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Enhanced Pedagogical Toolkit: The Impact of Project SMART

Esper L. Feliciano*
Benguet State University
La Trinidad, Benguet, Philippines

Corazon L. Ocden and Arlene L. Palasico
Cordillera Career Development College
La Trinidad, Benguet, Philippines

Abstract. This study evaluated the impact of Project SMART (Supporting, Mentoring, and Reinforcing Teachers), a teacher education institution (TEI) extension project designed to enhance instructional practices through a continuing professional development (CPD) framework. Grounded in a dual-framework approach—utilizing the logic model for operational fidelity and Kirkpatrick's four-level evaluation for multi-tiered outcomes—this parallel mixed-methods analysis investigated participant satisfaction, pedagogical shifts, and intended professional actions. Purposive sampling was employed to define a quantitative sample of unique, matched participants (N = 143) using paired-samples t-tests, alongside a qualitative cohort (n = 40) comprising 30 participant-beneficiaries selected through data saturation and 10 project team members selected via complete enumeration. Qualitative data were processed through thematic induction. Results demonstrated high participant satisfaction (M = 3.85) and revealed statistically significant gains for Key Stage 1 participants (t (28) = -3.53, p = .001) in applying the conceptual-representational-abstract (CRA) model. While Key Stage 2 results indicated a non-significant but positive upward trend (d = -0.342), qualitative findings confirmed a universal intent to implement these practices. The study culminated in the Integrated Pedagogical Toolkit Enhancement Model (IPTEM), providing an empirical blueprint for achieving systemic effect (Level 4). By integrating cyclical feedback loops and rigorous assessment, these findings offer a scalable roadmap for measuring authentic impact in educational extension projects.

Keywords: Project SMART; Kirkpatrick evaluation model; mixed-methods research; conceptual-representational-abstract model; extension project

*Corresponding author: Esper L. Feliciano; *e.feliciano@bsu.edu.ph*

1. Introduction: Background and Objective Statement

Despite significant global investments in teacher education, a persistent challenge remains in bridging the gap between pedagogical knowledge and effective instructional practice. This is particularly evident in foundational STEM areas, where Philippine basic education has historically struggled with conceptual mastery (Mavhunga & van der Merwe, 2020; Wang et al., 2023). Contemporary educational goals require teachers to move beyond traditional instruction and adopt high-impact, evidence-based pedagogies (Kanthimathi & Raja, 2025; Wani & Hussian, 2024; Wang, 2019). This transformation calls for a continuous renewal of the educator's pedagogical toolkit (Angwaomaodoko, 2024; Hazard et al., 2024). Failure to equip teachers with innovative, research-based models directly undermines student learning and achievement globally (Mandot, 2023; Rosmaria, 2024).

Addressing this challenge requires robust, adaptive models of continuing professional development (CPD) (Chew, 2016; Mavhunga & van der Merwe, 2020). Existing programs—often governed by centralized frameworks such as the National Educator Academy of the Philippines (NEAP)—typically follow standardized delivery models that may lack the agility to address specific pedagogical deficits at the classroom level (Main & Pendergast, 2019; Merino et al., 2025). Consequently, the extension mandate of teacher education institutions (TEIs) is recognized as a critical mechanism for bridging this gap (Argabright et al., 2019). Teacher education institutions are strategically positioned to translate research findings, informed by rigorous training needs assessments (TNAs), into practical, classroom-ready skills (Ashraf et al., 2023). This partnership is vital to supporting Sustainable Development Goal (SDG) 4: Quality Education (Unni et al., 2019). In the Philippines, this model is further reinforced by Republic Act No. 11713 (Congress of the Philippines, 2022), which designates extension services as core standards for TEIs to maintain relevance to basic education.

In fulfillment of its mandate as a state university and college (SUC) and a center of excellence (COE), the Benguet State University College of Teacher Education (BSU-CTE) Department of Elementary Teacher Education (DETED) launched Project SMART in June 2022. The initiative aimed to enhance educators' pedagogical toolkit while fostering professional ethics and lifelong learning. Project SMART strengthened participants' capacity to deliver standards-aligned elementary education that met both national mandates and community needs. This was achieved through a series of meticulously designed, multi-phase training workshops that provided systematic support, mentoring, and reinforcement essential to participants' professional growth.

However, completing such workshops represents only the initial phase of the extension cycle. Rigorous impact assessments, such as those applied to Project SMART, are essential to move beyond mere operational compliance toward institutional accountability (Kirkpatrick & Kirkpatrick, 2006). Unlike traditional evaluations focused on process, this study utilized an impact framework to measure the transfer of training—Kirkpatrick's Level 3 (Behavior)through

intended classroom actions. Evaluating this transfer is critical for ensuring that pedagogical innovations are effectively translated into practice (Baker, 2013). Such analysis moves beyond anecdotal feedback to provide an empirical basis for university investment while increasing transparency for stakeholders (Patton, 2008). By establishing a link between the intervention and observed shifts in practice, these evaluations enable the project team to identify specific strengths and weaknesses (Chen, 2015). Ultimately, this process facilitates the data-driven refinement of future initiatives, ensuring they remain capable of influencing broader educational policies and practices (Cahapay, 2021; Chiappelli & Leoncini, 2025).

To ensure scholarly rigor, this study evaluated Project SMART through three specific dimensions. The study aimed to:
(1) Assess program fidelity relative to the operational design of the project.
(2) Determine immediate outcomes in terms of participant satisfaction and measurable pedagogical gains.
(3) Evaluate the shifts in knowledge, beliefs, and actions (KBA) resulting from the Project SMART participation.

2. Conceptual Framework

This impact analysis is grounded in an integrated theoretical framework designed to assess the transformation of the pedagogical toolkit and validate the efficacy of the TEI-led extension project. It utilizes three pillars, specifically a process model, a measurement model, and a behavioral change mechanism, to provide a thorough evaluation.

The study adopted a CPD framework as its overarching lens, specifically focusing on the micro-level transformation of instructional practices (Hosseini et al., 2023). Within this framework, the logic model (W.K. Kellogg Foundation, 2004) functions as the process model, ensuring program fidelity by structuring the evaluation of implementation quality and resource allocation (Patton, 2008). It essentially answers whether the inputs and activities of the project were delivered as intended. In parallel with the logic model, Kirkpatrick's four-level training evaluation model (Kirkpatrick & Kirkpatrick, 2006) serves as the primary measurement model.

This study used a cross-sectional design focusing on Levels 1 (Reaction), 2 (Learning), and 3 (Behavior). This focus is necessary because the progression from learning to behavior is often interrupted by a transfer gap, in which participants struggle to translate theoretical ideas into classroom actions; evaluating these levels provides a robust proxy for training transfer (Wang et al., 2023). To explain how this transfer occurs, the analysis utilized social learning theory (SLT) (Bandura, 1977) as the underlying behavioral mechanism. By focusing on perceived self-efficacy and vicarious learning, SLT justifies the shifts in knowledge, beliefs, and actions (KBA)—the measurable indicators of pedagogical impact (Göçen Kabaran & Uşun, 2021). This entire theoretical structure, which bridges institutional inputs with specific behavioral outputs, is

visually synthesized through the input-process-output (IPO) model, illustrated in Figure 1.

