



Teachers' Perceptions of the Effectiveness and Implementation Challenges of the Technology and Livelihood Education (TLE) Program: Evidence from a Provincial Education Division in the Philippines

Article History:

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|---------------------------|------------------|
| Initial submission: | 03 February 2026 |
| First decision: | 08 February 2026 |
| Revision received: | 18 March 2026 |
| Accepted for publication: | 23 March 2026 |
| Online release: | 28 March 2026 |

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Abstract

Technology and Livelihood Education (TLE) play a critical role in equipping Filipino secondary learners with practical skills for employment and entrepreneurship. However, in geographically isolated and resource constrained divisions such as Catanduanes, variations in instructional capacity and material support continue to affect program implementation. Despite strong national policy support for skills-based education, uneven delivery at the school level highlights the need for localized, teacher centered evaluations. This study examined teachers' perceptions of the effectiveness of the TLE program, and the challenges encountered in its implementation in the Division of Catanduanes, with emphasis on how these vary across teacher specialization, teaching experience, and training exposure. Using a descriptive comparative research design, data were collected from 139 senior high school TLE teachers selected through stratified random sampling. A researcher developed questionnaire with high reliability (Cronbach's alpha = 0.986) measured program effectiveness in terms of curriculum relevance, teaching strategies, and resource availability, as well as implementation challenges across the same domains. Descriptive statistics, t-tests, and one-way ANOVA were employed for data analysis. Results revealed that the TLE program was generally perceived as highly effective, particularly in curriculum alignment and instructional strategies, while resource availability emerged as the most serious implementation challenge. Significant differences in perceived effectiveness and challenges were found across specialization, teaching experience, and number of trainings attended, underscoring the influence of professional competence and development on program outcomes. Based on the findings, a targeted teacher capability building program was proposed to strengthen instructional quality and address persistent resource constraints. The study provides empirical evidence to inform localized policy interventions and professional development initiatives aimed at enhancing the sustainability and effectiveness of skills-oriented education in provincial contexts.

Keywords: Technology and Livelihood Education (TLE), teacher perceptions, program effectiveness, implementation challenges, capability building program



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INTRODUCTION

Technology and Livelihood Education (TLE) play a pivotal role in preparing secondary school learners for employment, entrepreneurship, and meaningful community participation, particularly in developing economies where technical and vocational education and training (TVET) functions as a critical bridge between formal schooling and labor market demands

(UNESCO, 2016; OECD, 2019a). In the Philippines, TLE is embedded as a core component of the K to 12 curriculum, emphasizing practical competencies, contextualized instruction, and work readiness. Despite its strong policy positioning, research indicates that the effectiveness of skills-based programs such as TLE depends not only on curriculum design but also on the fidelity of implementation, teacher competence, and the adequacy of instructional

resources (UNESCO-UNEVOC, 2018a; World Bank, 2020a).

Recent international literature underscores that implementation fidelity remains a persistent concern in TVET systems, particularly within decentralized and resource-constrained contexts (OECD, 2020; Asian Development Bank, 2021a). Although national frameworks articulate clear competency standards, disparities in teacher specialization, access to professional development, and material support frequently result in uneven program delivery at the school level. Moreover, empirical studies emphasize that teachers' perceptions serve as critical indicators of program effectiveness, as they directly capture classroom realities and operational constraints that may not be fully reflected in policy-level evaluations (Billett, 2018; Darling-Hammond et al., 2017).

In the Philippines context, existing studies on TLE and TVET implementation has predominantly concentrated on curriculum alignment, student employability outcomes, or broad program evaluations at national or regional scales (Orbeta & Paqueo, 2019; UNESCO-UNEVOC, 2020). Nevertheless, three significant gaps remain evident. First, there is limited empirical inquiry into teachers' perceptions of TLE effectiveness alongside the specific challenges encountered in day-to-day implementation, particularly in provincial and island divisions. Second, few investigations systematically examine how teacher profile variables—such as specialization, years of teaching experience, and professional training exposure—influence both perceived effectiveness and implementation challenges within a unified analytical framework. Third, while professional development is widely acknowledged as indispensable, there remains a scarcity of empirically derived capability-building models grounded in teachers' articulated needs and contextual constraints.

The present study directly responds to these gaps by examining teachers' perceptions of the effectiveness and implementation challenges of

the TLE program in the Division of Catanduanes, a geographically distinct and resource-sensitive provincial context. Unlike prior research that treats effectiveness and challenges as discrete constructs, this investigation integrates both dimensions and analyzes variations across teacher profile variables through a descriptive-comparative design. Anchored in Implementation Fidelity Theory and Teacher Professional Competence and Capacity-Building Theory, the study advances beyond descriptive reporting and provides an explanatory framework for understanding variations in program outcomes (Durlak & DuPre, 2008; Darling-Hammond et al., 2017).

Importantly, the primary contribution of this study lies in its contextualized, teacher-centered analysis that links perceived program effectiveness, implementation challenges, and professional characteristics to the formulation of an evidence-based capability-building program. However, the scope of the investigation is confined to TLE teachers within the Division of Catanduanes and focuses solely on their self-reported perceptions of effectiveness and implementation challenges. The study does not directly measure student performance outcomes, institutional financial data, or longitudinal program impacts. Furthermore, given its descriptive-comparative design and geographically specific setting, the findings may not be generalizable to other divisions with substantially different structural or resource conditions. Nonetheless, by concentrating on teachers as primary implementers of TLE, the study generates actionable insights for enhancing instructional quality, addressing systemic resource limitations, and informing localized policy and professional development initiatives.

Consequently, the findings contribute to the expanding body of TVET and skills education research by providing empirically grounded evidence from a provincial education division, thereby strengthening the contextual relevance and applicability of TLE reforms in similar educational environments.

Statement of the Problem. The study examined teachers' perceptions of the effectiveness of the Technology and Livelihood Education (TLE) program and the challenges encountered in its implementation within the Division of Catanduanes. Specifically, it sought to answer the following questions:

1. What is the profile of TLE teachers in the Division of Catanduanes in terms of:
 - 1.1 area of specialization;
 - 1.2 length of teaching experience; and,
 - 1.3 number of TLE-related trainings and seminars attended?
2. What is the perceived level of effectiveness of the TLE program in terms of:
 - 2.1 curriculum relevance and alignment to livelihood competencies;
 - 2.2 teaching strategies and instructional practices; and,
 - 2.3 availability and adequacy of instructional resources?
3. What challenges are encountered by TLE teachers in the implementation of the program with respect to:
 - 3.1 curriculum delivery;
 - 3.2 instructional strategies; and,
 - 3.3 resource availability?
4. Is there a significant difference in the perceived effectiveness of the TLE program when teachers are grouped according to their profile variables?
5. Is there a significant difference in the challenges encountered in TLE implementation when teachers are grouped according to their profile variables?
6. What teacher capability-building program may be proposed based on the findings to enhance TLE program effectiveness and address identified implementation challenges?

