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Developing a Sustainable Technology-Integrated Professional Development Model for Arabic Language Teachers in Madrasah

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Abstract : *This study addresses the increasing demand for meaningful technology integration in education, which has not yet been adequately supported by systematic and sustainable professional development models, particularly in Arabic language teaching in madrasah. The study aims to develop a sustainable, reflective, and contextually grounded professional development model based on technology integration. This research employed a Research and Development (R&D) approach using a Design-Based Research (DBR) framework involving 30 Arabic language teachers at the Madrasah Aliyah level. Data were collected through questionnaires, interviews, observations, and document analysis, and analyzed using descriptive statistics and thematic analysis. The findings reveal a high level of need for sustainable technology-based professional development. The developed model (Pro-TArMad) was validated as highly valid by experts and demonstrated effectiveness through iterative DBR cycles, as indicated by improvements in teachers' TPACK competence and instructional practices. The model emphasizes continuous cycles of needs analysis, design, implementation, reflection, and refinement. This study contributes both practically, by offering an implementable model for madrasah, and theoretically, by advancing the discourse on sustainable teacher professional development in technology-enhanced language education.*

Keywords: *teacher professionalism, Arabic language teaching, TPACK, technology integration, madrasah*

INTRODUCTION

The integration of digital technology has become a defining feature of contemporary education, fundamentally reshaping teaching and learning practices across disciplines. In the 21st century, technology is no longer viewed as a supplementary tool but as an integral component of effective pedagogy. However, research consistently shows that the educational impact of technology depends largely on how it is pedagogically integrated rather than merely adopted (Koehler et al., 2013; Schindler et al., 2017). This suggests that the key challenge lies not in access to technology, but in teachers' ability to meaningfully align it with instructional goals.

In language education, the role of technology is particularly significant, as it can support interaction, authentic input, and learner autonomy. Studies indicate that technology-enhanced language learning can improve engagement and learning outcomes when used strategically (Kessler, 2018; Golonka et al., 2014). However, the effectiveness of such integration is highly dependent on teachers' pedagogical decisions. Without sufficient professional competence, technology use often remains superficial and disconnected from learning objectives.

In the context of Arabic language teaching in madrasah, these challenges are even more pronounced. Arabic language instruction involves complex linguistic structures and requires context-sensitive pedagogical approaches. Empirical evidence suggests that teachers often use digital tools primarily for presentation purposes rather than as part of a structured pedagogical strategy (Alasmari & Alshammari, 2021). This indicates a gap between technological usage and pedagogical integration, particularly in non-Western and religious educational contexts such as madrasah.

One of the major contributing factors to this issue is the limited effectiveness of existing professional development (PD) programs. Many PD initiatives are short-term, fragmented, and lack follow-up support, making them insufficient to produce sustained changes in teaching practice. Research has demonstrated that effective professional development must be continuous, collaborative, content-focused, and embedded in teachers' daily practice (Desimone, 2009; Darling-Hammond et al., 2017). This highlights the need for structured and sustainable models of teacher professional development that go beyond one-off training sessions.

From a theoretical perspective, the Technological Pedagogical Content Knowledge (TPACK) framework provides a robust foundation for understanding

effective technology integration in teaching. TPACK emphasizes the interplay between content knowledge, pedagogical knowledge, and technological knowledge as a prerequisite for meaningful instructional design (Mishra & Koehler, 2006). Teachers who develop strong TPACK are more capable of designing adaptive and contextually relevant learning experiences. However, studies indicate that many teachers still struggle to operationalize this framework in practice, particularly in specialized subject areas such as language education.

In addition, frameworks of digital competence, such as DigCompEdu, emphasize that teachers' digital proficiency extends beyond technical skills to include instructional design, assessment, and professional collaboration in digital environments (Redecker, 2017). This broader perspective aligns with recent findings that highlight the importance of integrating digital competence with pedagogical and content expertise (Falloon, 2020). In the case of Arabic language teachers, challenges such as limited access to appropriate digital resources, lack of training, and time constraints further complicate the development of such integrated competence.

Despite the growing body of research on technology integration and teacher professional development, studies specifically addressing Arabic language education remain limited. Existing research calls for the development of systematic and context-sensitive models that can guide teachers in integrating technology in a pedagogically meaningful way (Alasmari & Alshammari, 2021). Therefore, this study aims to develop a sustainable professional development model for Arabic language teachers in madrasah, integrating technological, pedagogical, and content knowledge within a cyclical and reflective framework. The novelty of this study lies in its use of Design-Based Research (DBR) to iteratively design and refine a contextually grounded model (Pro-TArMad), contributing both to theoretical discourse and practical implementation in technology-enhanced language education.