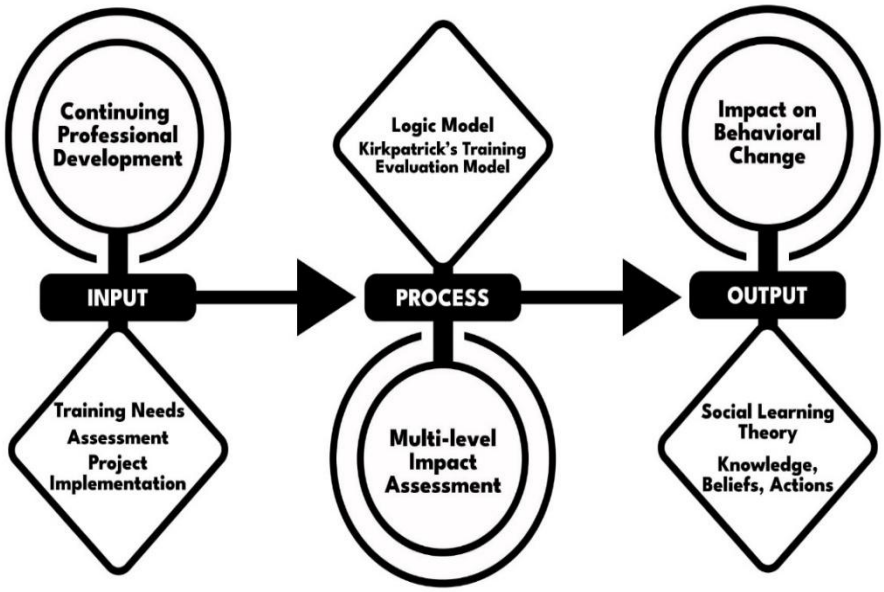

Figure 1: Integrated theoretical framework for impact analysis

2.1 Continuing Professional Development in Extension Project Evaluation

The CPD framework serves as the primary model for assessing the effectiveness of implemented extension projects (Al-Thani et al., 2025; Argabright et al., 2019). Research demonstrates that robust CPD directly enhances implementers' capabilities, thereby improving both project execution and instructional methods (Chachar et al., 2023). A central requirement for success is contextual adaptability, which ensures that activities are successfully tailored to the unique needs of the extension environment (Merry et al., 2023). This necessitates a structured, comprehensive approach that integrates rigorous needs assessments, policy alignment, and systematic evaluation to meet professional standards (Friedman, 2023; Merino et al., 2025).

Beyond institutional structure, the literature warrants a close examination of specific delivery methods—particularly the integration of active learning and reflective practices (Jeyakumar et al., 2024). These elements are critical for translating theoretical knowledge into practical applications and enhancing overall project delivery (Porcenaluk et al., 2023; Riyadi et al., 2024). Ultimately, the efficacy of the intervention hinges on the direct link between professional growth and project outcomes. When enhanced skills and improved performance are achieved, they contribute significantly to the long-term success of the project (Wallace & May 2016).

2.2 Knowledge, Beliefs, and Actions in Extension Impact Analysis

The effectiveness of extension projects is rigorously assessed by analyzing sequential changes in participants' KBA (Chazdon et al., 2016; Göçen Kabaran &

Uşun, 2021). These parameters capture how programmatic interventions influence individuals by leveraging knowledge-based systems to drive organizational outcomes (Jensen & Lund, 2024). By integrating robust knowledge management and collaborative structures, extension activities foster sustainable development and long-term institutional relevance (Pejić-Bach et al., 2017; Symonov & Symonov, 2024). Foundational to this process are changes in knowledge, reflecting the initial acquisition of skills and methodologies (Riyadi et al., 2024). This cognitive gain serves as the catalyst for shifts in beliefs.

As new information reshapes participants' perceptions, subjective knowledge becomes a primary predictor for engagement in new practices (Göçen Kabaran & Uşun, 2021; Merry et al., 2023). This psychological transition is underpinned by SLT (Bandura, 1977), which posits that internal factor—specifically self-efficacy—critically influence the move from theoretical awareness to professional action (Baker, 2013). Ultimately, changes in action represent the tangible application of these shifts. Within this analysis, a distinction is maintained between reported behavior (intentions) and enacted behavior (actual classroom implementation). While this study utilized the former as a proxy, it specifically captures the participant's reported transition from awareness to execution (Göçen Kabaran & Uşun, 2021). Although these outcomes are quantifiable, evaluation must account for the non-linear relationship between knowledge acquisition and behavioral execution (Chazdon et al., 2016).

2.3 Empirical Qualities of Effective Teacher Education Extension Projects

Effective TEI extension projects are defined by specific qualities that catalyze professional development and social transformation (Mavhunga & van der Merwe, 2020). Central to these initiatives is community engagement, which ensures that services remain relevant to the local population (Friedman, 2023). When projects align with these grassroots needs, they demonstrate progress across the KBA continuum (Chazdon et al., 2016).

To enhance skills transfer, successful projects integrate experiential learning opportunities that allow participants to apply theory in real-world settings (Al-Thani et al., 2025; Hazard et al., 2024**).** This is facilitated by a knowledge-to-action pipeline, where return demonstrations enable participants to move from concrete experience to reflective observation. This process refines mental models and bolsters self-efficacy, effectively reducing the cognitive load required to implement new strategies. Ultimately, project success hinges on robust partnerships between higher education institutions and local schools (Argabright et al., 2019).

3. Methodology

3.1 Research Design

The study employed an ex post facto, mixed-methods design grounded in a pragmatic paradigm. This approach was necessitated by the assessment of a completed intervention (Project SMART), which precluded the manipulation of independent variables (Bowen, 2009). By evaluating the intervention in its natural institutional state, the design captures the ecological validity of the extension

work. This provides an accurate understanding of how the extension program operated within standard professional constraints. This pragmatic stance justifies integrating quantitative and qualitative methods, with document analysis as the primary data collection strategy (Creswell & Creswell, 2018). Specifically, the quantitative component used a quasi-experimental one-group pretest-posttest design to measure immediate outcomes—specifically, participants' reactions and learning (Kirkpatrick Levels 1 and 2). These quantitative results subsequently guided the qualitative analysis to validate KBA, providing a comprehensive, contextually grounded view of project effectiveness.

3.2 Data Sources and Study Participants

Data sources were classified as primary (document-based) and complementary (contextual) to enable triangulation (Denzin, 2017). The primary source consisted of internal project documentation covering 624 participations across various project activities. For the quasi-experimental analysis, the sample was restricted to participants who completed both pre- and post-tests (N = 143) and was stratified by Key Stages 1 and 2 for content analysis. Complementary qualitative data were gathered via semi-structured key informant (KI) interviews (n = 40) to provide the interpretive depth necessary to bridge documented outputs with actual professional shifts.

While document analysis established objective metrics of knowledge acquisition, the KI interviews captured the subjective shifts in self-efficacy and belief that drive the KBA model. This sample included 30 participant-beneficiaries, selected purposively until data saturation was reached (Flick, 2018), and 10 project team members, selected through complete enumeration. This dual-perspective approach was essential for capturing both implementation fidelity and the belief shifts underpinning program outcomes.

3.3 Data Collection Procedures

Data collection followed a systematic document analysis protocol to extract numerical data (test scores, satisfaction ratings) and textual data (open-ended responses) from project records (Bowen, 2009). Concurrently, assessors used a structured protocol to capture delivery dynamics and engagement. To ensure an objective assessment of the action dimension, an output critique used a qualitative rubric applied to tangible participant products, grounding the assessment in evidence rather than mere self-report.

Finally, semi-structured interview guides were utilized to provide nuanced insights into participants' self-efficacy and the contextual barriers faced by the implementation team. To mitigate confirmation bias, the protocols were designed to elicit negative cases, implementation challenges, and success stories. By focusing on these immediate pedagogical shifts, the procedures remained strictly within the study's evidentiary scope, prioritizing a high-fidelity assessment of Level 3 behavior change over speculative long-term results.

3.4 Data Analysis Procedures

The analysis followed a sequential, mixed-methods integration process rooted in the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2006). For quantitative analysis,

descriptive statistics (means and ratings) were utilized for Level 1 (Reaction) and inferential statistics (paired-samples t-tests) for Level 2 (Learning). These results established the cognitive and affective preconditions for the subsequent qualitative inquiry. To mitigate potential confirmation bias arising from sequential dependence, the qualitative thematic analysis was conducted using an independent coding protocol. This ensured that Level 3 (Behavior) findings emerged from participants' testimonies and documentary evidence rather than being forced to align with pre-existing quantitative trends. In alignment with the cross-sectional design of the study, the analysis remained strictly within Levels 1 to 3. Rather than inferring systemic Level 4 (Results) outcomes, the findings were used to assess institutional readiness for impact and to provide a data-driven basis for refining future extension cycles.

