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Bridging Multilingual Policy and Classroom Practice: The Impact of Teacher Professional Development in Lebanese Public Schools

أثر التنمية المهنية للمعلمين: ردم الفجوة بين سياسات التعليم متعدد اللغات والممارسات الصفية
في المدارس الرسمية اللبنانية

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GRAPHICAL ABSTRACT

INPUT	PROCESS	OUTCOME
68 teachers • 312 students Lebanese public schools Pre-/post-test design	6-week MTPD programme Translanguaging • DI • Scaffolding Classroom application	Teacher outcomes ↑ Student outcomes ↑ H1–H4 supported

Figure 1. Graphical abstract: Input–Process–Outcome overview of the professional development intervention. $N = 68$ teachers, 312 students (156 interventions, 156 control).

HIGHLIGHTS

HG1	A substantial gap exists between Lebanon's multilingual education policy and actual classroom practice.
HG2	A six-week professional development programme led to large improvements in translanguaging, scaffolding, differentiated instruction, and teacher self-efficacy.
HG3	Classroom observations confirmed meaningful changes in teaching practices following the intervention.
HG4	Professional development effectively narrowed the policy–practice gap and

improved students' perceptions of clarity, inclusion, and academic support.

ABSTRACT

Multilingual education has long been regarded as an advantage for schools in Lebanon because of the country's history of multilingualism (Arabic, French, and English). Nonetheless, in spite of the policy towards multilingualism, the gap between policy and pedagogy persists, particularly for schools within the context of Lebanon's economic division of schools with different levels of resources and high diversities of students. This study employed a quasi-experimental design with pre-test–post-test and intervention ($n=34$) and control ($n=34$) teacher groups and 312 student participants (intervention group and 156 in the control group) to explore how teachers cope with linguistic diversity when they face structural challenges without institutional support. The study explored the effects of a six-week structured instructional coaching program (Multilingual Teaching Professional Development [MTPD] program) focusing on translanguaging, differentiating instruction, and scaffolding techniques. The results showed significant large improvements in teachers' self-efficacy in relation to instruction ($d=1.02$), differentiating instruction ($d=1.15$), translanguaging practices ($d=1.28$), and scaffolding techniques ($d=1.19$). In classes of intervention group teachers, significant progress has been made. The typology is developed based on the output of three domains: teacher instructional behavior, student classroom experience, and classroom ecology, integrating evidence from quantitative and qualitative findings. Together, the findings demonstrate that sustained, practice-based professional development can strengthen multilingual teaching practices, improve students' classroom experiences, and help narrow the gap between multilingual education policy and classroom practice in Lebanese public schools.

Keywords: multilingual education; teacher professional development; translanguaging; differentiated instruction; scaffolding; Lebanese public schools; mixed-methods research

1. Introduction

1.1 The Paradox of Multilingual Education in Lebanon

Multilingual education is more dependent on the successful enactment of a policy by the classroom teachers than a policy's mere existence (Ball et al., 2012). In Lebanon's trilingual education system, where Arabic, French and English play complementary roles, there is a persistent gap between policy expectations and classroom practice, or the "policy–practice divide" (Krulatz et al., 2022).

This gap is particularly challenging for under-resourced public schools where teachers lack the instructional repertoires to accommodate multilingual learners (Krulatz et al., 2022). This dissonance, coupled with increasing levels of diversity in student backgrounds and a tendency to

marginalise Arabic language in Eurocentric pedagogical approaches (Karam, 2019; Shaaban & Ghaith, 1999), necessitates a greater focus on practice-based professional learning.

1.2 Multilingual Education Context in Lebanon

Educational institutions in Lebanon are built on the principle of multilingualism, which means the use of three languages – Arabic, English, and French. The usage of these languages in the field of education in Lebanon can be viewed as one of the peculiarities of education in this country since it helps to develop multilingualism in students without depriving them of their national identity. Therefore, as it is stated by Karam (2019, p. 37), "Lebanon's linguistic approach to education is seen to be strategic in its capacity to ensure its citizens' participation in international networks, but also that it preserves local identities."

However, the policy of multilingual education is based on a number of factors that affect its implementation in different ways in different educational institutions and even classes. Factors such as the availability of necessary resources in educational institutions, the preparedness of teachers, the availability of textbooks, and others significantly influence the process of the implementation of the mentioned policy, especially in public schools where it is not properly implemented (Frayha, 2004).

1.3 Classroom Diversity and Instructional Demands

Lebanese public schools have become increasingly diverse with the enrolment of refugee students from a wide range of linguistic and educational backgrounds (UNICEF Lebanon, 2022). As classrooms become more diverse, teachers are required to support learners with varying levels of proficiency in the languages of instruction. Research has shown that translanguaging, scaffolding, and differentiated instruction can help teachers respond more effectively to classroom diversity. These approaches have been associated with improved student understanding, greater participation, and stronger learning outcomes in multilingual educational settings (García & Wei, 2014).

1.4 The Policy–Practice Gap in Multilingual Instruction

The gap between national education policy objectives and classroom practices continues to be an issue in large part because of the entrenchment of monolingual conventions and, of equal importance, the overall shortage of professional development for multilingual teaching practices. Without systematic support, "policy implementation often depends on individual teacher improvisation rather than pedagogical principles" (Shaaban & Ghaith, 1999, p. 16). This research shows that professional development needs to address the policy-implementation gap not at an individual level, but by framing professional learning as a more connected, practice-based approach designed to integrate pedagogy with policy directions.

1.5 Structural Constraints and Teacher Agency

In addition to the preparatory aspect of teacher pedagogy, there are larger structural issues that play a role in influencing the multilingual teaching practices in Lebanese public schools. Firstly, the ongoing economic crisis in Lebanon has created numerous difficulties for the teaching profession. For instance, decreasing salaries, excessive workloads, and worsening working conditions have lowered the morale of teachers and their willingness to apply innovative approaches to teaching (Frayha, 2004). Furthermore, economic problems have been complemented by an existing problem of inequality in terms of allocating resources between the public and private educational institutions (Karam, 2019). Inequality leads to unequal access to instructional materials, technology, and professional development in teachers. However, similar issues exist not only in Lebanon but also in other contexts of conflicts and resource-limited settings. Research in this field has shown that the ability of teachers to apply reform pedagogy depends largely on institutional support systems (Borg, 2015; UNESCO, 2021).

In spite of these difficulties, it has been found through empirical research that teachers can maintain a significant amount of professional autonomy if properly supported institutionally and pedagogically. Earlier researches have demonstrated increased flexibility in teaching, improved multilingual self-efficacy, and participation of all students in the classroom as a result of specific professional development interventions, thus demonstrating that adequate support programs can enhance teachers' preparedness to meet the challenge posed by linguistic diversity (Darling-Hammond et al., 2017; Krulatz et al., 2022). In fact, this conclusion is in line with the body of literature on teacher autonomy, because it has been argued earlier that structural conditions cannot define completely the instructional practices, as teachers may use their professional expertise and change their approach if properly supported (Priestley et al., 2015).

1.6 The Need for Targeted Professional Development

Effective implementation of multilingual education policies is contingent on adequate provision of teacher professional development. Currently, the provision of professional development in Lebanon takes the form of theory-centered short-term workshops with little chance for classroom application, collaboration, and follow up (Shaaban & Ghaith, 1999). Such a pattern of provision of professional development has failed to effectively mediate policy intentions and classroom practices since the provision has not offered teachers sufficient and practice-based opportunities to develop necessary multilingual pedagogies.

There have been numerous studies that highlight several characteristics of effective professional development. Duration of professional development, contextualization, provision of opportunities for active learning and modelling, reflection, and collaboration are some of the elements that contribute to effective learning and instruction change (Darling-Hammond et al., 2017; Desimone, 2009; Kennedy, 2016). Practice-based professional development, which allows embedding learning in teachers' daily practice in classrooms, has proved to be an effective tool for the transition from theoretical learning to classroom practices (Ball & Cohen, 1999; Borg, 2015). Research in the area of multilingual education demonstrates the effectiveness of the programs that incorporate classroom application, peer observation, and reflective practice in teachers' learning (Krulatz et al., 2022; Lorenz et al., 2021).