METHOD

Research Design

This study adopted a Research and Development (R&D) approach operationalized through a Design-Based Research (DBR) framework. DBR is a systematic yet flexible methodology that integrates the iterative design of educational interventions with empirical investigation in real-world settings, aiming to generate both practical solutions and theoretical insights (Wang & Hannafin, 2005; Anderson & Shattuck,

2012). The selection of DBR was grounded in its suitability for addressing complex educational problems that require contextualized and iterative solutions. In this study, DBR enabled the development and refinement of a sustainable professionalism model for Arabic language teachers through successive cycles of analysis, design, implementation, evaluation, and revision, ensuring both ecological validity and practical applicability. This approach also aligns with the goal of producing a model that is not only theoretically grounded but also empirically validated within the madrasah context.

Participants and Research Setting

The study involved 30 Arabic language teachers from public and private Madrasah Aliyah (Islamic senior secondary schools) in Bojonegoro Regency, Indonesia. Participants were selected using purposive sampling, which allows researchers to intentionally select information-rich cases relevant to the research objectives (Creswell & Plano Clark, 2018).

The selection criteria included: (1) teaching experience, (2) access to digital infrastructure, and (3) willingness to participate in iterative intervention cycles. The research setting represents a typical madrasah environment where technological resources are relatively available, yet their pedagogical integration remains suboptimal. This context was considered appropriate for testing and refining a technology-based professional development model.

Data Collection

Data were collected using four complementary techniques to ensure depth and triangulation. First, a structured questionnaire was administered to assess teachers' professional competence, technology integration practices, perceived barriers, and development needs. Second, semi-structured interviews were conducted with school principals and supervisors to capture institutional perspectives and contextual factors influencing teacher professionalism.

Third, non-participant classroom observations were carried out to document authentic instructional practices, particularly the integration of technology within Arabic language teaching. Fourth, document analysis was conducted on lesson plans, digital instructional materials, and reflective teaching notes to provide additional evidence of pedagogical practices.

To enhance the validity and credibility of the findings, methodological triangulation was employed by cross-validating data from multiple sources and methods (Denzin, 2012). This approach strengthens the robustness of qualitative inquiry and reduces potential bias.

Instruments

Three primary instruments were utilized in this study. The needs analysis questionnaire, developed using a five-point Likert scale, measured four key dimensions: (1) professional competence, (2) technology utilization, (3) pedagogical and digital constraints, and (4) the need for sustainable professional development.

The interview protocol was designed to explore institutional policies, support mechanisms, and perceptions of teacher professionalism. The observation checklist focused on evaluating the integration of pedagogical strategies, Arabic language content, and digital technology in classroom practices.

All instruments were constructed based on established theoretical frameworks, particularly Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006) and digital competence frameworks for educators (Redecker, 2017). Prior to data collection, the instruments were subjected to expert validation to ensure content validity and conceptual alignment.

Data Analysis

Quantitative data obtained from the questionnaire were analyzed using descriptive statistics, including mean scores and percentages, to determine the level of teachers' needs and readiness.

Qualitative data from interviews, observations, and documents were analyzed using thematic analysis, following the systematic procedures proposed by Braun and Clarke (2006), including data familiarization, initial coding, theme development, and interpretation. This method allows for the identification of recurring patterns and meaningful insights across data sources.

The integration of quantitative and qualitative findings was conducted through a convergent analytical approach, enabling a comprehensive understanding of the research context and informing the iterative refinement of the proposed model.

Model Development Procedure

The development of the model followed iterative DBR cycles. The first phase involved needs analysis, aimed at identifying teachers' competencies, challenges, and contextual constraints. The second phase focused on model design, where a preliminary framework integrating TPACK and psycholinguistic principles of Arabic language learning was developed.

The third phase consisted of initial implementation, in which the model was applied in a limited setting to assess feasibility and user response. The fourth phase involved evaluation and reflection, where data from observations, feedback, and performance indicators were analyzed to determine effectiveness.

Finally, the fifth phase involved revision and refinement, in which the model was iteratively improved based on empirical findings until a valid, practical, and contextually appropriate final model was achieved. This cyclical process reflects the core principle of DBR, emphasizing continuous improvement through real-world application (Reeves, 2006).