Null Hypotheses. The following null hypotheses were systematically tested at the 0.05 level of statistical significance:

H₀₁: There is no significant difference in the perceived effectiveness of the TLE program among teachers when grouped according to their profile variables.

H₀₂: There is no significant difference in the challenges encountered in TLE implementation among teachers when grouped according to their profile variables.

Theoretical and Conceptual Framework. This study is grounded in Implementation Fidelity Theory and Teacher Professional Competence and Capacity-Building Theory, providing a comprehensive framework for examining the effectiveness and implementation challenges of the Technology and Livelihood Education (TLE) program. Implementation Fidelity Theory posits that the outcomes of educational programs depend on the extent to which curriculum, instructional strategies, and learning resources are executed as designed (Durlak & DuPre, 2008; Carroll et al., 2017). In the TLE context, deviations from prescribed curriculum standards, insufficient instructional materials, or inconsistent classroom delivery can compromise program effectiveness despite strong policy frameworks. Complementarily, Teacher Professional Competence Theory emphasizes that teachers' specialization, teaching experience, and participation in professional development are critical for high-quality instruction and faithful curriculum enactment (Darling-Hammond et al., 2017; Avalos, 2018a). Variations in teachers' training and pedagogical preparedness help explain differences in perceived program effectiveness and implementation challenges.

Figure 1 illustrates the conceptual paradigm, highlighting how teacher profile variables including specialization, years of experience, and TLE-related training interact with perceived program effectiveness and implementation challenges. Program effectiveness is examined through curriculum relevance, instructional strategies, and resource availability, whereas implementation challenges encompass curriculum delivery, teaching practices, and adequacy of resources. By integrating

theoretical and empirical perspectives, the paradigm emphasizes the role of teachers' perceptions and challenges as the foundation for designing a targeted capability-building program. Such a program aims to enhance instructional quality, address systemic barriers, and ensure the sustainable implementation of TLE across secondary schools in the Division of Catanduanes. Collectively, this framework bridges theory and practice, providing guidance for evaluating program outcomes and informing evidence-based interventions in skills-oriented education.

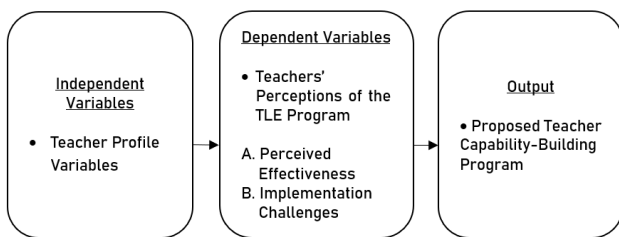


Figure 1
Conceptual Paradigm of the Study

LITERATURE REVIEW

Technology and Livelihood Education (TLE) serve as a cornerstone of skills-oriented schooling in the Philippines, aimed at equipping learners with practical competencies that enhance employability, entrepreneurship, and economic participation (UNESCO, 2016; World Bank, 2018). Anchored within the global framework of technical and vocational education and training (TVET), TLE emphasizes the alignment of classroom learning with labor market demands and community development goals (OECD, 2020). While policy frameworks outline its objectives, the effectiveness of TLE ultimately depends on classroom enactment, particularly teachers' instructional decisions and adaptations to local conditions (UNESCO-UNEVOC, 2020). Local empirical studies further affirm that teachers' technological competencies, professional awareness, and instructional challenges significantly shape educational program outcomes (Cordial et al., 2025a; Cordial et al., 2025b; Cordial et al., 2025c; Cordial et al., 2026). Consequently, teachers' perceptions of curriculum effectiveness,

instructional adequacy, and implementation challenges have emerged as critical indicators of program success and sustainability. The following review synthesizes existing literature on these dimensions, highlighting the interplay between teacher profiles, instructional strategies, resource availability, and capability-building interventions, while identifying gaps that the present study seeks to address in the context of provincial Philippine schools.

Technology and Livelihood Education (TLE) and Skills-Oriented Schooling. Technology and Livelihood Education (TLE) is anchored in the global framework of technical and vocational education and training (TVET), which emphasizes the development of practical competencies responsive to labor market demands and community development goals (UNESCO, 2016; OECD, 2020). In developing education systems such as the Philippines, TLE is positioned as a key mechanism for strengthening employability, entrepreneurship, and inclusive economic participation among secondary school learners (World Bank, 2018). However, contemporary scholarship increasingly asserts that the success of skills-oriented curricula depends less on formal policy design and more on how programs are enacted at the classroom level, particularly through teachers' instructional decisions and contextual adaptations (UNESCO-UNEVOC, 2020). Supporting this view, Cordial et al. (2025a) demonstrated that teachers' technological knowledge and instructional integration practices significantly influenced the effectiveness of classroom implementation, with resource limitations and pedagogical challenges constraining program delivery. This perspective has redirected empirical inquiry toward teachers' perceptions as critical indicators of both program effectiveness and long-term sustainability.

Teachers' Perceptions of Curriculum Effectiveness. Teachers' perceptions are widely recognized as valid and informative indicators of curriculum effectiveness, especially in applied and competency-based learning areas such as TLE (Hargreaves & Fullan, 2017).

Empirical studies suggest that teachers are more likely to perceive curricula as effective when learning competencies demonstrate clear alignment with workplace practices, livelihood skills, and local economic realities (OECD, 2019b). Within TVET-related programs, perceived effectiveness is closely associated with the suitability of teaching strategies, opportunities for experiential learning, and the coherence between curriculum standards and classroom conditions (Lucas et al., 2017). Local research further supports this relationship, as Cordial et al. (2025c) found that the effectiveness of the Rapid Mathematics Assessment program was closely tied to teachers' instructional strategies and perceived feasibility of program components. Similarly, Cordial et al. (2026) reported that teachers perceived gains in reading recovery strategies were strongly associated with program effectiveness, while implementation barriers moderated instructional outcomes. Conversely, when teachers identify gaps between curriculum expectations and available instructional support, perceived effectiveness declines despite strong policy intentions (Prieto et al., 2021). These findings highlight the importance of examining curriculum effectiveness through teachers' professional judgments, as they mediate policy implementation in everyday instructional contexts.