3.5 Ethical Considerations

The Project SMART team formally requested this assessment to fulfill institutional accountability requirements, thereby justifying the researchers' access to retrospective project documentation. To ensure confidentiality, all identifying information was removed from documents and transcripts prior to analysis (Flick, 2018). Informed consent was obtained from all participants involved in interviews and observations. All data were stored securely on password-protected institutional servers, accessible only to the research team.

4. Results and Findings

This section presents the empirical findings of the Project SMART impact analysis, structured according to Kirkpatrick's evaluation hierarchy and the supplementary KBA model. The findings are categorized into quantitative metrics of immediate uptake (Levels 1 and 2) and qualitative indicators of behavioral intent (Level 3 proxy), together providing a multi-layered view of the effectiveness of the project.

4.1 Project SMART (Supporting, Mentoring, and Reinforcing Teachers)

Prior to the inception of the project, a TNA was conducted based on the indicators of the Philippine Professional Standards for Teachers (PPST) (Department of Education, 2017). The assessment served as a foundational diagnostic to align the objectives of the extension project with the stakeholders' actual competency gaps. The TNA utilized a unified ranking process for both pre-service and in-service teachers to establish a professional development continuum. This integrated approach was selected to ensure that theoretical training in the institution aligns with the practical demands of the field. By surveying both groups, the project aimed to identify foundational pedagogical gaps early, preventing theoretical deficits from becoming entrenched as pre-service teachers transition into professional practice. This strategy fosters shared pedagogical language, facilitating an evidence-based transition from the university to the classroom.

4.1.1 Training needs assessment results

a) Content

The project implementers analyzed the TNA results using thematic proximity, identifying conceptual overlaps among PPST domains that address the instructional core at the intersection of the teacher, the learner, and the content.

This criterion enabled the team to cluster 37 distinct PPST strands into 4 manageable areas of concern, ensuring that design decisions were grounded in broad pedagogical themes rather than isolated data points. When grouped according to this framework, five distinct clusters emerged, as shown in Table 1. The primary focus, the pedagogical toolkit, was developed by integrating the learning environment (Domain 2, Strand 2.3), the diversity of learners (Domain 3, Strand 3.3), curriculum and planning (Domain 4, Strand 4.1), assessment and reporting (Domain 5, Strand 5.1), and community linkages and professional engagement (Domain 6, Strand 6.1).

Table 1: Training needs assessment content results

PPST domain strand	Percentage of frequency	Overall rank
Management of classroom structure and activities *(Strand 2.3)*	65	3
Learners with disabilities, giftedness, and talents *(Strand 3.3)*	40	5
Planning and management of the teaching and learning process *(Strand 4.1)*	77.5	1
Design, selection, organization, and utilization of assessment strategies *(Strand 5.1)*	75	2
Establishment of learning environments that are responsive to community contexts *(Strand 6.1)*	60	4

Based on these results, the extension team concentrated the project exclusively on the pedagogical toolkit, intentionally excluding the other clusters. Rather than covering many topics briefly, the project prioritized depth in high-leverage areas to promote stronger skills development (Gulamhussein, 2013). This focused, single-cluster approach aimed to support meaningful classroom application rather than surface-level familiarity.

b) Mode of delivery: The hybrid rationale

While the TNA indicated a strong preference for face-to-face sessions, geographic and professional barriers necessitated a more flexible approach. Participants expressed recurring concerns regarding the travel distance to the university, while the extension team faced significant logistical constraints that limited frequent off-campus outreach. Given the team's concurrent academic and professional responsibilities, relying exclusively on either on-campus or outreach delivery would have restricted the accessibility of the project.

Recognizing that quality interaction is best served by in-person engagement, but scale requires digital reach, the team adopted a flexible, hybrid delivery model. This strategic shift was designed to maximize resource efficiency while ensuring the project could realize its full potential for a broader regional audience. By balancing synchronous online sessions with targeted face-to-face workshops, the delivery mode remained strictly aligned with the goal of high-impact extension, maintaining instructional fidelity while simultaneously overcoming physical barriers to professional development.

c) Instructional method: Andragogical and social learning theory frameworks
While a significant majority of participants favored a workshop format for its collaborative potential, the project implementers formalized this preference through andragogical principles (Knowles, 1980). By requiring the production of tangible outputs, such as contextualized lesson plans aligned with the MATATAG curriculum, the design ensured that training remained problem-centered and immediately applicable. To bridge the gap between reported and enacted behavior, the workshops operationalized SLT through a sequence of vicarious learning (expert demonstrations) and performance accomplishments (hands-on application). This culminated in return demonstrations subject to structured critique. Using the PPST Resource Package rubrics as the evaluative framework, these critiques provided the objective feedback needed to move beyond surface-level familiarity and ensure high-fidelity transfer of skills into professional practice.

4.1.2 Project SMART implementation
To address the prioritized gaps identified in the TNA, the team operationalized Project SMART as a multi-phase training workshop sequence. While the assessment results dictated the content—specifically the pedagogical support required for planning and management, the implementation structure (Table 2) was designed to move participants through a progressive learning curve.

Table 2: Profile of Project SMART

SMART phase	Objectives	Time/ modality	Beneficiaries
Phase 1: Transforming pre-service/beginning teachers' needs to action: regional	– Retool participants on managing inclusive learning environments, innovative teaching practices, and instruction management. – Foster skills application through demonstration.	June 13–14, 2022. Online via Zoom.	132 pre-service teachers from CAR SUCs and colleges.
Phase 2: Initiative for nurturing strategic innovation for high-impact teaching (INSIGHT)	– Provide opportunities for research dissemination. – Equip teachers to integrate innovative teaching with content and pedagogy. – Develop practical application skills.	March 23, 2024. Online via Zoom.	100 in-service teachers from SDO Baguio and Benguet, MAED elementary education students.
Phase 3 (Series 1 and 2): Revitalizing math education: Engaging learners through conceptual	– Identify philosophical and theoretical bases for math concepts. – State mathematical thinking using precise language and representations.	March 15 and 29, 2025. Hybrid (online & F2F). Venue: King's College of	249 in-service teachers from DEPED-CAR (private and public schools).

understanding and concrete representational approach (CRA)	– Determine multiple pedagogical approaches (CRA).	the Philippines, La Trinidad, Benguet, Philippines.	
Phase 3 (Series 3): Foundations for effective teaching: A workshop for key skills and strategies	– Translate identified competencies into specific, measurable, achievable, relevant, and time-bound (SMART) learning objectives, demonstrating accurate alignment between competencies and objectives. – Develop comprehensive science investigatory projects (SIPs) utilizing learned methodological principles and structured investigation.	March 29, 2025. Hybrid (online & F2F). Venue: King's College of the Philippines, La Trinidad, Benguet, Philippines.	143 in-service teachers from DEPED-CAR private and public schools.

a) Planning and structural alignment

The project utilized a tiered design to move participants through three progressive phases: theoretical foundation, research-based innovation, and hands-on application. To maintain high-quality implementation, the BSU Office of Extension Services (BSU-OES) provided formal governance, upholding the university's extension framework through continuous oversight. In coordination with the impact assessors, BSU-OES served as the quality assurance team, monitoring deliveries and reviewing participant artifacts against the approved objectives. This proactive structure enabled real-time adjustments, maintained consistency with the project plan, and ensured that the workshop execution remained faithful to the priority needs that surfaced during the initial TNA.

b) Pre-implementation and mobilization

Following institutional endorsement, the project transitioned to active mobilization by finalizing resource-person engagement and coordinating committee briefings across collaborating institutions. To ensure regional reach, the team engaged with the Commission on Higher Education (CHED) and the Department of Education (DepEd), leading to the issuance of official memoranda that encouraged participation across school divisions. This formal outreach was supplemented by a digital mobilization strategy that used social media platforms for promotion and pre-registration. This dual-track approach—combining traditional administrative channels with digital engagement—ensured a broad and diverse pool of participants, effectively bridging the transition from the project's planning phase to its regional execution.

c) Training and instructional delivery

By leveraging the established hybrid model, the project bridged the gap between regional accessibility and high-fidelity, in-person interaction. The delivery was anchored in SLT and used a workshop sequence—concept presentation, practical demonstration, and interactive forum—to facilitate active knowledge construction. This framework moved participants beyond theoretical awareness into active learning, where group collaborations and return demonstrations served as the primary vehicles for skills acquisition.