These findings underscore the need for professional development models that move beyond one-off training events toward sustained, practice-embedded professional learning. The present

study responds to this need by implementing a structured six-week programme that integrates theoretical grounding with iterative classroom application, peer feedback, and guided reflection.

1.7 Purpose of the Study

The present investigation attempts to fill in the research and policy voids by exploring how a structured teacher professional development program affects multilingual pedagogical practices and students' classroom experiences in public Lebanese schools. The program focused on enhanced and targeted application by teachers of three pedagogical strategies, translanguaging, differentiation and scaffolding which have become a prominent in the literature of multilingual education. It tried to draw together three pedagogical strategies in one professional development package and hoped to promote deeper students' understandings and engagement and more equitable student experiences. The study addresses the issue by making three major contributions to the field. First, it gives us quasi-experimental evidence from the public schools' system in Lebanon since most of previous research in that region is predominantly descriptive and qualitative. Second, it takes an integrated approach and addresses different levels of pedagogical practice and the experience of students through an embedded mixed methods approach combining survey, observation, interview and essay data. Third, it has pragmatic implications for policy makers who need to improve public programs for multilingualism in their respective context.

1.8 Research Questions

The study was guided by the following research questions:

- RQ1.** Does participation in a structured professional development programme improve teachers' multilingual instructional practices?
- RQ2.** To what extent does the intervention influence students' perceptions of instructional clarity, inclusion, and academic support?
- RQ3.** Which dimensions of classroom practice show the greatest change following the intervention?

1.9 Hypotheses

Based on the theoretical framework and existing literature, the following hypotheses were tested:

- H1:** Teachers in the intervention group will demonstrate significantly greater gains in instructional self-efficacy than those in the control group.
- H2:** Intervention group teachers will show greater improvement in the use of differentiated instruction strategies.
- H3:** Intervention group teachers will demonstrate increased implementation of translanguaging practices.
- H4:** Intervention group teachers will exhibit greater use of scaffolding strategies relative to the control group.

H5: Students of intervention group teachers will report significantly greater improvements in instructional clarity, inclusion, academic support, and engagement than students of control group teachers.

2. Literature Review

2.1 Multilingual Education in the Lebanese Context

The Lebanese public education system operates within a long-established trilingual framework that promotes the use of Arabic, French, and English as languages of instruction and communication (Karam, 2019; Shaaban & Ghaith, 1999). This multilingual policy is widely regarded as a strategic asset, enabling students to develop competencies across multiple linguistic repertoires while maintaining connections to their cultural and linguistic identities. As Karam (2019, p. 37) notes, "Lebanon's linguistic approach to education is considered to be strategic in its ability to ensure its citizens' participation in international networks, but also that it preserves local identities."

The implementation of this trilingual policy, however, has been complicated by significant structural pressures, including the substantial enrolment of refugee students following the Syrian conflict. According to UNICEF Lebanon (2022), approximately one-third of students enrolled in Lebanese public schools are non-Lebanese, the majority of whom are Syrian refugees. These students bring diverse linguistic backgrounds, varying levels of proficiency in the languages of instruction, and, in many cases, interrupted educational trajectories. Despite this linguistic and educational diversity, a critical gap persists within the public education system: there is no centralised or mandatory pre-service or in-service teacher education programme specifically designed to prepare teachers for multilingual education. This lack of systematic professional preparation fundamentally limits teachers' capacity to address the complex linguistic needs of increasingly diverse classrooms and represents a critical challenge to achieving equitable and inclusive education.

2.2 Pedagogical Approaches in Multilingual Classrooms

There are many methods that can be found beneficial for use within multilingual learning environments, the first of which is differentiated instruction, also referred to by various other terms. "In order to meet diverse cognitive and linguistic demands in the curriculum, students need access to content, processes, and products that respond to their varying readiness, interests and learning profiles" (Tomlinson, 2014, p. 1). This strategy assumes that students arrive in a classroom setting already equipped with different learning styles, prior experiences, language and academic competencies and that teachers are responsive to these differences through methods such as varying the composition of flexible groups, implementing tiered assignments or providing various paths to attain learning targets.

Scaffolding, based on the theoretical underpinnings of Vygotsky's zone of proximal development (Vygotsky, 1978), is temporary assistance to learning, gradually reduced as the learner achieves more independence. Multilingual classes involve several types of scaffolding, such as visual aids, language modeling, strategic questions, and collaboration with peers, to allow students to interact with materials which exceed their current competence.

Translanguaging, as defined by García & Wei (2014), is an active application of the learners' complete linguistic toolkit to create meaning through different languages. Unlike considering separate and isolated languages, translanguaging perceives multilingualism as a resource for strategic understanding and communication. According to a systematic review of 25 secondary EFL classrooms in the context of 25 empirical studies, despite the consistent justification of translanguaging for cognitive, affective, and sociocultural reasons and its strategic implementation by teachers, translanguaging lacks institutional support, with structured professional development concerning translanguaging in less than a handful of the reviewed studies (Zakharova & Lasagabaster, 2026). The discrepancy between the advantages of translanguaging and the lack of professional development is what motivates the intervention design of the current study.

2.3 Teacher Preparedness and Professional Development

A recurring theme in the multilingual education literature is that many teachers feel unprepared to teach in linguistically diverse classrooms, particularly in the absence of professional development focused on multilingual pedagogy (Krulatz et al., 2022; Shaaban & Ghaith, 1999). Research has consistently identified that sustained instructional change depends on professional development that is extended in duration, relevant to teachers' classroom contexts, provides opportunities to model and practise instructional strategies, and incorporates structured reflection and feedback (Darling-Hammond et al., 2017; Desimone, 2009). Short, isolated workshops, by contrast, have been shown to produce limited and short-lived effects on classroom practice (Garet et al., 2001; Kennedy, 2016).

The importance of practice-based professional development is particularly pronounced in multilingual contexts, where teachers must navigate the complex interplay between language development and content learning. Effective professional development in this domain should equip teachers with not only theoretical knowledge but also practical strategies for responding to diverse language needs, designing accessible instruction, and fostering inclusive classroom environments (Cummins, 2021; Lucas & Villegas, 2013).

2.4 Empirical Studies on Teacher Training in Multilingual Contexts

Multiple empirical studies have established that structured professional development (PD) for educators can enhance instructional practice and produce improved student outcomes across a wide variety of educational settings (Liu et al., 2021; Bozkurt et al., 2020). A meta-analysis of studies examining PD revealed that PD programs that provided active learning opportunities, collaborative work, and opportunities for sustained professional development had a moderate to large positive effect on teacher knowledge and practice (Darling-Hammond et al., 2017). Furthermore, following participation in a structured online PD program, teachers' adaptive

competence improved significantly, with effect sizes ranging from $d = 0.45$ to 0.60 (König et al., 2020).

2.5 Theoretical Framework

This research is informed by two different but related theories namely, the Sociocultural Theory (Vygotsky, 1978) and the Technological Pedagogical Content Knowledge Theory (TPACK) (Mishra & Koehler, 2006). In the Sociocultural Theory, learning is viewed as a social process and the individual's development takes place through social interactions and participation. It is important to note that learning takes place in the zone of proximal development where the individual can do things assisted that he/she cannot do alone.

Most importantly for the current study, a longitudinal study among in-service teachers of English as an additional language in Norway showed that regular professional development activities made teachers more sensitive to the needs of multilingual students and fostered more positive attitudes towards multilingually oriented education, despite the fact that changes in classroom practice trailed the changes in attitudes (Lorenz et al., 2021). This shows how important it is to use both self-reporting and classroom observations when assessing the impact of professional development on teachers.

Nevertheless, in Lebanon and the wider MENA region, empirical studies of the impact of professional development programs in teachers are very scarce – the overwhelming majority of the existing literature is either descriptive or based on interviews and surveys (Karam, 2019; Shaaban & Ghaith, 1999). It leaves a lot of room for improvement and the current study aims to fill at least some of it by providing quasi-experimental evidence from Lebanese public schools.