Instructional Strategies and Resource Adequacy. Effective TLE instruction relies heavily on pedagogical approaches that prioritize experiential learning, problem-based tasks, and industry-aligned practices (Billett, 2018). Post-2016 literature consistently identifies inadequate instructional resources—such as tools, equipment, and consumable materials—as major constraints to delivering competency-based education effectively (UNESCO-UNEVOC, 2018; Asian Development Bank, 2021a). Teachers' perceptions of instructional adequacy are further shaped by their capacity ADB to adapt strategies under resource-constrained conditions, often necessitating improvisation and personal financial investment (Lucas & Hanson, 2016).

These challenges are particularly pronounced in provincial and rural school settings, where disparities in funding and infrastructure persist (World Bank, 2020b). Consistent with these findings, Cordial et al. (2025a) documented that limited technological resources and insufficient instructional materials significantly hindered teachers' ability to implement integrated teaching practices effectively. As such, instructional effectiveness in TLE is inseparable from material conditions and systemic support.

Implementation Challenges in Skills-Based Education. Implementation challenges in TLE and comparable skills-based programs are commonly clustered around curriculum delivery, instructional practice, and resource availability (Durlak & DuPre, 2016). Curriculum delivery challenges emerge when prescribed competencies exceed available instructional time, facilities, or teacher expertise, resulting in partial or superficial skills acquisition (Carroll et al., 2017). Instructional challenges are intensified when teachers lack sustained professional development aligned with evolving curriculum standards and industry practices (Darling-Hammond et al., 2017). Empirical studies in Philippine school contexts echo these concerns, as Cordial et al. (2025b) identified professional capacity gaps and institutional constraints as key challenges influencing teachers' compliance and practice across educational programs. Moreover, Cordial et al. (2025c) and Cordial et al. (2026) reported that implementation barriers, including limited training and logistical constraints, adversely affected program effectiveness. Resource-related constraints are repeatedly identified as structural barriers that undermine fidelity of implementation, particularly in decentralized education systems where local capacities vary widely (OECD, 2020). Collectively, these studies suggest that implementation challenges are systemic rather than individual, reinforcing the need for empirical, context-specific investigations.

Teacher Profile Variables and Variations in Perceptions. Recent scholarship emphasizes that teachers' professional characteristics such

as area of specialization, length of teaching experience, and exposure to relevant training shape how educational programs are perceived and implemented (Avalos, 2018a; Opfer & Pedder, 2019). Teachers with appropriate specialization and continuous training tend to report higher instructional confidence and fewer perceived implementation challenges, while those teaching outside their specialization often experience instructional strain and reduced perceptions of program effectiveness (Darling-Hammond et al., 2017). Moderately related findings further suggest that instructional leadership competence among school heads contributes to improved administrative performance and instructional support structures (Cordial et al., 2025d). However, findings across contexts remain mixed, with some studies reporting minimal differences across experience levels, suggesting that contextual factors may mediate these relationships (Prieto et al., 2021). This inconsistency underscores the importance of localized studies that examine teacher profile variables within specific education divisions and program contexts.

Capability Building and Evidence-Based Interventions. Contemporary educational research increasingly positions teacher capability-building as a strategic response to persistent implementation challenges in skills-based education (Avalos, 2018b; OECD, 2019b). Effective professional development is characterized as sustained, context-responsive, and embedded in instructional practice rather than delivered through isolated training events (Darling-Hammond et al., 2017). Local empirical studies reinforce the value of targeted interventions informed by teachers' perceived needs and contextual constraints (Cordial et al., 2025a; Cordial et al., 2026). In TLE and TVET contexts, capability-building initiatives that integrate technical upskilling, pedagogical enhancement, and resource support have been shown to improve instructional confidence and curriculum effectiveness (UNESCO-UNEVOC, 2020). However, scholars emphasize that such interventions must be grounded in systematic

assessments of teachers' perceived needs and challenges to ensure relevance and sustainability (Billett, 2018).

Research Gap and Contribution of the Present Study. Despite the breadth of international literature on TVET and skills-oriented education, several critical gaps persist. First, there is limited empirical research examining teachers' perceptions of both effectiveness and implementation challenges of TLE within provincial education divisions in the Philippines, where contextual constraints differ significantly from urban settings. Second, many studies treat program effectiveness and implementation challenges as separate constructs rather than examining them concurrently and comparatively across teacher profile variables. Third, existing research often stops at problem identification without translating findings into empirically grounded capability-building interventions.

The present study addresses these gaps by systematically examining teachers' perceptions of TLE effectiveness and implementation challenges, analyzing differences across key profile variables, and using the findings as the empirical basis for proposing a targeted teacher capability-building program. In doing so, the study contributes context-specific evidence to the literature on skills-based education implementation and supports evidence-informed decision-making at the divisional level.

METHODS

Research Design. A descriptive-comparative research design is appropriate for examining teachers' perceptions of the effectiveness and implementation challenges of the Technology and Livelihood Education (TLE) program, as it enables systematic description and comparison of naturally occurring differences across teacher profile variables. Descriptive research is effective in portraying existing conditions and perceptions, while comparative analysis facilitates the identification of significant variations among groups without manipulating

variables (Creswell & Creswell, 2018). This design is widely used in educational research to explore relationships between teacher characteristics and program outcomes through survey-based data collected at a single point in time (Fraenkel et al., 2019). Moreover, the integration of descriptive and comparative approaches provides empirical evidence that supports data-driven decision-making and the development of targeted teacher capability-building interventions within educational programs.

Population, Samples and Sampling Technique.

The study population comprised 212 senior high school teachers from 42 public secondary schools in Catanduanes, Philippines, with school populations ranging from 1 to 18 teachers. To ensure both representativeness and practical feasibility, Slovin's formula with a 5% margin of error was applied, yielding a total sample of 139 respondents. The sample was proportionally allocated across schools to preserve the relative contribution of smaller and larger institutions, ensuring that each school's representation reflected its actual teacher population.

A stratified random sampling technique was utilized, with each of the 43 public secondary schools offering TLE in the Division of Catanduanes serving as a distinct stratum to ensure proportional representation across varied school contexts. From a total population of 212 TLE teachers, 139 were randomly selected based on each school's size, including larger institutions such as Catanduanes National High School (18; n=12), San Andres Vocational School (16; n=11), and Pandan School of Arts and Trades (16; n=11), as well as smaller schools such as Baldoc Integrated School (1; n=1) and Dariao National High School (1; n=1). This proportional stratification minimized selection bias and enhanced representativeness across the division (Taherdoost, 2018; Etikan et al., 2016), while enabling meaningful comparative analyses of teachers' perceptions regarding TLE effectiveness, instructional adequacy, and implementation challenges.