Rather than merely receiving information, participants produced pedagogical artifacts appraised by the project team using the PPST Resource Package rubrics. This systematic application of national proficiency indicators provided the objective feedback loop necessary to validate participant alignment with professional standards. Each phase concluded with an immediate impact assessment, utilizing the KBA model to evaluate the effectiveness of the delivery strategy.

4.2 Program Effectiveness: Beneficiary Satisfaction and Learning Outcomes

Program effectiveness was evaluated using Kirkpatrick's Levels 1 (Reaction) and 2 (Learning) to establish the foundational affective and cognitive conditions observed following the intervention.

4.2.1 Beneficiary satisfaction

Evaluation of participant reactions (Table 3) indicates that Project SMART met and exceeded established assurance benchmarks for extension excellence. While these results confirm that the training environment was well-received, the Level 1 data are interpreted as measures of initial engagement rather than predictors of sustained behavioral change.

Table 3: Extent of beneficiaries' satisfaction with Project SMART

SMART phases/indicators	Phase 1 Mean/DR	Phase 2 Mean/DR	Phase 3 Mean/DR	Total Mean
Project organization	3.78 (HS)	3.85 (HS)	3.88 (HS)	3.84 (HS)
Service rendered	3.78 (HS)	3.91 (HS)	3.95 (HS)	3.88 (HS)
Content contribution to knowledge	3.85 (HS)	3.87 (HS)	3.94 (HS)	3.89 (HS)
Resource person's mastery and facilitation	3.81 (HS)	3.90 (HS)	3.92 (HS)	3.88 (HS)
Activity's gender responsiveness	3.70 (HS)	3.95 (HS)	3.89 (HS)	3.85 (HS)
Physical facilities	3.73 (HS)	3.80 (HS)	3.73 (HS)	3.75 (HS)
Overall mean	3.78 (HS)	3.88 (HS)	3.89 (HS)	3.85 (HS)

Statistical limit

Numerical ratings	Descriptive ratings	Operational definition
1.00–1.75	Low satisfaction (LS)	On average, respondents report low satisfaction. This suggests significant areas for improvement
1.76–2.50	Moderately satisfied (MS)	Respondents are somewhat satisfied, but there is room for improvement. Satisfaction is not consistently high.
2.51–3.25	Satisfied (S)	On average, respondents are satisfied. This indicates a generally positive experience.
3.26–4.00	Highly satisfied (HS)	Respondents are highly satisfied. This represents a strong positive perception and likely areas of strength.

Nevertheless, these high satisfaction ratings established a favorable affective climate for learning. The overall mean satisfaction score of 3.85 (highly satisfied) aligns with the university's quality change. A longitudinal analysis across the three phases revealed a slight upward trend, from an initial mean of 3.78 in Phase 1 to 3.89 in Phase 3. This progressive trajectory suggests an enhanced participant response, as the instructional delivery matured and hybridized interactions became more established. Satisfaction remained consistent across all indicators, with "Content's contribution to knowledge" (M = 3.89) scoring the highest, highlighting the perceived relevance of the curriculum to professional needs. Conversely, "Physical facilities" recorded the lowest relative mean (M = 3.75). While this may reflect the logistical complexities of the hybrid model, the score remains well within the "highly satisfied" range, indicating that physical or digital barriers did not significantly impede the training experience.

4.2.2 Learning outcomes

To evaluate knowledge acquisition, Kirkpatrick Level 2 was measured using paired-samples t-tests. Preliminary analysis (Table 4) confirmed that pre–post-test differences followed a normal distribution ($p > 0.05$), satisfying the primary assumption for parametric testing, alongside the requirements for interval-level data and independent observations.

Table 4: Paired comparison of pre- and post-test scores for SMART concepts

Content/ participants	Mean scores		*N*	*t*	*df*	*p*	Mean difference	SE difference	Cohen's *d*
Contents for KS1 participants	Pre-test	8.14	29	3.53	28	0.001**	-2.45	0.694	-0.655
	Post-test	10.60							
Contents for KS2 Participants	Pre-test	7.72	34	1.99	33	0.055ns	-1.35	0.679	-0.342
	Post-test	8.97							

Note: N = number of matched pairs; *df* = degrees of freedom; * $p < 0.05$, ** $p < 0.01$
The difference is calculated as the pre-test minus the post-test. The negative mean difference and effect size indicate an increase in post-test scores.

The results revealed a highly significant increase in knowledge among Key Stage 1 (KS1) participants, with mean scores increasing from 8.14 to 10.60 ($t(28) = 3.53$, $p = 0.001$). The large effect size ($d = -0.655$) indicates a substantial

improvement in pedagogical understanding. Conversely, while Key Stage 2 (KS2) participants showed an upward trend (Mpre = 7.62 to Mpost = 8.97), the difference did not reach statistical significance ($t(33) = 1.99$, $p = 0.055$). Although the small-to-medium effect size ($d = -0.342$) suggests a positive educational effect, the lack of statistical significance is likely due to limited statistical power—stemming from sub-group sample sizes or baseline knowledge variance. Consequently, while Level 2 evidence confirms cognitive gains for KS1, the measurable impact for KS2 remains an area for further longitudinal observation.

4.3 Changes in Knowledge, Beliefs, and Actions

The qualitative impact analysis, structured around the KBA model (Figure 2), provides interpretive depth to the quantitative results by documenting participants' self-reported shifts and behavioral intent. This section serves as a proxy for Kirkpatrick Level 3 (Behavior), offering a high-fidelity view of how educators internalize and plan to deploy new pedagogical strategies. While these findings capture significant perceived professional shifts, it is important to acknowledge the inferential limits: the evidence reflects prospective application and intent rather than direct, longitudinal observation of sustained classroom change. Participants' insights are coded as (B) for beneficiaries and (T) for project team members to distinguish between learner reception and facilitator observation.

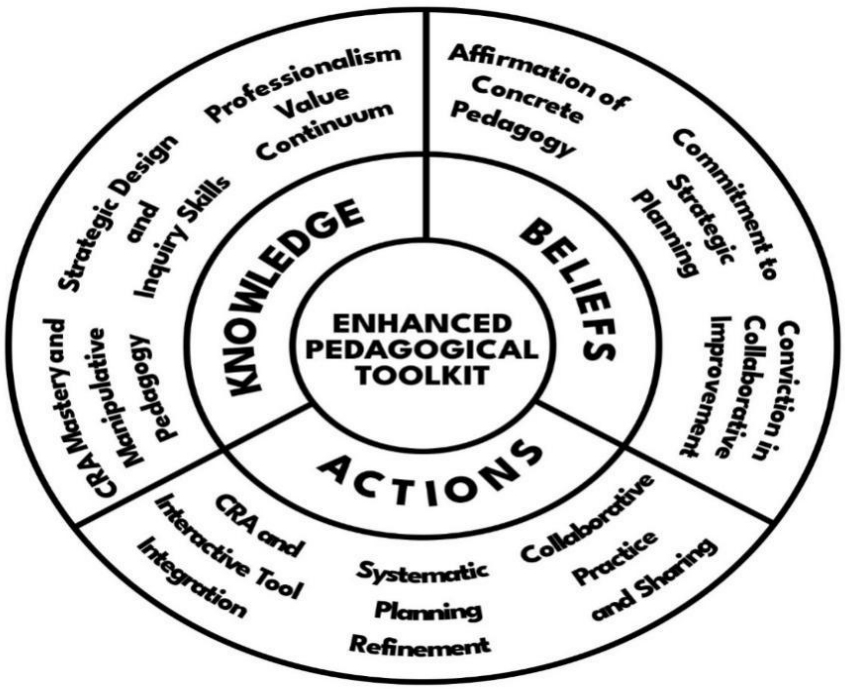

Figure 2: Enhanced pedagogical toolkit: knowledge, beliefs, actions

4.3.1 Knowledge gained

Qualitative analysis confirms that participants achieved technical proficiency across three thematic areas: pedagogical techniques, strategic planning, and professional value. To ensure evaluative rigor, these outcomes were verified by

mapping participant outputs against the previously established PPST benchmarks, moving the assessment beyond self-reported satisfaction into the domain of demonstrated competence.