The majority of TPACK research is dedicated to how to effectively implement technology in classrooms. Similarly, although the “structural logic” of TPACK, as opposed to the “T,” is adapted for my research (whereby, teachers connect areas of their knowledge not to foster expertise but to promote student understanding), “TPACK is a useful framework for understanding knowledge domain integration within multilingual classrooms; that is, where pedagogy must coexist with, and informed by, awareness of students’ content knowledge and the students’ linguistic knowledge, their local context, their linguistic skills and needs. Instead of the whole framework, a revised version of TPACK (where the T is stripped and context/sociolinguistics is enhanced) is the frame through which I examine how pedagogy and context inform classroom decision making within multilingual classes.

Figure 2
Conceptual framework of the study

SOCIOCULTURAL THEORY	↔	TPACK FRAMEWORK
<i>Vygotsky (1978)</i>		<i>Mishra & Koehler (2006)</i>
Zone of Proximal Development · Mediated Learning · Scaffolding as Social Practice		Pedagogical Knowledge · Content Knowledge · Contextual / Sociolinguistic Awareness

Note. The figure illustrates how Sociocultural Theory and the TPACK Framework jointly inform the six-week structured professional development (PD) intervention and its expected outcomes, including improvements in teacher self-efficacy, translanguaging, differentiated instruction, scaffolding, and student learning experiences.

Together, these two frameworks provide a means of understanding the processes by which professional learning causes instruction to change. Sociocultural theory accounts for the mediated nature of teacher learning and TPACK (modified) identifies what teachers must blend to enact effective practice in the multilingually-situated learning setting. These two perspectives inform the design of a six week structured intervention, developed for purposes of cultivating teachers' pedagogical, content, and contextual knowledge in scaffolded professional learning experiences.

2.6 Research Gap and Study Contribution

Despite growing recognition of the challenges associated with multilingual education in Lebanon, empirical evidence examining the impact of professional development on multilingual instructional practices remains limited. Most studies in Lebanon and the wider MENA region have focused on describing challenges and barriers rather than evaluating intervention outcomes. This study addresses this gap by providing mixed-methods quasi-experimental evidence from Lebanese public schools. Using a pre-test–post-test control-group design involving 68 teachers and 312 students (156 per group), the study examines the extent to which core principles of multilingual pedagogy can be implemented and evaluated in authentic classroom settings.

The theoretical perspectives outlined above provide a foundation for understanding how teachers learn to implement multilingual practices, while the methods described in the following section operationalize these perspectives within a rigorous research design.

3. Methods

3.1 Research Design

This study employed a mixed-methods pre-test–post-test control group quasi-experimental design to evaluate the impact of a structured professional learning programme on teachers' multilingual teaching practices and student classroom experiences in Lebanese public schools. Quantitative and qualitative data were collected concurrently and integrated during the data interpretation phase (Creswell & Creswell, 2018). The quasi-experimental design was necessitated by the practical constraints of conducting research in authentic school settings, where random assignment of individual teachers or students was not feasible. To strengthen the rigour of the design, schools were purposively selected from similar public-school contexts to enhance comparability between intervention and control groups.

3.2 Participants and Sampling

Participants comprised 68 teachers and 312 students drawn from public schools in Lebanon. Teachers were assigned to intervention ($n = 34$) or control ($n = 34$) groups at the school level using purposive cluster sampling. Student participants were nested within intact classrooms of participating teachers, with 156 students in the intervention group and 156 in the control group. All participating schools served student populations with comparable educational and linguistic characteristics and were located in similar socio-economic contexts.

Table 1
Participant Characteristics

Variable	Description
Total teachers	68
Intervention group	34
Control group	34
Total students	312 (156 intervention, 156 control)
Education level	Upper primary – secondary
School type	Public schools, Lebanon
Sampling method	Purposive cluster sampling
Assignment unit	School (cluster level)
Teacher gender distribution	Male: 18 (26.5%); Female: 50 (73.5%)
Years of teaching experience (M, SD)	M = 11.4 years, SD = 5.2
Subjects taught	English: 21; French: 19; Science: 12; Mathematics: 10; Humanities: 6 (total > 68 as some teachers taught multiple subjects)
Languages in which teachers are proficient	Arabic: 68 (100%); French: 52 (76.5%); English: 61 (89.7%)
Prior exposure to multilingual-education PD	Yes: 16 (23.5%); No: 52 (76.5%)

Note. Student participants were nested within intact classrooms of participating teachers. PD = professional development.

An a priori power analysis (G*Power 3.1) confirmed that a minimum of 64 teachers was required to detect a medium effect size (Cohen's $d = 0.50$) at $\alpha = .05$ with statistical power of .80. The final sample ($N = 68$) exceeded this threshold. Descriptive baseline survey results indicated

similar levels of instructional self-efficacy, translanguaging, differentiated instruction, and scaffolding practices across the intervention and control groups prior to the intervention (see Table 3); formal inferential tests of baseline equivalence were not conducted and are noted as a limitation (Section 5.7). Ethical approval was granted by the Institutional Review Board (IRB-2025-042) prior to data collection.

3.3 Instruments and Validity Evidence

Teacher Survey

The teacher survey assessed instructional self-efficacy and the use of differentiated instruction, translanguaging, and scaffolding practices through a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha coefficients ranged from .82 to .88 across subscales, indicating good internal consistency. Prior to data collection, the instrument was reviewed by three specialists in language education, multilingual pedagogy, and educational research to establish content validity. Their feedback led to minor revisions in wording and item phrasing. The survey was developed with reference to the theoretical perspectives of García and Wei (2014), Tomlinson (2014), and Vygotsky (1978). The instrument was pilot-tested with 10 teachers from a non-participating school to assess clarity, readability, and completion time. Minor wording adjustments were made based on pilot feedback.

Student Survey

The student survey measured perceptions of instructional clarity, inclusion, academic support, and engagement using a five-point Likert scale. Cronbach's alpha coefficients ranged from .80 to .86 across subscales, indicating acceptable internal consistency. Items were adapted from established educational survey instruments and reviewed to ensure suitability for the local educational context. Sample items included: “My teacher explains things in a way I can understand” (clarity), “I feel valued in my classroom” (inclusion), “My teacher helps me when I am struggling” (academic support), and “I participate actively in my lessons” (engagement).

Classroom Observation Checklist

A structured observation checklist was developed to document classroom practices during the intervention. Inter-rater reliability was established through a structured calibration process prior to the commencement of observations. Two trained observers independently coded a total of 12 lessons (approximately 20% of the total observation sample) during the calibration phase. Following each calibration session, discrepancies were discussed and resolved to ensure consistent application of the observation criteria. Inter-rater reliability, calculated as percentage agreement, reached 87% across the calibration sessions. Cohen's kappa was also computed, yielding a coefficient of $\kappa = 0.81$, indicating near-perfect agreement beyond chance (Landis & Koch, 1977). Reliability checks were conducted at two additional points during the data collection period (after Weeks 3 and 6) to monitor observer drift; agreement remained above 85% at both checkpoints.

3.4 Intervention: Professional Development Programme

The intervention consisted of a six-week structured professional development programme, the Multilingual Teaching Professional Development (MTPD) programme, addressing translanguaging, differentiated instruction, and scaffolding as mutually reinforcing components of multilingual teaching competence. The programme was designed to integrate theoretical foundations with practical classroom application, incorporating iterative cycles of learning, application, reflection, and feedback.

Table 2
Six-Week Professional Development Programme Structure

Week	Topic	Key Activities
1	Translanguaging Foundations	Theory/principles; case study analysis; classroom application task
2	Translanguaging in Practice	Designing multilingual activities; reflective discussion; peer sharing of experiences
3	Differentiated Instruction	Content/process/product differentiation; levelled task design; peer feedback
4	Scaffolding Strategies	Visual/linguistic scaffolds; ZPD-based lesson planning; microteaching practice
5	Guided Classroom Implementation	Application of strategies; peer observation and feedback; reflective discussions
6	Integration and Reflection	Combined use of all strategies; observation debrief; action planning for future practice

Note. The six-week MTPD programme progressively integrated translanguaging, differentiated instruction, and scaffolding through theory, classroom application, peer collaboration, and reflective practice.