Instrumentation. The study employed a researcher-developed questionnaire informed by a comprehensive review of current literature on Technology and Livelihood Education (TLE) and competency-based teaching (Billett, 2018; Avalos, 2018b). The instrument comprised four parts: Part I collected demographic and professional profiles of TLE teachers, including specialization, years of teaching experience, and participation in TLE-related trainings or seminars; Part II evaluated teachers' perceptions of the program's effectiveness in relation to curriculum, instructional strategies, and resource availability; Part III explored the challenges encountered in program implementation, while Part IV integrated space for additional qualitative insights. To ensure face validity, the questionnaire was reviewed by the specialization committee, and their recommendations were incorporated into the final instrument.

Reliability was assessed through a pilot test involving 30 TLE teachers from Calatagan High School, Virac North District, yielding a Cronbach's alpha of 0.986, indicating excellent internal consistency (Taherdoost, 2016). Program effectiveness and implementation challenges were measured using 4-point Likert scales, with higher scores reflecting greater effectiveness or more serious challenges, respectively.

Date Collection. Data were collected through a researcher-developed questionnaire administered to TLE teachers in the Division of Catanduanes, consistent with quantitative research design principles (Creswell & Creswell, 2018; Fraenkel et al., 2019). To address Research Question 1, the first section elicited teachers' profile data, including area of specialization, length of teaching experience, and number of TLE-related trainings and seminars attended. For Research Question 2, the second section measured perceived program effectiveness across curriculum alignment to livelihood competencies, instructional practices, and adequacy of resources using scaled-response items.

For Research Question 3, the third section gathered data on challenges encountered in curriculum delivery, instructional strategies, and resource availability. A final section solicited inputs for a proposed capability-building program. The instrument underwent expert validation for content and reliability testing using Cronbach's alpha (Taherdoost, 2016). Ethical protocols were observed prior to distribution and retrieval (Israel & Hay, 2016), after which responses were coded and statistically analyzed to generate descriptive results and test for significant differences across teacher profile variables.

Data Analysis. Data collected from the researcher-developed questionnaire were coded, tabulated, and analyzed using both descriptive and inferential statistical techniques. Descriptive statistics, including frequency, percentage, weighted mean, and standard deviation, were used to summarize teachers' profiles, perceptions of TLE program effectiveness, and implementation challenges, providing a clear depiction of existing conditions (Creswell & Creswell, 2018; Fraenkel et al., 2019). Comparative analyses were conducted using the independent samples t-test and one-way analysis of variance (ANOVA) to examine significant differences in perceptions across teacher profile variables such as specialization, years of experience, and training exposure (Field, 2018). Pearson's correlation coefficient was also employed to determine relationships between perceived effectiveness and identified implementation challenges. All statistical analyses were performed using SPSS version 26, ensuring accuracy, reliability, and interpretability of results, which informed evidence-based recommendations for targeted teacher capability-building interventions.

Ethical Considerations. The present study adhered to established ethical standards in educational research to protect the rights and welfare of participants. Participation was entirely voluntary, and respondents were informed about the purpose, scope, and procedures of the study prior to data collection,

ensuring informed consent (Israel & Hay, 2016). Respondents were assured of the confidentiality and anonymity of their responses, with all data coded and stored securely to prevent unauthorized access. No personally identifiable information was collected, and aggregated results were reported to maintain privacy. Participants were also informed of their right to withdraw from the study at any point without penalty, minimizing potential coercion or undue influence (Creswell & Poth, 2018). Additionally, the study sought approval from the relevant school authorities and followed local institutional guidelines for conducting research in public schools. These measures ensured compliance with ethical principles, including beneficence, respect for persons, and justice, thereby safeguarding both the participants and the integrity of the research process (Fraenkel et al., 2019).

RESULTS

The results of the study are presented in this section according to the key research domains, including the demographic and professional profile of TLE teachers, their perceptions of program effectiveness, the challenges encountered in TLE implementation, differences across teacher profile variables, and the development of a proposed capability-building program to enhance instructional outcomes.

Profile of TLE Teachers in the Division of Catanduanes. Table 1 presents the profile of the 139 TLE teachers in terms of specialization, years of teaching experience, and number of trainings attended. The distribution of specializations indicates a strong technical orientation among respondents, with the largest proportion holding a Bachelor of Science in Industrial Technology (30.21%), followed by Agriculture and Fishery (20.86%) and Information and Communication Technology (14.38%). This suggests that most teachers possess academic backgrounds aligned with the practical and skills-based nature of the TLE curriculum. In terms of teaching experience, the majority of teachers

fall within the 5–9 years (35.97%) and 10–14 years (34.53%) brackets, reflecting a predominantly mid-career workforce with sufficient exposure to curriculum implementation. Only a small proportion (7.92%) have more than 20 years of experience, indicating limited representation of highly veteran teachers. Regarding professional development, over half of the respondents (51.94%) reported attending at least 10 trainings, suggesting moderate to high engagement in capability-building activities. However, a notable 28.06% attended fewer than five trainings, highlighting potential gaps in continuous professional development. Overall, the profile reflects a technically trained and moderately experienced teaching force, with varying levels of professional training that may influence perceptions of program effectiveness and implementation challenges.

Table 1
Profile of TLE Teachers (n = 139)

| Profile Variable | Category | Frequency | Percentage (%) |
|-------------------------------------|---|------------|----------------|
| Specialization | Bachelor of Agriculture and Fishery | 29 | 20.86 |
| | Bachelor of Science in Accountancy | 2 | 1.44 |
| | Bachelor of Science in Accounting Technology | 3 | 2.16 |
| | Bachelor of Science in Business Administration | 8 | 5.76 |
| | Bachelor of Science in Office Administration | 11 | 7.91 |
| | Bachelor of Science in Entrepreneurship | 4 | 2.88 |
| | Bachelor of Science in Secondary Education | 14 | 10.07 |
| | Bachelor of Science in Industrial Technology | 42 | 30.21 |
| | Bachelor of Science in Information and Communication Technology | 20 | 14.38 |
| | Bachelor of Science in Nutrition and Dietetics | 6 | 4.32 |
| Years of Teaching Experience in TLE | Total | 139 | 100.00 |
| | 25 years and above | 5 | 3.60 |
| | 20–24 years | 6 | 4.32 |
| | 15–19 years | 10 | 7.19 |
| | 10–14 years | 48 | 34.53 |
| Number of Trainings Attended | 5–9 years | 50 | 35.97 |
| | Less than 5 years | 20 | 14.39 |
| | Total | 139 | 100.00 |
| | 15 or more | 27 | 19.43 |
| | 10–14 | 28 | 20.14 |
| Total | 5–9 | 45 | 32.37 |
| | Less than 5 | 39 | 28.06 |
| | Total | 139 | 100.00 |