a) Conceptual-representational-abstract mastery and manipulative pedagogy
Beneficiaries highlighted the tools as highly effective for providing "*an easier portrayal of objects*" (B1, B2), noting that they helped learners "*better understand the lesson*" by offering "*an idea or picture in their mind*" (B3, B4). The training emphasized that the conceptual-representational-abstract (CRA) method enabled a smooth transition "*from concrete manipulatives to abstract reasoning, fostering deeper learning*" (B5, T1) and "*effectively enhanced student understanding*" (B5, B12) by making "*abstract concepts more accessible and engaging*" (T2).

These insights were validated through the evaluation of outputs, where facilitators assessed applications against established instructional standards. A key example of enacted behavior was the demonstrated use of "*bottle caps and strips of paper to concretize the lesson about regrouping*" (T7). This evaluation confirmed that participants recognized manipulatives as "*the foundation of all learning before moving to abstract concepts*" (B6, B7). Consequently, this consensus established a clear understanding of how concrete strategies improved comprehension and retention across the cohort (B8, B9, B10).

b) Strategic design and inquiry skills
Participants demonstrated improved skills in strategic curriculum development, specifically in planning learning objectives and applying research methods for science investigatory projects (SIPs). This proficiency was evidenced through enacted planning behaviors during workshop simulations, in which participants demonstrated a deep understanding of "*how to unpack learning competencies to formulate learning objectives*" (B1, B2). They emphasized the need to write SMART objectives aligned with both Bloom's Taxonomy and SOLO (structure of the observed learning outcome) levels (B19, B26, T1, T2, T3).

The training also strengthened participants' understanding of SIPs; beneficiaries noted that these projects helped "*develop scientific skills in students starting at the elementary level*" (B3, T4), while facilitators reported learning to guide students in systematic research and data collection (T5). The research plan matrix served as the primary instrument for demonstrating these skills, providing the structured framework required for organization and clarity. One participant described learning how to approach complex problems by breaking them into smaller, manageable components (B4). Collectively, these responses indicate improved confidence and technical precision in planning structured, inquiry-based lessons.

c) Professional value continuum
Participants also reported a shift in their perception of professional development, moving away from viewing training as a terminal event toward recognizing it as a continuous process. Responses consistently emphasized the critical role of teacher mentorship and institutionalized support systems. Both beneficiaries and team members recognized that the activity "*reinforced the idea that school leaders should actively mentor and support teachers*" (B9, B11, B25, T6, T8, T10). Furthermore,

participants shared the conviction that "*learning is never-ending*" (B5) and that "*effective teaching requires continuous improvement, adaptability, and strong communication skills*" (B3, B7, B29). These insights suggest that the cohort internalized professional growth as a sustained, career-long continuum rather than a one-time intervention outcome. This shift aligns with the project's goal of fostering a collaborative educational ecosystem that transcends individual workshop attendance.

4.3.2 Beliefs changed

The acquisition of technical knowledge (K) informed participants' evolving pedagogical perspectives, providing the conceptual foundation for the internalization of new convictions. This shift was characterized by three key belief themes: a strong affirmation of concrete pedagogy, an active commitment to strategic planning, and a conviction in collaborative improvement. These internalized shifts suggest a cognitive bridge between newly acquired skills and a potential for sustained application that moved beyond mere administrative compliance.

a) Affirmation of concrete pedagogy

Beneficiaries expressed the firm conviction that abstract concepts, particularly in mathematics, were best understood when learners could physically interact with objects or visualize them through tangible representations. They affirmed that the CRA approach supported a gradual transition from concrete to abstract understanding. Participants described manipulatives as the "*foundation of all learning*" (B10, B21, T1, T3) and noted that these tools "*made it easier to represent objects*" (B14, B21, B25). Furthermore, participants linked concrete strategies to "*deeper understanding and retention*" (B5, B14, B28, T3). This represented a documented shift toward a pedagogical philosophy that prioritized experiential learning as a cornerstone of comprehension. By internalizing these concepts as professional convictions, the participants demonstrated a move toward sustaining the high-fidelity instructional practices established during the training.

b) Commitment to strategic planning

This theme reflects the internalized conviction that rigorous instructional planning is non-negotiable for achieving effective outcomes. Beneficiaries, as affirmed by team members, held the view that unpacking learning competencies into SMART objectives was essential for effective instruction (B8, B21, T4, T7, T10). This represents a documented shift from compliance-based planning toward a results-driven, systematic approach. Participants also highlighted the importance of introducing SIPs at an early stage, viewing them as a practical means of developing students' analytical and research skills (B23, T1). This internalized commitment indicates that participants viewed strategic planning not as an administrative burden but as a necessary catalyst for improving student learning. By realigning their professional values with these systematic methods, the cohort demonstrated a readiness for sustained curriculum implementation.

c) Conviction in collaborative improvement

This theme embodies the conviction that ongoing professional adaptation and a supportive ecosystem for educators are necessary for sustained success.

Participants relayed the notion that learning "*never stops*" (B10, B23) and affirmed that "*effective teaching requires continuous improvement, adaptability, and strong communication skills*" (B23, B28). Team members (T2, T5) further emphasized the value of guidance and leadership support as critical drivers for teacher efficacy. In addition, participants demonstrated an understanding of the importance of educational leadership in providing resources, training, and continuous support. These findings indicate a fundamental belief that a collaborative, reflective, and growth-oriented ecosystem within the institution enhances teaching effectiveness and optimizes student outcomes. By internalizing these collaborative values, participants signaled a move beyond individual skills acquisition toward an institutionalized culture of professional excellence.

4.3.3 Actions for adoption (Level 3 proxy)

The shifts in knowledge and beliefs provided evidence of intended behavioral change, satisfying the requirements for a Kirkpatrick Level 3 proxy within the scope of this intervention. Participants' commitment to change was articulated through three distinct action themes: the immediate deployment of new methods (CRA and Interactive Tool Integration), systematic improvements to lesson preparation (systematic planning refinement), and the institutional diffusion of strategies (collaborative practice and sharing). These responses indicate a strong intention to transfer learning into daily teaching practice, serving as the participants' roadmap for pedagogical adoption.

a) Conceptual-representational-abstract and interactive tool integration

Participants expressed a clear commitment to modifying their instructional methods by immediately applying hands-on, interactive strategies. Specifically, they committed to "*enhancing student engagement through interactive activities connected to real-life situations*" (B10, B15, T4) and detailed plans to implement hands-on math activities to bridge the gap between abstract concepts and student understanding (B3, B24, B27, T6). Beneficiaries also articulated intentions to incorporate "*problem-solving games and group discussions*" (B16, B21) as a means of maintaining learner interest.