3.5 Data Collection Procedures

Data were collected in three phases over a ten-week period:

Phase 1 (Pre-intervention, Week 1): Both intervention and control groups completed baseline surveys and participated in one 30-minute structured classroom observation per teacher. These observations established pre-intervention baseline measures of instructional practices.

Phase 2 (Intervention, Weeks 2–7): The intervention group participated in the six-week MTPD programme as described in Section 3.4. Between weekly sessions, teachers completed classroom application tasks designed to promote transfer of learning to authentic instructional contexts. The control group continued regular instructional duties without participating in any form of structured professional development related to multilingual pedagogy. Control-group teachers were informed

that they were participating in a study examining classroom practices in Lebanese public schools but were not made aware of the specific content or objectives of the intervention to minimize contamination effects. To uphold ethical standards, all control-group participants were offered the full MTPD programme as a compensatory training opportunity following the completion of post-intervention data collection.

Phase 3 (Post-intervention, Weeks 9–10): Both groups completed all measures again, including surveys and classroom observations.

Implementation Fidelity

To ensure the intervention was delivered as intended, several fidelity measures were implemented. All six weekly professional development sessions were facilitated by the same trained instructor, who followed a standardized facilitator guide with prescribed learning objectives, activity sequences, and time allocations for each session. Session attendance was recorded at each workshop; of the 34 intervention-group teachers, 32 (94.1%) attended all six sessions, with the remaining two teachers attending five of six sessions due to scheduling conflicts. Teachers in the intervention group completed weekly classroom application tasks between sessions, and submission rates were monitored; 31 of 34 teachers (91.2%) submitted all six application tasks. Facilitator self-checklists and session debrief notes confirmed that all core content areas (translanguaging, differentiated instruction, scaffolding) were covered within the prescribed timeframes. No significant deviations from the intended programme structure were observed.

3.6 Data Analysis

The quantitative data was analyzed using SPSS version 28. Teacher outcome scores gain scores were calculated for individual teachers (post-test – pre-test score). The independent samples t-tests was conducted for comparing the mean gain scores between intervention group and control group. Cohen's d (Cohen, 1988) was calculated as a measure of the magnitude of the effect sizes and interpreted as small (0.20), medium (0.50), and large (0.80).

For student outcomes, only inferential statistics was undertaken for the intervention group only (n=156), a pair t test conducted for pre-test versus post-test comparison on gain scores. The outcome scores of control group students are reported descriptively in table 5, as comparative data. This approach was taken, because the main research interest was to see if students' teachers' were able to improve them on some key performance measures, we did not test difference of student's gains scores in order to avoid problems arising from the clustered and nested nature of our data, and focused our inferential statistics upon within-group gain differences. All parameters' requirements were fulfilled (normality and homoscedasticity).

The data of teachers' reflective statements and observation notes were interpreted using thematic analysis following Braun and Clarke's (2006) six phases process, beginning by: getting familiarized to the data, generating an initial set of codes, searching for a relevant themes, reviewing the themes, defining and naming the themes and producing the final report.

4. Results

The results are presented in two stages. First, descriptive statistics are reported to establish baseline equivalence between participants prior to the intervention. Second, inferential analyses examine the effects of the six-week professional development programme on teacher outcomes, student outcomes, and classroom observations.

4.1 Descriptive Statistics

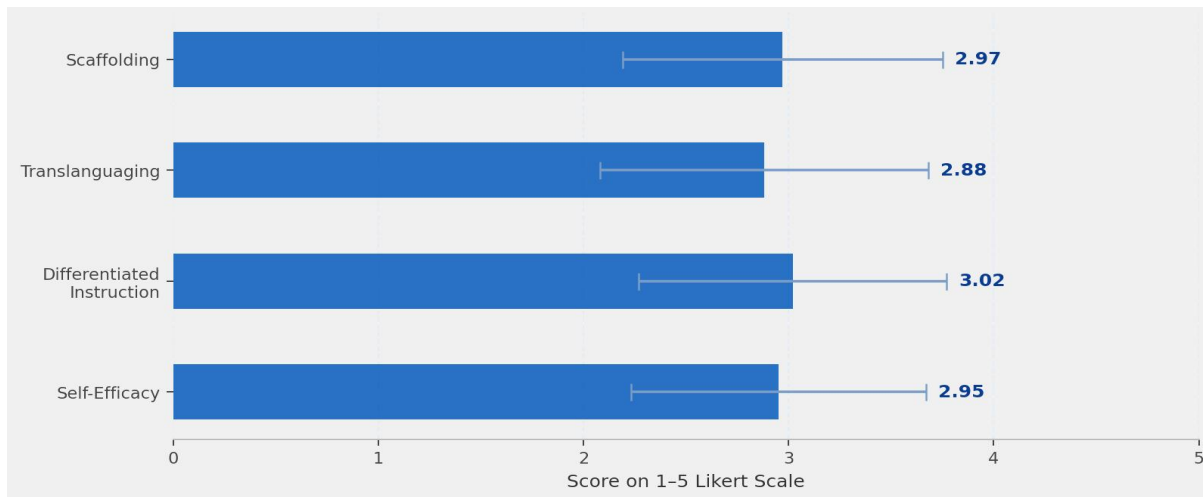
To establish baseline equivalence prior to the intervention, descriptive statistics were calculated for teacher self-efficacy, differentiated instruction, translanguaging, and scaffolding. As shown in Table 3, mean scores across the four instructional competency dimensions were comparable, indicating similar pre-intervention levels among participants. Figure 4 provides a visual summary of these baseline scores.

Table 3
Descriptive Statistics: Pre-Intervention Baseline Scores

Variable	N	M	SD	Min	Max
Self-Efficacy	68	2.95	0.72	1	5
Differentiated Instruction	68	3.02	0.75	1	5
Translanguaging	68	2.88	0.80	1	5
Scaffolding	68	2.97	0.78	1	5

Note. Descriptive statistics indicate comparable baseline levels across the four instructional competency dimensions prior to implementation of the professional development programme.

Figure 4
Baseline Teacher Scores Across the Four Instructional Competency Dimensions (Pre-Intervention)



Note. Mean pre-intervention scores are presented for teacher self-efficacy, differentiated instruction, translanguaging, and scaffolding. Error bars represent standard deviations and indicate comparable baseline performance across the four instructional competency dimensions before implementation of the professional development programme.

4.2 Inferential Statistics: Teacher Outcomes (H1–H4)

Independent-samples t-tests comparing gain scores between the intervention and control groups revealed statistically significant differences across all variables, providing strong support for H1–H4.

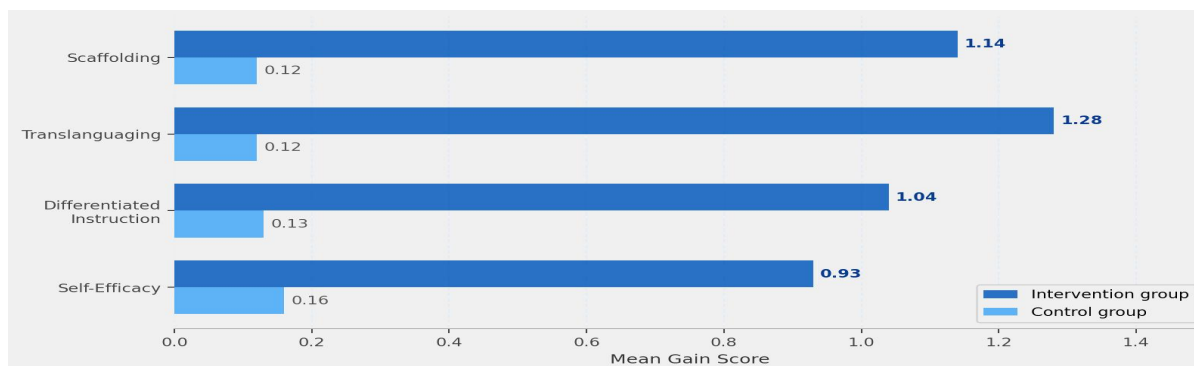
Table 4
Change in Teacher Outcomes by Group

Variable	Int. Gain	Ctrl. Gain	t-value	p-value	Cohen's d
Self-Efficacy	+0.93	+0.16	8.12	< .001	1.02
Differentiated Instruction	+1.04	+0.13	8.94	< .001	1.15
Translanguaging	+1.28	+0.12	9.31	< .001	1.28
Scaffolding	+1.14	+0.12	8.76	< .001	1.19

Note. All comparisons significant at $p < .001$. All effect sizes (Cohen's d) fall within the 'large' range ($d > 0.80$).