RESULTS AND DISCUSSION

Result

1. **Teachers' Needs as the Foundation for Model Development**

Table 1. *Results of Needs Analysis of Arabic Language Teachers*

Dimension	Indicators	Percentage (%)	Level
Professional Competence	Content mastery, instructional design, reflection	78.6	High
Technology Integration	Digital tools, LMS, ICT usage	81.2	High
Pedagogical & Digital Barriers	Methods, applications, infrastructure	79.4	High
Need for PD Model	Sustainability, mentoring, online support	82.5	Very High
Overall Mean	—	**80.4**	**High**

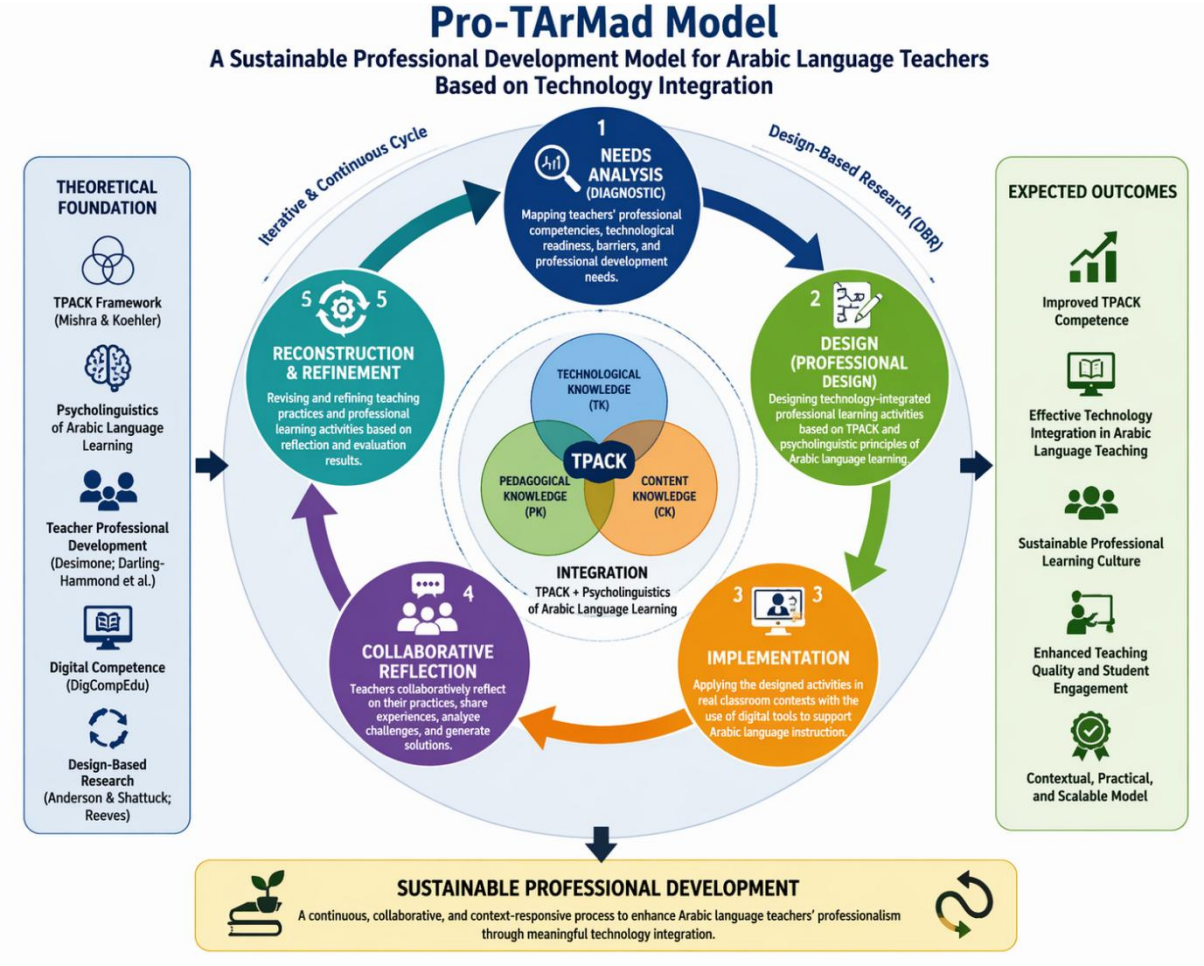
The results of the needs analysis reveal a consistently high level of demand for sustainable professional development among Arabic language teachers, with an overall mean score of 80.4%. Among the measured dimensions, the highest need was identified in the development of a structured professional model (82.5%), followed by technology integration (81.2%), pedagogical and digital challenges (79.4%), and professional competence (78.6%). These findings indicate that teachers are not only aware of the importance of technology integration but also recognize their limitations in implementing it effectively. The high level of need suggests a systemic gap between existing professional development practices and the evolving demands of technology-enhanced education.