The overall objective was to transform the learning environment into an "*engaging and interactive*" (T1, T7, T9) experience by "*creating activities that help students understand and apply concepts*" (B5, T10). This commitment is supported by documented plans to integrate both traditional and digital tools; participants intended to download and use curated digital learning resources (B9, B20) and to systematically integrate technology into their daily lessons (B6, B12, B25). By outlining these specific resource-use plans, participants demonstrated a move from theoretical knowledge toward intended pedagogical practice.

b) Systematic planning refinement

Participants indicated a clear intention to refine the instructional preparation phase, specifically through lesson planning and the implementation of new curricular strategies. Many participants planned actions focused on the planning process itself; they intended to "*integrate the CRA approach in lesson planning*" (B3, B9) and apply the sequence when creating formal teaching guides. Team members

reported that "*unpacking learning competencies when structuring lesson plans*" (T5, T7, T9) is a standard practice.

Participants also planned to incorporate inquiry-based strategies, with some intending to "*prepare students for research tasks*" (B14, B21) and "*integrate simple investigatory projects into lessons*" (B6, B11, B27). The use of structured tools, such as the research plan matrix, was identified as the primary method for organizing objectives, procedures, and data collection (B30, T4, T7). The integration of these elements demonstrates strong alignment with the systematic curriculum framework of the project, signaling a transition toward more structured, standardized instructional preparation.

c) Collaborative practice and sharing

Participants expressed clear intentions to share their newly acquired knowledge with colleagues, effectively extending the impact of the project beyond their individual classrooms. This theme emphasizes a shift toward a model of collective professional growth, in which participants intended to "*apply mentoring and peer collaboration*" (B8, B15) and to share best practices through lesson studies or team-teaching initiatives. Furthermore, beneficiaries articulated a commitment to "*implement these strategies while sharing them with co-teachers*" (B17, B26, B29). This desire to disseminate learned knowledge is further evident in the formal resolutions to "*share with others*" and "*reiterate this for implementation*" (T5, T8). Collectively, these responses reflect a professional commitment to ongoing learning and horizontal collaboration, signaling that the strategies of the intervention were viewed as institutional assets rather than isolated skills.

5. Discussion

5.1 The Operational Effectiveness and Program Fidelity of Project SMART

5.1.1 Foundational rigor and strategic design

The observed alignment between the foundational design of the project and the subsequent learning gains suggests that instructional success was not incidental, but a direct result of the structural rigor established during the planning phase. By anchoring the intervention in a preliminary TNA and the PPST indicators, the project bridged the gap between theoretical standards and local pedagogical needs. This targeted approach (W.K. Kellogg Foundation, 2004) implies that professional development is most effective when it moves away from fragmented models toward a cohesive "instructional dynamics" framework.

Furthermore, the operational fidelity maintained through consistent monitoring provided the necessary control to ensure that the logic model (Chew, 2016; Mavhunga & van der Merwe, 2020) was translated into practice. Unlike standard results that merely confirm participation, this structural consistency indicates that the design of the intervention was robust enough to facilitate the meaningful initial outcomes reported earlier. This suggests that the quality of the foundational blueprint of a program is a primary determinant of its capacity to trigger shifts in teacher competency (Al-Thani et al., 2025; Guan & Corpuz, 2023).

5.1.2 Operational adaptability and theoretical grounding

The operational flexibility of the project suggests a high degree of design quality that aligns with CPD principles emphasizing contextual relevance (Chew, 2016; Jeptepkeny & Keter, 2025; Mavhunga & van der Merwe, 2020). While participants initially signaled a preference for face-to-face instruction, the strategic shift to a hybrid delivery model in response to logistical constraints demonstrates a participant-centered approach that directly addresses barriers identified in the TNA (Friedman, 2023). Based on participant feedback and sustained engagement levels, this hybrid approach functioned as a practical bridge between broad accessibility and the high-touch interaction necessary for skills development (Tives et al., 2024). This adaptive capacity implies that the success of the intervention stemmed from its ability to reconcile institutional constraints with pedagogical needs.

Furthermore, the emphasis on active engagement and collaborative experiences provides empirical support for the grounding of the project in SLT (Bandura, 1977). By facilitating a shared learning environment—even within a hybrid space—the project created a social catalyst for professional growth (Al-Thani et al., 2025; Ashraf et al., 2023). This suggests that theoretical grounding is most effective when paired with operational agility, enabling delivery methods to pivot without compromising the core collaborative intent.

5.1.3 Structural integrity and collaborative capacity

The systematic processes maintained throughout the implementation suggest that the academic quality of the project was a function of its deliberate, phased architecture. By delivering training through clearly defined stages, the project provided a scaffolded learning experience that reflects the necessity of careful planning in complex curriculum transitions (Baker, 2013). This phased structure implies that successful pedagogical reform is not a singular event but a cumulative process in which each stage builds on the prerequisite readiness for the next.

The integration of pre-service and in-service teachers into cohesive groups functioned as a catalyst for a rich, collaborative ecosystem (Jensen & Lund, 2024). This diversity of experience indicates that the intervention moved beyond traditional top-down training to foster a community of practice. Furthermore, the collaborative engagement with external partners bridged the gap between academic theory and classroom reality (Porcenaluk et al., 2023; Wang et al., 2023). This synergy reflects a robust organizational capacity (W.K. Kellogg Foundation, 2004) that points toward the potential of the intervention for institutionalized quality assurance (Chiappelli & Leoncini, 2025). While these systemic effects are currently conceptual extensions of the data, adherence to these standards signals a readiness for sustained institutional adoption.

5.2 Immediate Outcomes and Validation of Learning

5.2.1 Validation of learning gains (Level 2) and adaptive expertise

The measurable short-term impact of Project SMART indicates a successful translation of curricular theory into teacher proficiency. The integration of high participant satisfaction with documented knowledge acquisition underscores the

capacity of the project to engage educators while simultaneously addressing cognitive gaps. Specifically, the statistically significant improvement among Key Stage 1 participants points toward a strengthening of foundational knowledge that is essential for early-grade instructional shifts (Göçen Kabaran & Uşun, 2021; Riyadi et al., 2024).

Conversely, the non-significant trend in the Key Stage 2 cohort ($p = 0.055$) posits a potential ceiling effect, in which high baseline proficiency likely constrained the statistical margin for measurable growth. This result implies a shift from basic fact acquisition toward the refinement and strategic integration of complex pedagogical knowledge. For these experienced educators, the intervention likely fostered the cultivation of adaptive expertise—the ability to apply knowledge flexibly to novel or challenging teaching scenarios (Main & Pendergast, 2019). This highlights that while quantitative gains may appear marginal in high-performing groups, the qualitative value of the training may lie in the sophistication with which knowledge is now applied rather than simply in how much was gained.

5.2.2 Beneficiaries' satisfaction and affective readiness (Level 1)

Beyond objective learning gains, the consistently high satisfaction ratings point toward a receptive environment conducive to professional growth (Kazanskaia, 2025). The fact that "Contribution to knowledge" received the highest rating underscores the perceived relevance of the MATATAG-aligned content to the participants' daily instructional needs. These favorable assessments of the operational components of the program indicate that the strategic planning and adherence of the project to its logic model functioned as a catalyst for participant buy-in (Al-Thani et al., 2025; Kazanskaia, 2025). Furthermore, the positive perception of an inclusive learning environment implies that the intervention succeeded in creating a psychologically safe space for pedagogical experimentation (Lagura, 2023). The upward trend in satisfaction signifies a transition into deeper affective shifts, aligning with the principles of SLT (Bandura, 1977).

In this context, satisfaction is distinguished from mere preference; rather, it serves as a critical reinforcement mechanism that fosters pedagogical self-efficacy—the internal belief in one's ability to implement new strategies (Chachar et al., 2023; Wang et al., 2023). Collectively, the synthesis of Level 1 and Level 2 data suggests that the project successfully established both cognitive readiness (knowledge acquisition) and affective readiness (self-efficacy). This dual readiness advances a necessary foundation for the subsequent phase of behavioral transformation, as educators are more likely to enact change when they feel both technically competent and institutionally supported.