Figure 5

Mean gain scores for teacher outcomes



Note. The intervention group demonstrated substantially greater mean gains than the control group across all four instructional competency dimensions, indicating the positive effect of the six-week professional development programme.

4.3 Student Outcomes

Paired-samples *t*-tests comparing pre- and post-intervention scores within the intervention group ($n = 156$) revealed statistically significant improvements across all four dimensions. Corresponding pre- and post-intervention scores for the 156 control-group students are reported in Table 5 for descriptive comparison; as student-level inferential analyses were conducted only for the intervention group (see Section 3.6), the apparent stability of control-group scores was not formally tested.

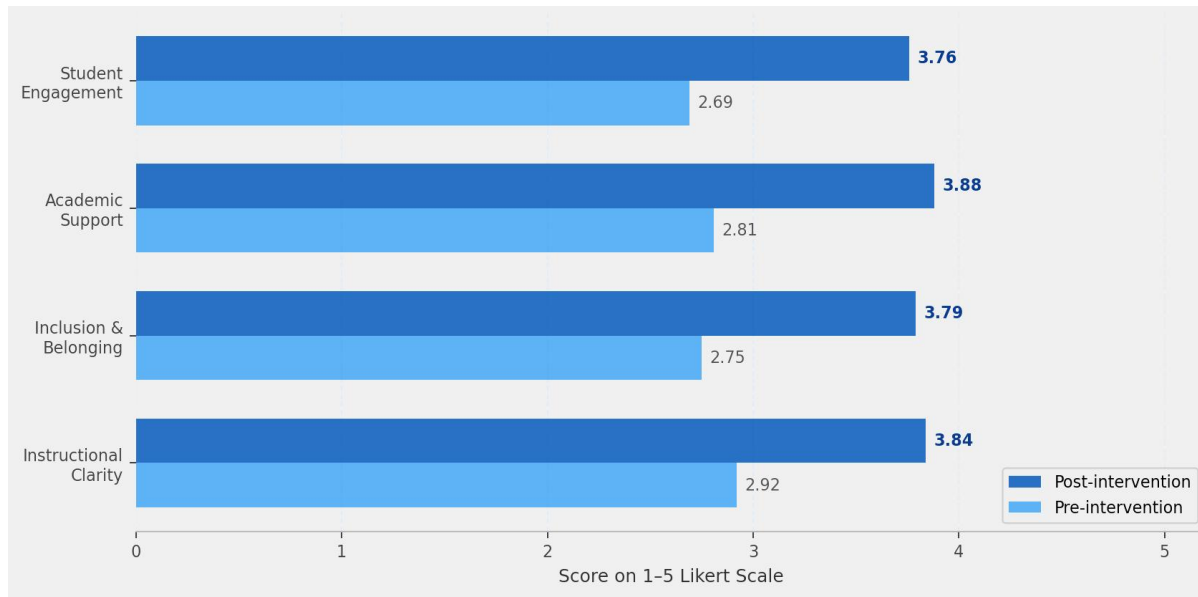
Table 5
Student Perception Scores: Pre- and Post-Intervention

Variable	Int. Pre	Int. Post	Ctrl. Pre	Ctrl. Post	t-value	p	Cohen's d
Clarity	2.92	3.84	2.88	3.01	10.42	< .001	~0.97
Inclusion	2.75	3.79	2.70	2.95	11.03	< .001	~1.03
Academic Support	2.81	3.88	2.79	3.02	11.03	< .001	~1.03
Engagement	2.69	3.76	2.65	2.90	9.87	< .001	~0.93

Note. Paired-samples *t*-tests were conducted for the intervention group ($df = 155$). Int. = Intervention; Ctrl. = Control. Students in the intervention group demonstrated consistent improvements across all four dimensions following the six-week professional development programme.

Instructional clarity improved significantly, $t(155) = 10.42$, $p < .001$, 95% CI [0.75, 1.10], while academic support showed the largest gain, $t(155) = 11.03$, $p < .001$, 95% CI [0.88, 1.26].

Figure 6
Student perception scores pre- and post-intervention



Note. Students in the intervention group reported higher post-intervention scores across instructional clarity, inclusion and belonging, academic support, and student engagement, indicating improved classroom experiences following the six-week professional development programme.

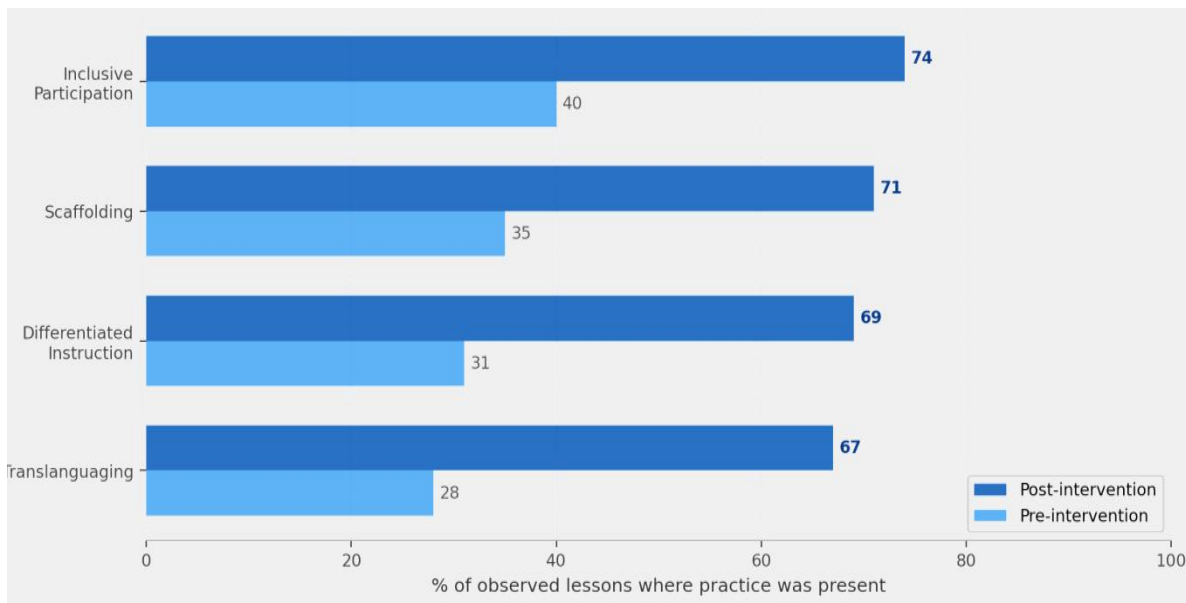
4.4 Classroom Observations

Table 6
Observed Teaching Practices Before and After the Intervention

Practice	Pre-Intervention (%)	Post-Intervention (%)	Absolute Change
Translanguaging	28%	67%	+39 pp
Scaffolding	35%	71%	+36 pp
Differentiated Instruction	31%	69%	+38 pp
Inclusive Participation	40%	74%	+34 pp

Note. Percentages represent the proportion of observed lessons in which each practice was present. pp = percentage points.

Figure 7
Observed classroom practice rates before and after the intervention



Note. Classroom observations indicated substantial increases in the implementation of translanguaging, differentiated instruction, scaffolding, and inclusive participation following the six-week professional development programme.

4.5 Qualitative Evidence from Classroom Observations

Teachers who participated in the training frequently described becoming more aware of the different language needs present in their classrooms and reported feeling better equipped to respond to them.

"Before the training, I tended to follow the same approach with all students. After the workshops, I started paying more attention to how students understood and expressed ideas, and I became more flexible in the way I explained concepts."

"What I found most useful was that the training focused on practical classroom situations. The strategies were simple to apply, and I noticed that more students became involved in the lesson, especially those who were usually hesitant to participate."