Perceived Level of Effectiveness of the TLE Program. Table 2 summarizes the composite effectiveness of the TLE program across key dimensions of curriculum, teaching strategies, and resource availability. Overall, the program

was rated as highly effective (WM = 3.18, SD = 0.62), indicating generally positive perceptions among TLE teachers regarding program implementation. Teaching strategies obtained the highest mean score (WM = 3.49, SD = 0.52), classified as very highly effective, suggesting that instructional practices such as hands-on activities, collaborative learning, and skills-based approaches are well implemented and strongly support student learning outcomes. Similarly, the curriculum dimension was rated very highly effective (WM = 3.46, SD = 0.55), reflecting teachers' confidence in the relevance and alignment of TLE competencies with livelihood skills and 21st-century demands. In contrast, resource availability recorded a lower yet still positive rating (WM = 2.59, SD = 0.80), falling under the highly effective category. The relatively larger standard deviation indicates greater variability in teachers' experiences with instructional materials, facilities, and technological resources across schools. Collectively, these findings suggest that while pedagogical practices and curriculum design are perceived as strong components of the TLE program, resource constraints remain a moderating factor that may influence the consistency of program effectiveness across different school contexts.

Table 2
Composite Effectiveness of the TLE Program

| Variable | Weighted Mean | SD | Verbal Interpretation | Rank |
|-----------------------|---------------|-------------|-------------------------|----------|
| Curriculum | 3.46 | 0.55 | Very Highly Effective | 2 |
| Teaching Strategies | 3.49 | 0.52 | Very Highly Effective | 1 |
| Resource Availability | 2.59 | 0.80 | Highly Effective | 3 |
| Overall | 3.18 | 0.62 | Highly Effective | — |

Legend: 3.25–4.00 = Very Highly Effective; 2.50–3.24 = Highly Effective; 1.75–2.49 = Less Effective; 1.00–1.74 = Least Effective

Challenges Encountered in TLE Program Implementation. Table 3 presents the composite challenges encountered in the implementation of the TLE program across curriculum, teaching strategies, and resource availability. Overall, the challenges were rated as less serious (WM = 2.09, SD = 0.71), suggesting that teachers

generally do not perceive major obstacles that severely hinder program delivery. Challenges related to teaching strategies obtained the lowest mean score (WM = 1.60, SD = 0.58), classified as least serious, indicating that teachers feel adequately equipped to implement appropriate instructional approaches such as hands-on activities and learner-centered strategies. Curriculum-related challenges were also perceived as less serious (WM = 2.00, SD = 0.73), implying that the content and structure of the TLE curriculum are largely manageable and responsive to learners' needs. In contrast, resource availability emerged as the most prominent concern (WM = 2.68, SD = 0.82), interpreted as serious. This finding reflects persistent issues related to insufficient tools, facilities, learning materials, and industry linkages necessary for effective skills-based instruction. The higher variability in responses further suggests unequal access to resources across schools. Taken together, the results indicate that while pedagogical and curricular aspects of TLE implementation are relatively stable, addressing resource constraints is critical to enhancing the overall quality and consistency of the program.

Table 3
Composite Challenges Encountered in TLE Program

| Variable | Weighted Mean | SD | Verbal Interpretation | Rank |
|-----------------------|---------------|-------------|-----------------------|------|
| Curriculum | 2.00 | 0.73 | Less Serious | 2 |
| Teaching Strategies | 1.60 | 0.58 | Least Serious | 3 |
| Resource Availability | 2.68 | 0.82 | Serious | 1 |
| Overall | 2.09 | 0.71 | Less Serious | — |

Legend: 3.25-4.00 = Very Serious; 2.50-3.24 = Serious; 1.75-2.49 = Less Serious; 1.00-1.74 = Least Serious

Differences in Perceived Effectiveness Across Teacher Profile Variables. Table 4 summarizes the significant differences in teachers' perceptions of TLE program effectiveness when grouped according to profile variables. Results indicate that specialization did not significantly influence perceptions of curriculum effectiveness (F = 1.016, p = .404), suggesting a shared evaluation of curricular relevance across academic backgrounds. However,

specialization significantly affected perceptions of teaching strategies (F = 4.059, p = .018) and resource availability (F = 7.242, p = .001), implying that teachers' disciplinary training shapes how instructional approaches and resources are utilized and assessed. Teaching experience significantly differentiated perceptions of curriculum effectiveness (F = 5.128, p = .001) and resource availability (F = 4.794, p = .013), indicating that more experienced teachers may develop heightened awareness of curricular alignment and structural constraints. In contrast, experience did not significantly influence views on teaching strategies (F = 2.626, p = .086), reflecting relative consistency in pedagogical practices across experience levels. Number of trainings attended emerged as a strong determinant of perceived curriculum effectiveness (F = 12.052, p = .000) and teaching strategies (F = 45.625, p = .000), underscoring the role of professional development in shaping instructional quality. Overall, the findings highlight training and experience as critical drivers of perceived program effectiveness, while specialization primarily influences instructional and resource-related dimensions.

Table 4
Significant Differences in the Perceived Effectiveness of the TLE Program by Profile Variables (n = 139)

| Profile Variable | Curriculum | Teaching Strategies | Resource Availability |
|------------------------------|------------------------|------------------------|-----------------------|
| Specialization | F = 1.016, p = .404 X | F = 4.059, p = .018 ✓ | F = 7.242, p = .001 ✓ |
| Teaching Experience | F = 5.128, p = .001 ✓ | F = 2.626, p = .086 X | F = 4.794, p = .013 ✓ |
| Number of Trainings Attended | F = 12.052, p = .000 ✓ | F = 45.625, p = .000 ✓ | F = 1.545, p = .229 X |

Note. ✓ = significant at $\alpha = .05$; X = not significant. Significant ANOVA results were subjected to post hoc multiple comparisons (reported in Supplementary Tables).

Differences in Challenges Encountered Across Teacher Profile Variables. Table 5 presents the significant differences in challenges encountered by TLE teachers across profile variables. Specialization significantly influenced perceived curriculum-related challenges (F = 24.906, p = .000) and teaching strategy challenges (F = 10.815, p = .000), indicating that teachers from different academic

backgrounds experience varying levels of difficulty in implementing curriculum content and instructional approaches. However, specialization did not significantly affect challenges related to resource availability ($F = 2.345, p = .098$), suggesting that material constraints are broadly experienced regardless of specialization. Teaching experience significantly differentiated curriculum challenges ($F = 11.333, p = .000$), implying that less experienced teachers may face greater difficulty in interpreting and delivering curriculum requirements, while experience did not significantly influence challenges in teaching strategies ($F = 1.312, p = .305$) and resources ($F = 0.667, p = .585$). Number of trainings attended significantly affected curriculum challenges ($F = 25.760, p = .000$) and resource availability challenges ($F = 15.782, p = .000$), highlighting the role of professional development in mitigating instructional and structural difficulties. Overall, the findings emphasize that curriculum-related challenges are strongly shaped by specialization, experience, and training, while resource constraints remain systemic across groups.