5.3 The Knowledge-Beliefs-Actions Synthesis

5.3.1 Mechanism of toolkit enhancement

The synthesis of the evaluative data of Project SMART points to an extension initiative that achieved meaningful initial outcomes. This interpretation emerges from the deliberate integration of quantitative indicators (Levels 1 and 2) and qualitative proxies (Level 3), providing a coherent, multi-layered account of early impact (Kirkpatrick & Kirkpatrick, 2006). Rather than viewing these results in

isolation, the alignment across these strands suggests a holistic trajectory of professional growth. The enhancement of the participants' pedagogical toolkit appears to hinge on integrated shifts across the KBA domains (Chazdon et al., 2016; Göçen Kabaran & Uşun, 2021; Moravek et al., 2017).

Each domain was verified through specific evidentiary streams: pre- and post-test gains (knowledge), thematic shifts in conviction (beliefs), and documented intentions within planning matrices (actions). Foundational growth was immediately evident in the knowledge (K) domain, where significant gains underscored a technical mastery of the CRA approach and SIP integration. This cognitive acquisition likely informed a subsequent shift in teaching beliefs (B), characterized by a strengthened commitment to experiential and interactive instruction. Consequently, the potential for longitudinal impact is further supported by the actions (A) domain, evidenced by participants' documented commitment to specific instructional applications.

The development of deeper conceptual strategies through the CRA approach posits a cognitive foundation that may facilitate more complex professional change. These belief shifts underscored an increase in pedagogical self-efficacy—a crucial driver of implementation (Göçen Kabaran & Uşun, 2021; Riyadi et al., 2024). While the behavioral intentions reported, such as incorporating inquiry-based strategies (Merry et al., 2023), serve as proxies for behavior rather than enacted classroom habits, the alignment across KBA indicates an integrated process of learning transfer. This synergy suggests that the intervention functioned as a catalyst for a readiness to change, although the transition to sustained habit remains a conceptual extension to be verified by future longitudinal study.

5.3.2 Methodological validation and future potential

While the use of intended actions (A) as a Level 3 proxy is a recognized methodological limitation, the theoretical grounding of the study recommends context-specific validation to mitigate it (Riyadi et al., 2024; Wang et al., 2023). The reliability of this behavioral proxy is not interpreted as a standalone measure; rather, it is reinforced by significant knowledge acquisition (Level 2) and enhanced pedagogical self-efficacy (Level 1→B). These cognitive and affective conditions emphasize a structural basis for short-term transfer (Merry et al., 2023). By demonstrating these preconditions, the KBA pattern postulates a logical progression of professional growth rather than a series of disconnected responses, reflecting a model of integrated learning transfer (Merry et al., 2023; Wang et al., 2023).

While intentions do not guarantee longitudinal behavioral change, they provide credible evidence of a readiness for implementation. Furthermore, although Level 4 organizational outcomes were not directly assessed, the collaborative themes observed in the qualitative data suggest a potential for broader institutional impact (Jensen & Lund, 2024). The commitment to "mentoring and peer collaboration" indicates a shift toward a community of practice, where the

burden of curriculum adoption moves from the individual to the collective (Al-Thani et al., 2025; Hazard et al., 2024).

This shared responsibility implies a developing capacity for horizontal knowledge transfer (Jensen & Lund, 2024), which is a vital prerequisite for systemic outcomes such as improved student achievement and lasting program relevance (Caingcoy, 2021; Friedman, 2023). Thus, while Level 4 results remain a conceptual extension of the current data, the evidence underscores that the intervention has established the necessary preconditions for future organizational transformation (Symonov & Symonov, 2024).

5.4 Integrated Pedagogical Toolkit Enhancement Model: SMART Project Impact

5.4.1 The knowledge-beliefs-actions synthesis: Mechanism of toolkit enhancement

While Project SMART yielded significant immediate gains, the findings indicate a critical challenge regarding long-term sustainability, as documented shifts in KBA may diminish without ongoing institutional reinforcement. To address this, the Integrated Pedagogical Toolkit Enhancement Model (IPTEM) (Figure 3; Tables 5a, 5b) is proposed as a longitudinal framework that embeds mentorship and institutional support into the professional development lifecycle. This model emerged through an inductive, post hoc analysis of the patterns observed in the data, specifically the consistent alignment across evaluation levels (Merry et al., 2023; Porcenaluk et al., 2023; Schwandt, 2015), and formalizes the synergistic relationships already evident in the findings rather than introducing an entirely novel theory.

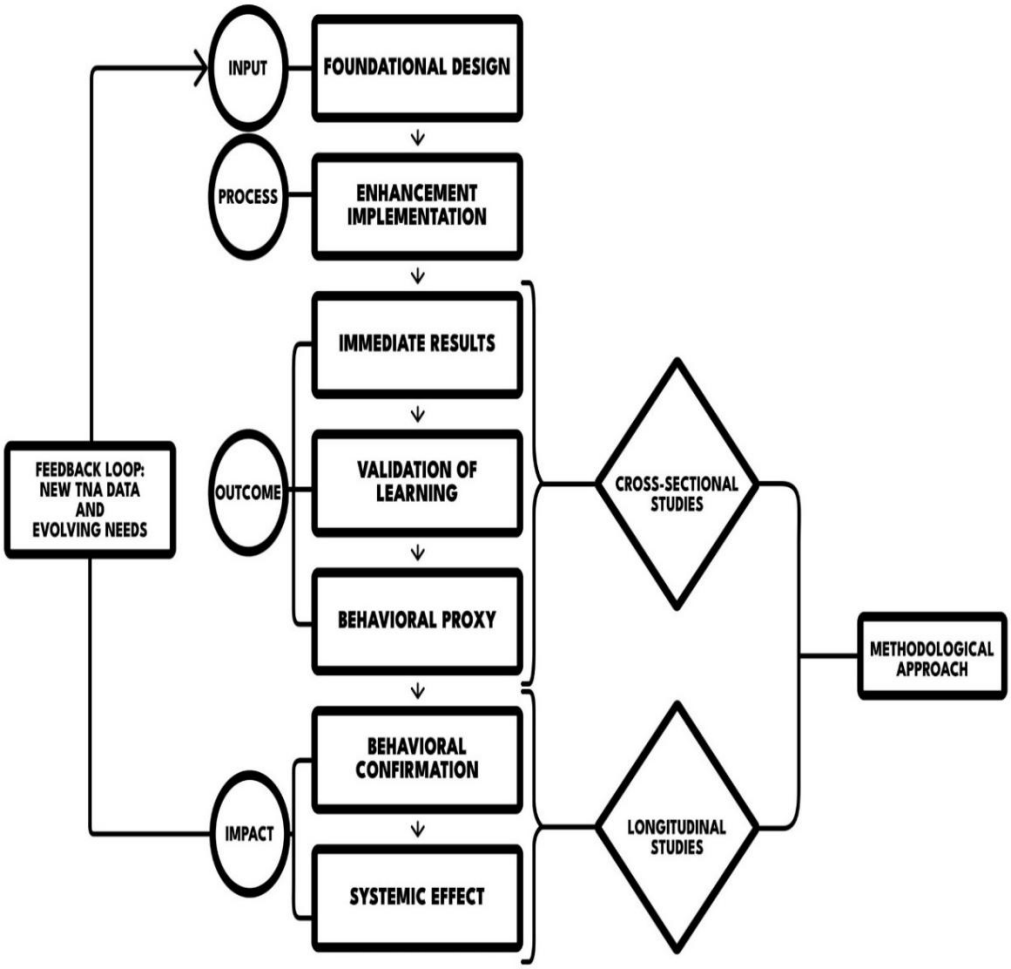

Figure 3: Integrated Pedagogical Toolkit Enhancement Model (IPTEM)

To mitigate the cross-sectional limits of the study—specifically the inability to empirically measure Kirkpatrick Level 4 results—the framework integrates theoretical concepts with established literature to provide a pathway for prospective longitudinal testing (Creswell & Creswell, 2018; Yin, 2018). Consequently, the IPTEM functions as an evidence-informed roadmap for higher education institutions, identifying qualitative and longitudinal indicators to guide the design of programs aimed at sustained behavioral and systemic change (Caingcoy, 2021; Friedman, 2023). By transitioning from "intended action" to "behavioral confirmation", the model underscores a conceptual extension of the current study, offering a structured approach to institutionalizing collective capacity and ensuring lasting program relevance through a systematic, multi-tiered evaluation process.