"One of the biggest changes for me was realizing that students learn better when I allow them to connect ideas across languages. I became less concerned about keeping languages separate and more focused on helping students understand the lesson."

"I noticed that students who rarely participated before the training became more willing to contribute during classroom discussions. Allowing different ways of expressing ideas seemed to increase their confidence and encourage greater participation."

"The training encouraged me to think more carefully about how I support students during lessons. Rather than relying on the same explanation for everyone, I started using different examples and providing additional support when needed."

These observations were consistent with the quantitative findings, which showed substantial improvements in translanguaging, scaffolding, differentiated instruction, and students' classroom experiences following the intervention. For example, teachers' reports of becoming "less concerned about keeping languages separate" align with the largest quantitative gain observed, in translanguaging ($d = 1.28$), while reports of increased participation among previously hesitant students correspond with the rise in observed inclusive participation (40% to 74%, Table 6). A more detailed mapping of qualitative themes to quantitative indicators is presented in the typology in Section 5.2 (Table 9).

Table 7

Emergent Themes from Classroom Observation Notes and Teacher Reflections

Theme	Description	Representative Evidence
Increased instructional flexibility	Teachers reported adapting explanations, activities, and support according to students' language needs.	Teachers described using multiple ways of presenting information and adjusting explanations during lessons.
Greater use of translanguaging	Teachers became more comfortable drawing on students' linguistic resources to support understanding.	Observations showed more frequent movement between languages to clarify concepts and instructions.
Enhanced student participation	Teachers reported increased involvement from previously hesitant students.	Observers noted higher levels of questioning, peer interaction, and classroom participation.
Improved confidence in multilingual teaching	Teachers expressed greater confidence in responding to linguistic diversity.	Reflections indicated stronger belief in ability to support learners with different language backgrounds.

Note. Themes were derived through inductive analysis of classroom observation notes and teacher reflections, illustrating teachers' experiences and perceived changes in multilingual instructional practices following the professional development programme.

4.6 Effect Sizes

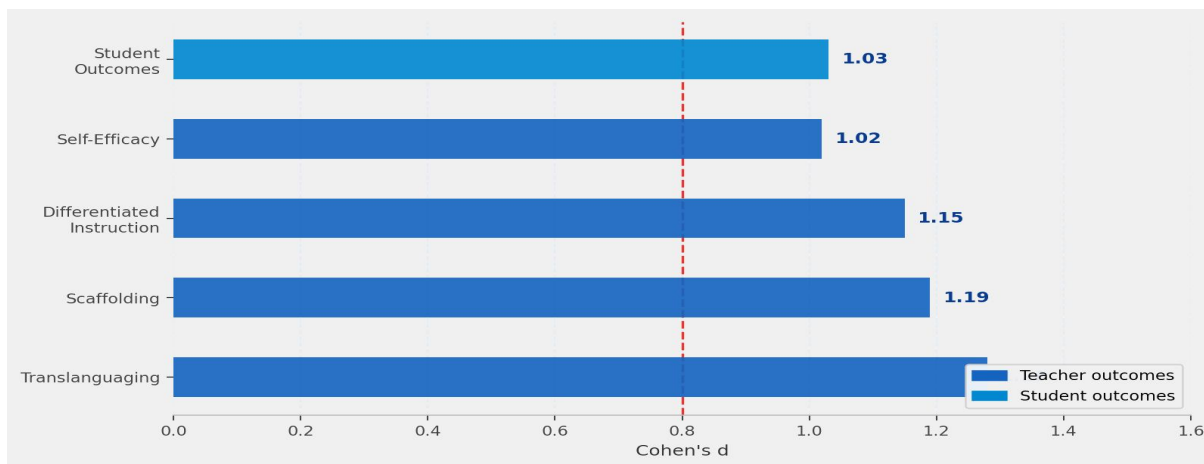
Effect sizes ranged from $d = 1.02$ to $d = 1.28$ for teacher outcomes and reached $d = 1.03$ for student outcomes. According to Cohen's (1988) benchmarks, all values fall within the 'large' range ($d > 0.80$).

Table 8
Effect Size Summary

Comparison	Test	Statistic	p-value	Effect Size (d)	Magnitude
Translanguaging: Int. vs Ctrl.	Independent t-test	$t(66) = 9.31$	$< .001$	1.28	Large
Scaffolding: Int. vs Ctrl.	Independent t-test	$t(66) = 8.76$	$< .001$	1.19	Large
Differentiation: Int. vs Ctrl.	Independent t-test	$t(66) = 8.94$	$< .001$	1.15	Large
Self-Efficacy: Int. vs Ctrl.	Independent t-test	$t(66) = 8.12$	$< .001$	1.02	Large
Student Inclusion (Pre vs Post)	Paired t-test	$t(155) = 11.03$	$< .001$	1.03	Large
Student Academic Support (Pre vs Post)	Paired t-test	$t(155) = 11.03$	$< .001$	1.03	Large
Student Engagement (Pre vs Post)	Paired t-test	$t(155) = 9.87$	$< .001$	0.93	Large

Note. Effect sizes were calculated using Cohen's d . All observed effects were large ($d \geq 0.80$), indicating substantial improvements in both teacher instructional competencies and student perceptions following the intervention.

Figure 8
Effect sizes (Cohen's d) for teacher and student outcomes



Note. All values exceed the threshold for large effects ($d = 0.80$), indicating practically significant intervention effects.

5. Discussion

5.1 Interpretation of Findings

The results suggest that the policy–practice gap in Lebanese multilingual education is influenced, in part, by professional capacity deficits, and appears improvable with appropriately tailored, practice-based professional development. Both groups reported similarly low levels of translanguaging, differentiated instruction, and scaffolding at baseline, indicating that exposure to policy and language command do not, by themselves, promote expert multilingual pedagogy (Darling-Hammond et al., 2017; Desimone, 2009).

The intervention group exhibited statistically significant and practically large effects on all four teacher outcome measures ($d = 1.02$ – 1.28). Translanguaging had the largest gain ($d = 1.28$), suggesting a deeper change in teacher beliefs about the validity of using students' complete linguistic repertoire as a resource (García & Wei, 2014). In practical terms, a d of this magnitude implies that the average intervention-group teacher's post-intervention translanguaging score exceeded roughly the 90th percentile of the control group's post-intervention distribution, illustrating the extent of separation between the two groups beyond statistical significance alone. Student outcomes showed a phased structure: proximal outcomes (clarity, inclusion) were more rapidly responsive than distal outcomes (engagement), consistent with Fredricks et al. (2004).

5.2 Output Analysis: What Changed and How

A closer examination of the findings organises the results into a three-domain typology of intervention output—teacher instructional behaviour, student classroom experience, and classroom ecology—each evidenced through a distinct combination of quantitative and qualitative indicators (Table 9).