Table 5
Significant Differences in the Challenges Encountered by TLE Teachers by Profile Variables (n = 139)

| Profile Variable | Curriculum | Teaching Strategies | Resource Availability |
|------------------------------|--------------------------|--------------------------|--------------------------|
| Specialization | $F = 24.906, p = .000$ ✓ | $F = 10.815, p = .000$ ✓ | $F = 2.345, p = .098$ ✗ |
| Teaching Experience | $F = 11.333, p = .000$ ✓ | $F = 1.312, p = .305$ ✗ | $F = 0.667, p = .585$ ✗ |
| Number of Trainings Attended | $F = 25.760, p = .000$ ✓ | $F = 2.379, p = .095$ ✗ | $F = 15.782, p = .000$ ✓ |

Note. ✓ = significant at $\alpha = .05$; ✗ = not significant. Significant ANOVA results were subjected to post hoc multiple comparisons (reported in Supplementary Tables).

Proposed Teacher Capability-Building Program Based on Study Findings

Rationale. The Capability Building Program for the Technology and Livelihood Education (TLE) Program is developed in response to the findings of the present study, which revealed that while the TLE program in the Division of Catanduanes is generally perceived as highly effective, particularly in curriculum relevance

and teaching strategies, persistent challenges remain, especially in the area of resource availability. Moreover, the study demonstrated significant differences in perceived program effectiveness and implementation challenges when teachers were grouped according to specialization, teaching experience, and number of trainings attended, underscoring the uneven distribution of competencies and support across teacher groups.

The results further highlighted that professional development plays a critical role in enhancing instructional quality, as teachers with greater training exposure consistently reported higher levels of effectiveness and fewer curriculum-related challenges. At the same time, the strong technical orientation of many TLE teachers, coupled with the presence of non-major instructors, necessitates targeted interventions to ensure pedagogical consistency, curriculum alignment, and effective utilization of limited resources.

In this context, the proposed Capability Building Program is designed to sustain existing strengths in curriculum implementation and teaching strategies, while systematically addressing resource-related constraints and professional gaps. By providing differentiated training, mentoring, and resource management support, the program aims to strengthen teachers' competence, instructional confidence, and adaptability. Ultimately, this initiative seeks to enhance the quality, equity, and sustainability of TLE instruction, thereby improving students' acquisition of practical skills and readiness for livelihood, entrepreneurship, and employment opportunities.

Objectives. The Capability Building Program for the TLE Program aims to:

1. Sustain and further enhance the effectiveness of TLE curriculum implementation and teaching strategies in secondary schools.
2. Reduce curriculum- and resource-related challenges encountered by TLE teachers

through targeted professional development and support mechanisms.

3. Strengthen the instructional competence of TLE teachers, particularly non-majors and less experienced teachers, through specialization-aligned and needs-based training.
4. Promote effective resource utilization, innovation, and school-community-industry partnerships to address persistent material and facility constraints.

Expected Outcomes. The implementation of this Capability Building Program is expected to result in improved instructional consistency, enhanced teacher competence across specializations, reduced curriculum and resource-related challenges, and strengthened professional confidence among TLE teachers. In the long term, the program contributes to a more resilient and responsive TLE system that supports high-quality skills development and learner readiness for livelihood and employment. Table 6 presents the matrix of the Proposed Teacher Capability-Building Program.

DISCUSSION

This section presents and interprets the findings of the study in relation to existing literature on Technology and Livelihood Education (TLE), focusing on teachers' professional profiles, perceived program effectiveness, implementation challenges, and variations across specialization, teaching experience, and training exposure. It further integrates conclusions and evidence-based recommendations drawn from the results.

The profile of TLE teachers in the Division of Catanduanes demonstrates a workforce largely composed of technically aligned professionals, with the highest representation from Industrial Technology (30.21%), Agriculture and Fishery (20.86%), and Information and Communication Technology (14.38%). This distribution supports the skills-oriented mandate of TLE within the TVET framework (UNESCO, 2016; OECD, 2020). The predominance of teachers with five to fourteen years of experience (70.50%) reflects a mid-career workforce capable of curriculum implementation while remaining adaptable to pedagogical innovations.

Table 6

Matrix of Proposed Teacher Capability-Building Program to Address Identified Implementation Challenges.

| Objective | Activity | Timeline | Resources | Success Indicator: Results |
|---|--|---------------------------|--|---|
| To sustain and enhance the effectiveness of TLE curriculum implementation | Curriculum alignment workshops focusing on competency standards, contextualization, and localization | First Quarter (Year 1) | Curriculum guides, subject experts, DepEd specialists | Improved alignment of lesson plans with TLE competencies; increased teacher confidence in curriculum delivery |
| To strengthen teaching strategies across specializations | Specialized pedagogical training on hands-on, skills-based, and learner-centered approaches | Second Quarter (Year 1) | Training modules, master teachers, demonstration materials | Consistent use of effective teaching strategies across TLE specializations |
| To address disparities related to specialization | Cluster-based mentoring and peer coaching among major and non-major TLE teachers | Whole Academic Year | Mentor teachers, coaching guides, observation tools | Reduced gaps in instructional effectiveness between major and non-major teachers |
| To enhance professional competence through continuous development | Structured in-service training program with specialization tracks (ICT, Agri-Fishery, Industrial Arts, Entrepreneurship) | Annually | Training funds, external trainers, industry partners | Increased participation in trainings; improved perceptions of program effectiveness |
| To reduce curriculum-related challenges among less experienced teachers | Induction and refresher programs for novice and mid-career TLE teachers | First and Second Quarters | Orientation manuals, facilitators | Lower reported curriculum challenges among teachers with fewer years of experience |
| To mitigate resource availability challenges | Training on resource management, improvisation, and low-cost instructional material development | Third Quarter (Year 1) | Sample improvised tools, instructional guides | Improved utilization of available resources; reduced dependence on complete facilities |
| To strengthen school-community-industry linkages | Partnership-building workshops and local industry immersion | Fourth Quarter (Year 1) | MOA templates, local industry partners | Increased number of functional partnerships supporting TLE instruction |
| To institutionalize monitoring and sustainability | Periodic monitoring, evaluation, and feedback sessions | Every Semester | Evaluation tools, school heads, TLE coordinators | Sustained improvement in program effectiveness and reduced implementation challenges |

However, disparities in training exposure, where 28.06% attended fewer than five trainings, suggest uneven professional development opportunities. Consistent with Avalos (2018a) and Darling-Hammond et al. (2017), limited training participation may constrain instructional refinement and responsiveness to evolving curriculum demand.