From a theoretical perspective, this finding reinforces Desimone's (2009) argument that professional development must be aligned with teachers' actual instructional challenges to be effective. Similarly, Darling-Hammond et al. (2017) emphasize that professional development should be sustained and embedded in practice. The current findings extend this argument by demonstrating that such needs are particularly urgent in language education contexts where technology integration requires complex pedagogical adaptation. Thus, the needs analysis not only serves as a diagnostic stage but also provides a strong empirical justification for the development of a context-specific and sustainable model.

2. Development of the Pro-TArMad Model: Bridging Theory and Practice

Based on the identified needs, the Pro-TArMad model was developed as a cyclical and iterative professional development framework integrating TPACK and psycholinguistic principles. The model consists of five interconnected stages: needs analysis, design, implementation, collaborative reflection, and reconstruction.

Figure 1. Pro-TArMad Model of Sustainable Professional Development



As illustrated in Figure 1, the model operates as an iterative cycle consisting of needs analysis, design, implementation, collaborative reflection, and reconstruction, with TPACK as the core integration. Unlike conventional professional development models that tend to be linear and episodic, Pro-TArMad adopts a practice-based and recursive structure, allowing teachers to continuously refine their instructional practices. This structure operationalizes the TPACK framework by embedding it within concrete teaching activities, thus addressing the widely recognized gap between theoretical knowledge and classroom application (Mishra & Koehler, 2006).

Moreover, the inclusion of collaborative reflection introduces a social dimension to professional learning, enabling teachers to engage in collective inquiry and shared problem-solving. This aligns with contemporary perspectives on professional learning communities, which emphasize collaboration as a key driver of teacher development. The model therefore represents a conceptual advancement by

integrating multiple theoretical frameworks—TPACK, digital competence, and DBR—into a single, coherent system tailored to the madrasah context.

3. Model Validity: Evidence from Expert Evaluation

Table 2. Expert Validation Results

Aspect	Mean Score	Category
Model Construction	3.75	Very Valid
TPACK Integration	3.67	Very Valid
Psycholinguistic Basis	3.58	Valid
Practical Implementation	3.62	Very Valid
Overall Mean	**3.65**	**Very Valid**

The results indicate that the model is conceptually strong and practically applicable, although refinement is needed in linking psycholinguistic theory to practice.

The expert validation results indicate that the Pro-TArMad model achieved a high level of validity, with an overall mean score of 3.65 (very valid). The highest rating was observed in model construction (3.75), followed by TPACK integration (3.67), while the psycholinguistic foundation received a slightly lower score (3.58).

These results suggest that the model is both conceptually sound and practically feasible. However, the relatively lower score in the psycholinguistic dimension highlights the need for further elaboration in connecting theoretical principles with classroom implementation.

Importantly, the feedback provided by experts—such as simplifying technical language and including practical examples—reflects a common tension in educational model development between theoretical rigor and practical usability. Addressing this balance is crucial to ensure that models are not only academically robust but also accessible to practitioners.

Thus, the validation process strengthens the credibility of the model while also guiding its refinement toward greater applicability.

4. Effectiveness of the Model: Evidence from DBR Cycles

The implementation results demonstrate a significant improvement across DBR cycles.

Table 3. *Comparison of DBR Implementation Cycles*

Indicator	Cycle 1	Cycle 2
TPACK Competence Score	2.8	3.6
Positive Teacher Response (%)	76%	89%
Tech–Pedagogy Alignment	Moderate	High
Professional Collaboration	Low	High

The implementation of the Pro-TArMad model through two DBR cycles demonstrates its effectiveness in improving teachers' competencies and instructional practices. The increase in TPACK competence from 2.8 to 3.6 indicates a substantial enhancement in teachers' ability to integrate technology, pedagogy, and content.

In addition, the percentage of positive teacher responses increased from 76% to 89%, suggesting growing acceptance and perceived relevance of the model. Improvements were also observed in the alignment between technology use and linguistic objectives, as well as in professional collaboration among teachers.

These findings provide empirical support for the argument that iterative and practice-based professional development is more effective than one-time training interventions. The DBR cycles allowed teachers to experiment, reflect, and refine their practices, leading to deeper and more sustained learning.

This is consistent with Guskey's (1985) model of teacher change, which emphasizes that changes in beliefs and attitudes follow improvements in practice. The findings of this study extend this model by demonstrating how iterative design processes can facilitate such changes in a technology-enhanced learning context.