Table 9

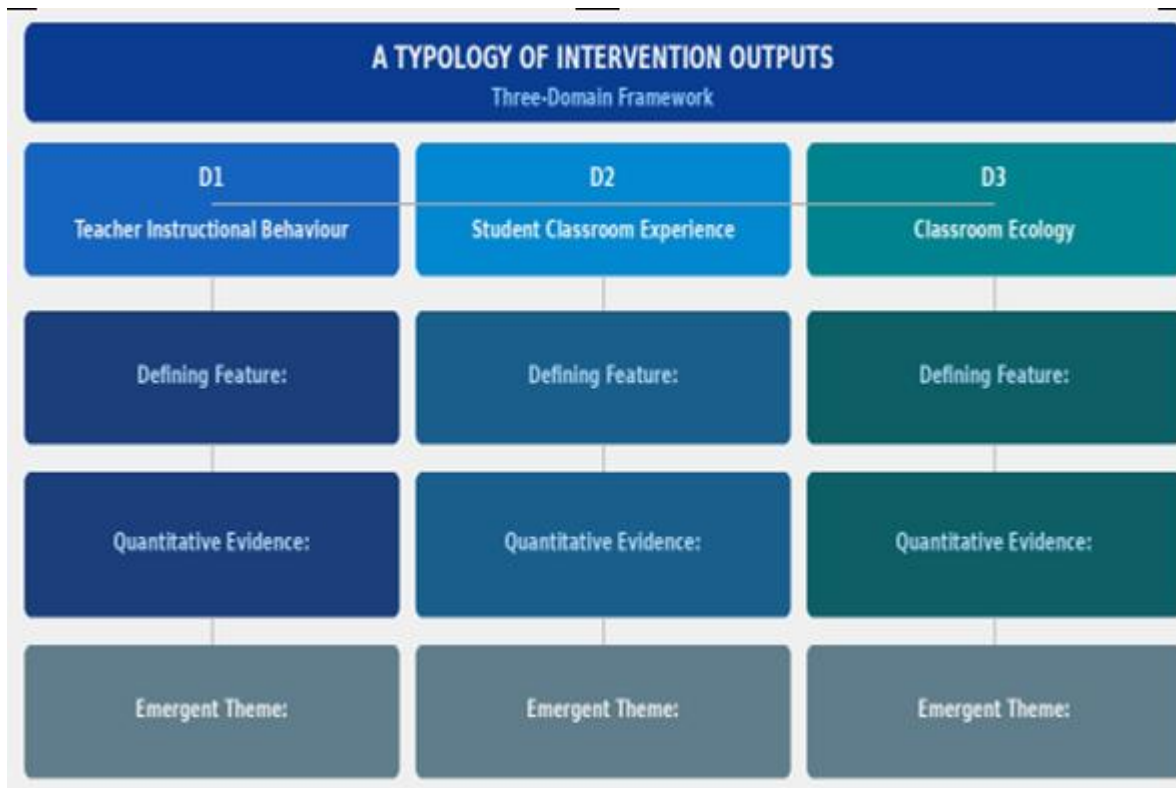
A Typology of Intervention Outputs: Domains, Indicators, and Emergent Themes

Domain	Defining Feature	Quantitative Evidence	Emergent Theme
D1 Teacher Instructional Behaviour	Convergence of self-reported and observed use of translanguaging, differentiated instruction, and scaffolding	Observed practice rose +34 to +39 pp; $d = 1.02$ – 1.28	Instructional flexibility · Greater translanguaging
D2 Student Classroom Experience	Phased pattern: proximal gains (clarity, support) precede distal gains (engagement)	Clarity $t(155) = 10.42$, $p < .001$; inclusion $d = 1.03$; engagement $d = 0.93$	Enhanced student participation
D3 Classroom Ecology	Shift in the relational and linguistic climate of the classroom	Inclusive participation 40% → 74% (+34 pp)	Multilingual confidence

Note. The typology integrates quantitative findings with qualitative themes to illustrate how changes in teacher practices, student classroom experiences, and classroom ecology converged following the professional development programme. Effect sizes are reported as Cohen's d ; pp = percentage points.

Figure 9

Three-Domain Typology of Intervention Outputs Derived from the Mixed-Methods Findings



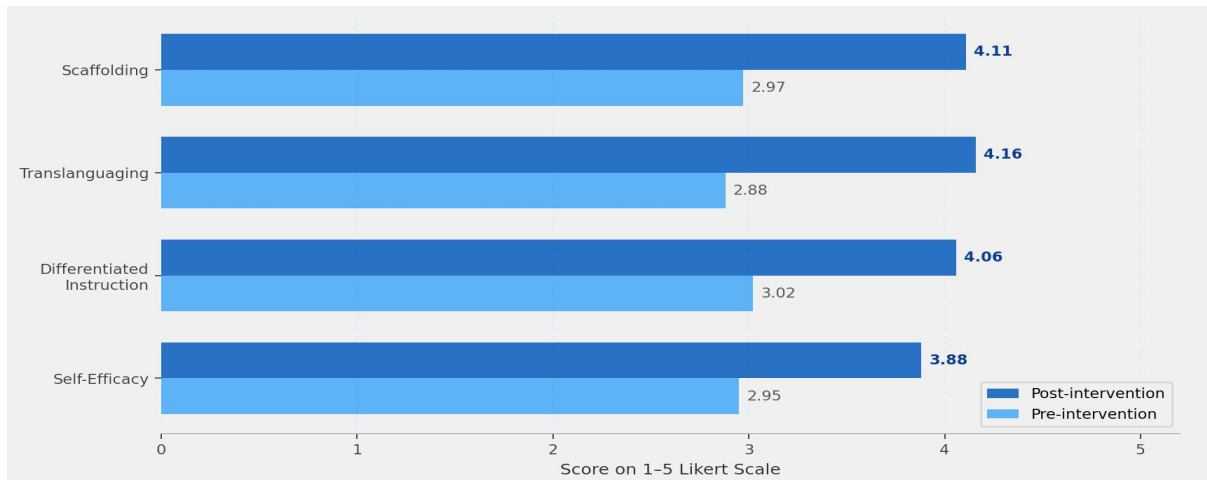
Note. The figure presents an integrated visual summary of the intervention outcomes across three domains by linking defining features, quantitative evidence, and emergent qualitative themes. It illustrates the convergence of the mixed-methods findings following the six-week professional development programme.

The value of this typology lies in its capacity to demonstrate convergent validity across independent sources of evidence. By organising the findings into discrete but interlocking domains, the typology makes explicit that the intervention produced change at three levels simultaneously: in what teachers do, in what student's experience, and in the broader relational climate of the classroom.

The qualitative data supported the quantitative findings. For instance, the theme "increased instructional flexibility" (Table 7) aligns with the large effect size for differentiated instruction ($d = 1.15$). Similarly, the theme "greater use of translanguaging" ($d = 1.28$) was reflected in teacher reflections about becoming less concerned about keeping languages separate. This convergence strengthens confidence that the observed changes were authentic rather than artefacts of self-report bias.

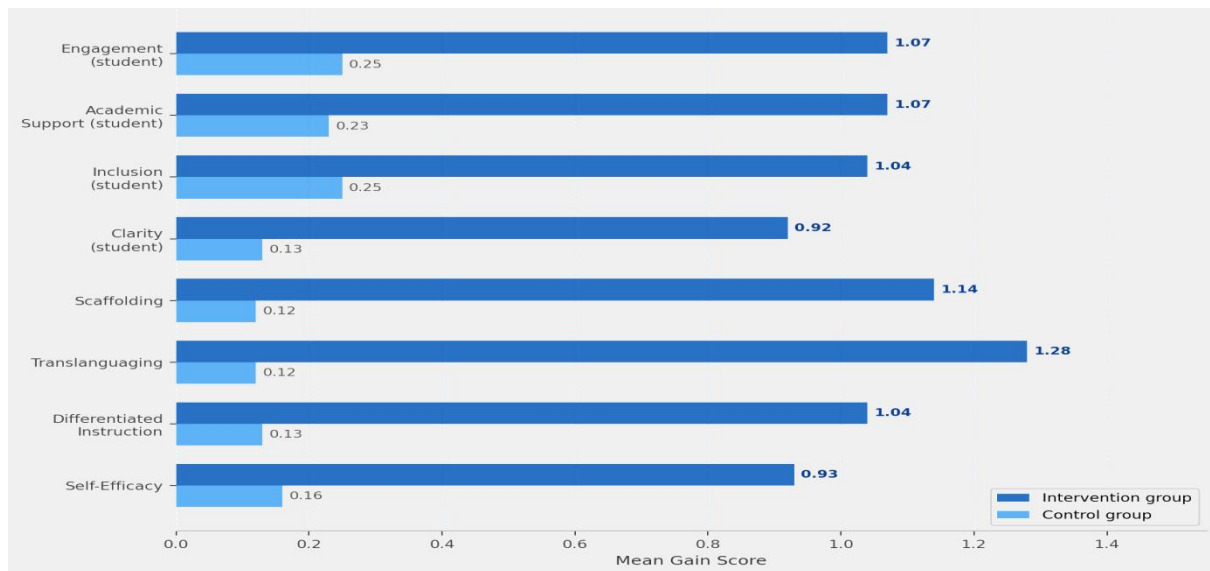
Figure 10

Pre- and Post-Intervention Teacher Scores Across the Four Instructional Competency Dimensions