Table 5a: Integrated Pedagogical Toolkit Enhancement Model (IPTEM) details

	INPUT	PROCESS	OUTCOMES (1)
OUTCOME FOCUS	FOUNDATIONAL DESIGN	ENHANCEMENT IMPLEMENTATION	IMMEDIATE RESULTS
KEY ACTIVITY	Training needs assessment Resource allocation	Training and instructional delivery	Beneficiary satisfaction and learning outcomes
EXPECTED RESULT	Contextualized enhancement blueprint	Operational effectiveness and program fidelity	Pedagogical self-efficacy
METHODOLOGICAL APPROACH			Cross-sectional studies
GUIDING THEORETICAL FRAMEWORK	Logic model theory	CPD framework (grounded in SLT)	Kirkpatrick's evaluation model Level 1: Reaction

Table 5b: Integrated Pedagogical Toolkit Enhancement Model (IPTEM) details

	OUTCOMES (2)		IMPACT	
OUTCOME FOCUS	VALIDATION OF LEARNING	BEHAVIORAL PROXY	BEHAVIORAL CONFIRMAT-ION	SYSTEMIC EFFECT
KEY ACTIVITY	Changes in knowledge, beliefs, and actions	Proxy corroboration via data triangulation	Thematic synthesis & pattern matching	(a) Institutionalizat-ion of collective capacity and program relevance (b) Return on expectation (ROE) analysis & documented institutionalizat-ion
EXPECTED RESULT	Learning gains and adaptive expertise	Behavioral translation manifested in coherent KBA	Sustained behavioral change	Learner performance improvement & program relevance
METHODOL-OGICAL APPROACH	Cross-sectional studies	Cross-sectional studies	Longitudinal studies	Longitudinal studies
GUIDING THEORETICAL FRAMEWORK	Kirkpatrick's evaluation model Level 2: Learning	Kirkpatrick's evaluation model Level 3 (Prediction): Behavior	Kirkpatrick's evaluation model Level 3 (Actual): Behavior	Kirkpatrick's evaluation model Level 4: Results

5.4.2 Outcomes: Immediate results and learning validation (Levels 1 & 2)
The success of the implementation process is reflected in the immediate outcomes, which serve as the primary indicators of a receptive and functional learning environment. High participant satisfaction at Level 1 signals more than mere approval; it advances the existence of the affective readiness and "buy-in" required for professional persistence. Concurrently, the Level 2 results indicate significant knowledge gains and a heightened understanding of instruction (Göçen Kabaran & Uşun, 2021; Riyadi et al., 2024). For the more experienced educators within the cohort, these improvements signify the refinement of adaptive expertise—the sophisticated ability to restructure existing knowledge for novel classroom challenges—rather than the simple acquisition of basic facts (Wong & Kitto, 2023).

By synthesizing these results, the IPTEM implies that Levels 1 and 2 are not just endpoints, but foundational scaffolds. This cognitive and affective baseline provides the momentum for the transition to Level 3 behavioral change. Without this validated "readiness", the subsequent attempt to implement complex strategies, such as the CRA approach, would likely face significant resistance. Thus, the validation of immediate results functions as a critical gatekeeper for the long-term sustainability of the pedagogical toolkit enhancement.

5.4.3 Impact
a) Behavioral transformation: Proxy and confirmation (Level 3)
The core contribution of the model resides in the behavioral transformation stage, which explains how the intervention triggers professional change. The current data synthesis points to a clear causal progression: knowledge acquisition at Level 2 strengthened the pedagogical self-efficacy identified at Level 1, which, in turn, served as the primary driver of the behavioral intentions reflected in the Level 3 proxy (Mavhunga & van der Merwe, 2020; Merry et al., 2023). This alignment across the KBA domains implies a structural readiness for implementation and the early adoption of new strategies. To analyze this transformation analytically, the IPTEM splits the assessment into two phases, establishing a conceptually robust chain of evidence.

The first phase, Level 3 (Prediction), serves as a behavioral proxy within the cross-sectional design of this study. While it does not confirm enacted behavior in the classroom, the consistency between participant interview responses and documented planning outputs provides strong confidence in the reliability of the proxy as an indicator of learning transfer (Chiappelli & Leoncini, 2025; Merry et al., 2023). The second phase, Level 3 (Actual), is proposed for future longitudinal research to verify lasting change. This phase posits that thematic synthesis can be used to track interview consistency over time, while pattern matching can be used to compare behavioral trends with expected institutional outcomes. This dual-phase structure suggests that while the current study captures a perspective of readiness, the model provides the necessary framework to validate whether these intentions eventually crystallize into sustained classroom habits.

b) Systemic effect

The final level of the model moves beyond individual behavior to interpret the potential for organizational change. This conceptual outcome, referred to as the systemic effect, represents the goal of professional development. The Level 3 commitment to collaborative action leads to the formation of a community of practice, which functions as a bridge toward potential Level 4 impact (Jensen & Lund, 2024). This shared responsibility implies a shift toward collective capacity—a necessary condition for driving systemic outcomes such as improved learner performance and curriculum relevance (Caingcoy, 2021; Friedman, 2023).

While Level 4 serves as a theoretical extension of the primary data, it provides a necessary conceptual pathway for future longitudinal inquiry. Assessment at this level points toward institutionalization and strategic alignment, utilizing return on expectation (ROE) analysis to determine whether program outcomes meet stakeholders' qualitative and strategic objectives. Evidence of this systemic shift would require tracing the integration of program principles into organizational structures, such as strategic plans, budget allocations, and internal policies. Such an evaluation underscores the evolution of the initiative from a short-term intervention to a sustained institutional practice, signaling that the pedagogical toolkit has been successfully absorbed into the broader institutional culture.

6. Conclusion

Project SMART yielded measurable improvements in participants' pedagogical toolkits, as evidenced by significant initial outcomes at Kirkpatrick Levels 1 (Reaction) and 2 (Learning). While these findings provide strong support for the efficacy of context-responsive CPD, they also highlight the need for systematic assessment at Levels 3 (Behavior) and 4 (Results) to evaluate the long-term impact. Consequently, this study recommends the Integrated Pedagogical Toolkit Enhancement Model (IPTEM) as a conceptual framework to address these evaluation gaps.

While the IPTEM offers a proposed roadmap for adoption by TEIs, its long-term efficacy and the feasibility of its proposed cyclical feedback loop remain to be empirically validated in future evaluation cycles. By prioritizing rigorous TNAs and leveraging adaptive hybrid modalities, the framework aims to facilitate a data-driven ecosystem in which longitudinal outcomes inform future program design. This ensures that CPD evolves from a one-time intervention into a sustained institutional practice responsive to the shifting needs of the educational landscape.

7. Conflict of Interest

The authors disclose the following institutional and operational roles related to the Project SMART impact analysis. The first author is affiliated with the department responsible for implementing Project SMART and was assigned to conduct the initial impact analysis. This potential conflict of interest in the internal evaluation was mitigated by including external collaborators. Specifically, the second and third authors were identified to join the impact analysis to ensure objectivity and impartiality in the assessment. These authors are affiliated with an

external partner institution with which a memorandum of agreement (MOA) is currently forged, establishing a legitimate and ongoing partnership in instruction, research, and extension activities. This collaborative structure was designed to provide an objective external lens on the efficacy and findings of the project. All authors confirm that there are no financial conflicts of interest related to this publication.

8. AI Acknowledgments

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