommendations

1. Professional Development: Design training programs focused specifically on Technological Pedagogical Knowledge, moving beyond basic skills to lesson design, assessment, and troubleshooting. Provide differentiated modules for Basic Literacy and Accreditation & Equivalency teachers.

2. Support Systems: Establish regular peer learning sessions and technical support to reduce barriers in technology use.

3. Instructional Improvement: Guide teachers to use technology not just for delivery, but to design activities that develop critical thinking and mastery of competencies.

4. Future Research: Conduct similar studies with larger samples, include learner performance data, and use mixed methods to explore deeper experiences.

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