Overall, the TLE program was rated as highly effective (WM = 3.18), with teaching strategies receiving the highest effectiveness rating (WM = 3.49). This result indicates strong institutionalization of experiential and learner-centered methodologies, which aligns with Billett's (2018) assertion that hands-on pedagogies enhance competency acquisition in skills-based education. Similarly, the very high effectiveness of the curriculum dimension (WM = 3.46) reflects alignment between TLE competencies and livelihood-oriented goals, consistent with OECD (2019a) findings that relevance to labor market needs strengthens perceived curriculum quality. However, resource availability recorded a comparatively lower effectiveness rating (WM = 2.59), accompanied by higher variability (SD = 0.80), suggesting uneven material support across schools. This mirrors UNESCO-UNEVOC (2018b) and World Bank (2020b) reports identifying resource inadequacy as a persistent barrier in provincial TVET contexts.

Implementation challenges were generally perceived as less serious (WM = 2.09), particularly in teaching strategies (WM = 1.60), indicating sufficient pedagogical competence among teachers. This supports Durlak and DuPre's (2016) assertion that strong instructional capacity can mitigate many operational barriers. Nevertheless, resource availability emerged as a serious challenge (WM = 2.68), reinforcing structural limitations previously documented in both international and local studies (Asian Development Bank, 2021b; Cordial et al., 2025a). The prominence of resource constraints suggests that while instructional practices are well developed, systemic support remains insufficient to ensure consistent program quality.

Significant differences in perceived effectiveness across profile variables further highlight the role of professional characteristics. Specialization significantly influenced perceptions of teaching strategies ($F = 4.059, p = .018$) and resource availability ($F = 7.242, p = .001$), indicating that teachers' academic backgrounds shape instructional utilization and access to materials. Teaching experience significantly affected curriculum effectiveness ($F = 5.128, p = .001$) and resource perceptions ($F = 4.794, p = .013$), suggesting that experienced teachers develop greater awareness of curricular coherence and institutional constraints. Moreover, number of trainings attended emerged as a strong determinant of curriculum effectiveness ($F = 12.052, p = .000$) and teaching strategies ($F = 45.625, p = .000$), underscoring professional development as a critical driver of instructional quality. These findings align with Opfer and Pedder (2019), who emphasized sustained training as central to instructional improvement in competency-based programs.

Similarly, challenges encountered varied significantly across profile variables. Specialization significantly influenced curriculum challenges ($F = 24.906, p = .000$) and teaching strategy challenges ($F = 10.815, p = .000$), suggesting that non-major teachers may experience greater instructional strain, as noted by Darling-Hammond et al. (2017). Teaching experience significantly differentiated curriculum challenges ($F = 11.333, p = .000$), implying that novice teachers face greater difficulty in interpreting curricular demands. Training exposure also significantly affected curriculum challenges ($F = 25.760, p = .000$) and resource-related challenges ($F = 15.782, p = .000$), reinforcing the mitigating role of professional development. In contrast, resource challenges remained largely systemic, unaffected by specialization and experience, highlighting structural inequities.

Taken together, the results indicate that the TLE program in Catanduanes is pedagogically strong and curriculum-aligned but structurally constrained by resource limitations and uneven

professional development. Consequently, the study concludes that sustaining program effectiveness requires institutional investments in instructional materials, facilities, and equitable training opportunities. The proposed Capability Building Program directly responds to these needs by emphasizing specialization-aligned training, mentoring, resource management, and partnership development. Consistent with Darling-Hammond et al. (2017) and UNESCO-UNEVOC (2020), such sustained and context-responsive interventions are expected to enhance instructional consistency, reduce implementation challenges, and improve long-term program sustainability.

The study concludes that the Technology and Livelihood Education program in the Division of Catanduanes is largely effective in achieving its curricular and instructional objectives, particularly through strong learner-centered teaching strategies and relevant competency-based content. The technical alignment and moderate experience of the teaching workforce contribute positively to program implementation. However, persistent resource limitations and uneven access to professional development continue to moderate the consistency of instructional quality across schools. Significant variations in effectiveness and challenges based on specialization, teaching experience, and training exposure further indicate that teacher capacity and institutional support structures play a critical role in shaping program outcomes. Overall, while pedagogical foundations of the TLE program are sound, systemic strengthening is necessary to sustain its long-term impact.

Based on the findings, it is recommended that education administrators prioritize sustained and equitable professional development opportunities tailored to teachers' specializations and experience levels. Institutional investments in instructional materials, workshops, and facilities should be strengthened to address persistent resource-related challenges. The implementation of the proposed Capability Building Program is strongly encouraged as a structured

mechanism for enhancing instructional competence, reducing curriculum-related difficulties among novice and non-major teachers, and promoting innovative resource utilization. Additionally, partnerships with local industries, communities, and training institutions should be institutionalized to supplement material support and ensure curriculum relevance. Continuous monitoring and evaluation of TLE implementation are further recommended to guide data-driven policy adjustments and instructional improvements.

This study is limited by its reliance on self-reported perceptions, which may be influenced by subjective experiences or social desirability bias. Future research should incorporate classroom observations, learner outcome measures, and administrative data to triangulate findings. Additionally, the focus on a single education division restricts generalizability. Comparative studies across diverse regions may yield broader insights into contextual influences on TLE implementation. Further qualitative investigations could explore the mechanisms through which specialization, experience, and training shape instructional practices. Finally, longitudinal studies assessing the implementation and impact of the proposed Capability Building Program would provide valuable evidence on its effectiveness in addressing systemic challenges and enhancing instructional outcomes.

Author contributions. Oliver M. Tabuzo: Conceptualization, Data Gathering, Methods, Results and Discussions | Johnmar F. Cordial: Introduction, Methods, Results and Discussions, References | Juan S. Torreja: Conceptualization.

Conflict of interest. The authors declare no conflict of interest.

Funding source. This research received no external funding.

Artificial intelligence use. AI-assisted language editing was performed using ChatGPT; authors reviewed and approved all content.

Ethics approval statement. This study involved human respondents; however, formal ethical approval was not sought from the authors' institution. The authors affirm that participation was voluntary, informed consent was obtained, and confidentiality of responses was strictly maintained. No procedures were undertaken that posed risk or harm to the participants.

Data availability statement. All data supporting the findings of this study are included within the manuscript and its supplementary materials.