5. Advancing TPACK in Context: From Conceptual Framework to Pedagogical Practice

One of the most significant contributions of this study is its demonstration of how TPACK can be operationalized in a specific disciplinary context. While previous research has established TPACK as a foundational framework, its practical implementation remains a challenge for many teachers.

The findings show that the Pro-TArMad model successfully translates TPACK into actionable pedagogical strategies, enabling teachers to move beyond superficial technology use toward meaningful integration aligned with instructional goals. This

is evidenced by the improved alignment between digital tools and linguistic objectives observed during the implementation phase.

This supports recent research suggesting that TPACK development requires contextualized and sustained professional learning experiences, rather than isolated training sessions (Falloon, 2020). Furthermore, it addresses a common limitation in language education, where technology is often used for presentation rather than for facilitating interaction and language acquisition (Kessler, 2018).

6. Contextual Contribution: Professional Development in Madrasah Education

This study also contributes to the limited body of research on technology integration in Arabic language education, particularly within the madrasah context. The findings demonstrate that effective professional development must be **context-sensitive**, taking into account the linguistic, cultural, and institutional characteristics of the educational setting.

The integration of psycholinguistic principles within the model ensures that technology supports the cognitive processes involved in language learning, rather than merely serving as a delivery tool. This contextualization addresses the gap identified in previous studies, which call for more systematic and locally relevant models of technology integration in Arabic language teaching (Alasmari & Alshammari, 2021).

Thus, the Pro-TArMad model represents a localized innovation with broader implications, showing how global frameworks such as TPACK can be adapted to specific educational contexts.

Discussion

The findings demonstrate that the Pro-TArMad model effectively addresses the limitations of conventional professional development by embedding learning within teachers' instructional practices. The significant improvement in TPACK competence suggests that professional knowledge develops more effectively through iterative and context-based engagement rather than isolated training.

This supports and extends the TPACK framework (Mishra & Koehler, 2006) by providing a practical mechanism for its implementation. Unlike previous studies where technology use remained superficial (Kessler, 2018), this study shows that structured cycles enable teachers to align technology with pedagogical and linguistic objectives.

Furthermore, the DBR cycles play a crucial role in sustaining teacher change. The improvement from Cycle 1 to Cycle 2 confirms that teacher development is a gradual process supported by reflection and feedback loops, consistent with Guskey's (1985) model of teacher change.

Another key contribution is the contextualization of the model within madrasah education. The integration of psycholinguistic principles ensures that technology supports language acquisition processes rather than merely delivering content. This addresses the gap identified in Arabic language education research (Alasmari & Alshammari, 2021).

Finally, the increase in professional collaboration highlights the importance of collective learning. The model fosters a professional learning community where teachers actively share experiences and co-construct knowledge, aligning with the principles of effective professional development (Darling-Hammond et al., 2017).

CONCLUSION

This study demonstrates that Arabic language teachers in madrasah face significant challenges in integrating technology into pedagogically meaningful instruction, despite having basic access to digital tools. The findings from the needs analysis reveal a high demand for sustainable and structured professional development, particularly in strengthening the integration of technology, pedagogy, and content knowledge.

The development and implementation of the Pro-TArMad model provide empirical evidence that a cyclical, iterative, and practice-based professional development approach is effective in improving teachers' competencies. The results of the DBR cycles indicate significant improvements in teachers' TPACK competence, instructional alignment, and professional collaboration. These findings confirm that professional development is more impactful when it is continuous, reflective, and embedded within real teaching practices rather than delivered through one-time training programs.

From a theoretical perspective, this study contributes to the literature by operationalizing the TPACK framework within a Design-Based Research approach, demonstrating how theoretical constructs can be translated into practical and context-sensitive professional development models. Furthermore, the integration of

psycholinguistic principles enriches the conceptualization of technology-enhanced language teaching, particularly within the underexplored context of Arabic language education in madrasah.

Practically, the Pro-TArMad model offers an implementable framework for schools and policymakers to design sustainable teacher professional development programs that are responsive to contextual needs. The model also promotes a culture of reflective practice and collaborative learning, which are essential for long-term professional growth.

However, this study is limited by its relatively small sample size and localized context. Future research is recommended to test the model across different educational levels and regions, as well as to examine its impact on student learning outcomes. Additionally, further studies may explore the integration of emerging technologies, such as artificial intelligence and learning analytics, to enhance data-driven professional development. In conclusion, this study underscores the importance of contextualized, sustained, and practice-oriented professional development in enabling teachers to effectively integrate technology into language teaching, thereby improving the quality of education in the digital era.

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