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REFERENCES

- Asian Development Bank. (2021a). *Innovative strategies in technical and vocational education and training for Asia and the Pacific*. <https://www.adb.org/publications/innovative-strategies-tvet-asia-pacific>
- Asian Development Bank. (2021b). *Strengthening technical and vocational education and training in the Philippines*. <https://www.adb.org/publications/strengthening-tvet-philippines>
- Avalos, B. (2018a). Teacher professional development in teaching and teacher education over ten years. *Teaching and Teacher Education*, 75, 1–12. <https://doi.org/10.1016/j.tate.2018.05.009>
- Avalos, B. (2018b). Teacher professional development in teaching and teacher education over ten years. *Teaching and Teacher Education*, 75, 7–16. <https://doi.org/10.1016/j.tate.2018.06.007>
- Billett, S. (2018a). Distinguishing lifelong learning from lifelong education. *Journal of Adult Learning, Knowledge and Innovation*, 2(1), 1–7. <https://doi.org/10.1556/2059.01.2018.01>
- Billett, S. (2018b). *Learning through practice: Models, traditions, orientations, and approaches*. Springer. <https://doi.org/10.1007/978-981-13-1176-9>
- Carroll, A., Forlin, C., & Jobling, A. (2017). The impact of teacher training in curriculum implementation. *Curriculum Perspectives*, 37(1), 33–44. <https://doi.org/10.1007/s41297-016-0006-2>
- Cordial, J. F., Amaranto, L. V., & Bermudo, P. J. V. (2025b). Teachers' awareness, compliance, and challenges in upholding the code of ethics: Insights from public elementary schools in Panganiban District, Catanduanes, Philippines. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, 6(1), 134–146. <https://doi.org/10.62718/vmca.pr-ijetas.6.1.SC-1025-013>
- Cordial, J. F., Evangelista, J. T., & Bermudo, P. J. V. (2025a). Technological knowledge, integration practices, and challenges of primary school teachers in Zone III, Division of Catanduanes: Insights from the TPACK framework. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, 6(1). <https://doi.org/10.62718/vmca.pr-ijetas.6.1.SC-1125-001>
- Cordial, J. F., Tabuzo, J. V., & Bermudo, P. J. V. (2025d). Instructional leadership competence, financial management proficiency, and administrative performance of elementary school heads. *Business Fora: Business and Allied Industries International Journal*, 6(1), 118–130. <https://doi.org/10.62718/vmca.bfbaiij.6.1.SC-1125-018>

- Cordial, J. F., Valledor, A. S., & Bermudo, P. J. V. (2025c). Implementation strategies, challenges, and effectiveness of the Rapid Mathematics Assessment (RMA) in improving learners' mathematical competence: Evidence from the Panganiban District, Schools Division of Catanduanes. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, 6(1), 147–158. <https://doi.org/10.62718/vmca.pr-ijetas.6.1.SC-1125-021>
- Cordial, J. F., Villegas, H. T., & Bermudo, P. J. V. (2026). Perceived gains, implementation barriers, and effectiveness of reading recovery strategies: Evidence from Viga East and West Districts, Schools Division of Catanduanes. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, 7(1), 17–30. <https://doi.org/10.62718/vmca.pr-ijetas.7.1.SC-1125-034>
- Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). *Sage Publications*.
- Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry and research design: Choosing among five approaches (4th ed.). *Sage Publications*.
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute. <https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report>
- Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes. *American Journal of Community Psychology*, 41(3–4), 327–350. <https://doi.org/10.1007/s10464-008-9165-0>
- Durlak, J. A., & DuPre, E. P. (2016). Implementation matters. *American Journal of Community Psychology*, 41(3–4), 327–350. <https://doi.org/10.1007/s10464-008-9165-0>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). *Sage Publications*.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). How to design and evaluate research in education (10th ed.). *McGraw-Hill Education*.
- Hargreaves, A., & Fullan, M. (2017). Professional capital: Transforming teaching in every school. *Teachers College Press*.
- Israel, M., & Hay, I. (2016). Research ethics for social scientists: Between ethical conduct and regulatory compliance (2nd ed.). *Sage Publications*.
- Lucas, B., & Hanson, J. (2016). Thinking like an engineer. *Royal Academy of Engineering*. <https://www.raeng.org.uk/publications/reports/thinking-like-an-engineer>
- Lucas, B., Spencer, E., & Claxton, G. (2017). How to teach vocational education. *City & Guilds*.
- OECD. (2019a). *OECD skills outlook 2019*. <https://doi.org/10.1787/df80bc12-en>
- OECD. (2019b). *Preparing for the changing nature of work in Asia and the Pacific*. <https://www.oecd.org/education/prepari>

- ng-for-the-changing-nature-of-work-in-asia-and-the-pacific-9789264313940-en.htm
- OECD. (2020). *Strengthening the governance of skills systems*. <https://doi.org/10.1787/3a4bb6a1-en>
- Opfer, V. D., & Pedder, D. (2019). Teacher change and changing teachers. *Teaching and Teacher Education, 47*, 63–80. <https://doi.org/10.1016/j.tate.2014.12.001>
- Prieto, L. P., Villagra-Sobrino, S., & Jorrín-Abellán, I. M. (2021). Teacher sense-making of curriculum reform. *Teaching and Teacher Education, 103*, 103346. <https://doi.org/10.1016/j.tate.2021.103346>
- Taherdoost, H. (2016). Validity and reliability of the research instrument; How to test the validation of a questionnaire/survey in research. *International Journal of Academic Research in Management, 5*(3), 28–36. <https://doi.org/10.2139/ssrn.3205040>
- Taherdoost, H. (2018). Sampling methods in research methodology; How to choose a sampling technique for research. *International Journal of Academic Research in Management, 7*(2), 18–27. <https://doi.org/10.2139/ssrn.3205035>
- UNESCO. (2016). *Strategy for technical and vocational education and training (TVET) 2016–2021*. <https://unesdoc.unesco.org/ark:/48223/pf0000245239>
- UNESCO-UNEVOC. (2018a). *Improving the quality of TVET systems*. <https://unevoc.unesco.org/home/TVET+Quality>
- UNESCO-UNEVOC. (2018b). *Innovations in TVET for sustainable development*. <https://unevoc.unesco.org>
- UNESCO-UNEVOC. (2020). *Teacher training for TVET*. <https://unevoc.unesco.org/home/TVET+Teacher+Training>
- World Bank. (2018). *World development report: Learning to realize education's promise*. <https://doi.org/10.1596/978-1-4648-1096-1>
- World Bank. (2020a). *Skills development in the Philippines*. <https://documents.worldbank.org>
- World Bank. (2020b). *TVET systems and labor market outcomes*. <https://documents.worldbank.org/en/publication/documentsreports/documentdetail/099548003102033553>