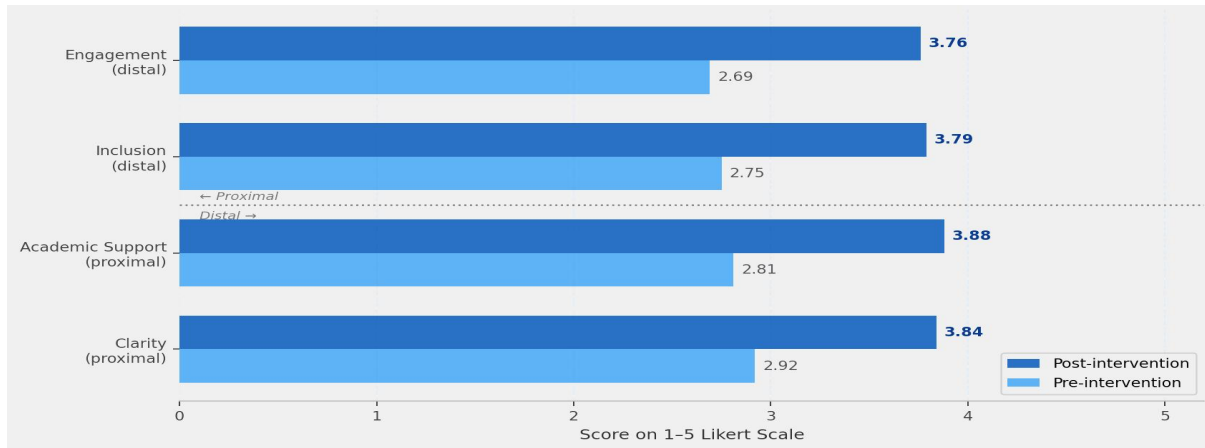
Note. Mean teacher scores increased across all four instructional competency dimensions following the six-week professional development programme, indicating improvements in self-efficacy, differentiated instruction, translanguaging, and scaffolding.

Figure 11
Comparison of Mean Gain Scores Between the Intervention and Control Groups Across Teacher and Student Outcomes



Note. Mean gain scores were higher for the intervention group than for the control group across all instructional competency and student perception measures.

Figure 12
Pattern of Change: Proximal vs Distal Student Outcomes



Note. Student-reported outcomes improved following the intervention. Instructional clarity and academic support showed the largest immediate gains, whereas student engagement increased more gradually over time.

5.3 Comparison with Previous Research

The effect sizes (teacher outcomes: $d = 1.02$ – 1.28) are substantially larger than those found in similar studies. König et al. (2020) found modest gains ($d = 0.45$ – 0.60) in teacher adaptive competency through online PD. The average effect size across US-based teacher PD studies is $d = 0.50$ (Desimone, 2009). A recent longitudinal study of monthly PD with Norwegian EAL teachers found that positive shifts in beliefs about multilingual education did not consistently translate into observed changes in classroom practice (Lorenz et al., 2021); the present study's structured, classroom-application design and convergence between self-reported and observed practice gains (Table 6) may help explain why belief change and practice change moved together here. Similarly, a systematic review of translanguaging research in secondary EFL classrooms found that structured professional development addressing translanguaging remained rare across the reviewed literature, with most teachers instead developing such practices informally (Zakharova & Lasagabaster, 2026); the present findings suggest that a structured, practice-oriented intervention can close this gap. The large effect sizes here may reflect lower baseline starting points in Lebanese public schools, which provide greater room for improvement. Many participating teachers had limited previous access to structured training in multilingual pedagogy, which may have increased the potential for noticeable short-term improvement following the intervention.

5.4 Theoretical Implications

The findings may extend Sociocultural Theory (Vygotsky, 1978) by suggesting that the zone of proximal development operates at the teacher level as well as the student level, in that teachers' instructional capacity was developed through scaffolded professional development experiences. The study also suggests a modification to TPACK: in multilingual settings, 'contextual knowledge' should explicitly include sociolinguistic knowledge about student background and learning histories (Mishra & Koehler, 2006).

5.5 Contribution to the Field

This study makes three distinct contributions. First, it provides rare quasi-experimental evidence from Lebanon showing that the policy–practice gap can be addressed through structured, intervention-based professional development. Second, it contributes to the measurement literature by providing reliability evidence and context-specific validity support for teacher and student instruments used in the Arabic–French–English trilingual school environment. Third, it demonstrates the explanatory value of integrating self-report, observation, and qualitative data in a convergent mixed-methods design.

5.6 Implications for Policy and Practice

For teachers: the findings highlight the value of translanguaging practices—viewing students' different language backgrounds as a resource rather than a challenge.

For curriculum designers: materials should be structurally differentiated.

For school administrators: a six-week structured PD intervention with collaborative reflection can yield large, reliable gains in instruction.

For policymakers: the trilingual policy framework does not need to be altered, but the professional development support structure needed to implement it must be built.

5.7 Limitations

Several limitations should be considered when interpreting the findings of this study. First, the quasi-experimental design limits the extent to which causal inferences can be made, as participants were not randomly assigned to groups. Comparability of the intervention and control groups at baseline was assessed descriptively (Table 3) rather than through formal inferential tests (e.g., independent-samples t-tests on pre-test scores), which limits confidence in the assumption of baseline equivalence. In addition, the use of gain scores and independent-samples t-tests, while appropriate for the research design and study objectives, has lower statistical power than ANCOVA and does not fully control for any residual baseline differences between groups. Future studies could utilise more advanced analytical approaches, such as ANCOVA with pre-test scores as covariates or repeated-measures analyses, to examine intervention effects in greater depth and to formally test baseline equivalence.

Second, the six-week intervention provided only a short-term view of instructional change and did not allow an examination of whether the observed improvements were sustained over time. Longer-term studies that include follow-up assessments would provide a clearer understanding of the durability of these effects.

Third, the substantial gains reported in this study should be interpreted in light of participants' limited prior exposure to professional development in multilingual pedagogy. Because many teachers had received little formal training in this area, the intervention may have produced larger short-term improvements than might be observed in contexts where multilingual professional development is already well established.

Fourth, the study relied partly on self-reported survey data, which may have been influenced by social desirability bias. Although classroom observations were used to strengthen the validity of the findings, participants' responses may not always have reflected their actual classroom practices.

Fifth, the study did not include validated instruments measuring teachers' beliefs about multilingual teaching and learning. As a result, it was not possible to examine the cognitive and attitudinal changes that may have contributed to the observed improvements in instructional practice.

Sixth, the participating schools were selected purposively from a limited educational context, which restricts the generalisability of the findings to the wider Lebanese public-school system and to multilingual educational settings beyond Lebanon.

Finally, student participants were nested within intact classrooms, meaning that classroom-level influences may have affected some of the observed outcomes. Future research could employ multilevel modelling techniques to account more explicitly for the hierarchical structure of educational data and to better distinguish teacher-level and student-level effects.

5.8 Directions for Future Research

Future research should examine conditions under which multilingual teaching practices are sustained across different educational contexts. Longitudinal studies with at least three data collection points are needed. Comparative studies should determine whether this PD model can be applied to public and private schools in Lebanon, and subsequently across multilingual education systems in the Gulf and North African regions (Cummins, 2021; Shaaban & Ghaith, 1999). Future studies should also include delayed follow-up assessments to examine whether improvements in instructional practices and student outcomes are maintained over time. Such evidence would provide a clearer understanding of the long-term effectiveness and sustainability of professional development interventions in multilingual educational settings.

Beyond extending the evidence base, several practical strategies could support the sustainability of the gains observed here. Embedding the MTPD programme's core activities within school-based professional learning communities would allow teachers to continue refining translanguaging, scaffolding, and differentiated-instruction practices through ongoing peer observation and reflection, rather than relying on a single time-limited workshop series. A train-the-trainer model, in which experienced intervention-group teachers are prepared to lead future cohorts, could extend the reach of the programme without requiring repeated external facilitation. At the

institutional level, sustaining these gains would likely require school leaders to allocate protected time for collaborative planning and peer mentoring, and for district or ministry-level structures to recognize multilingual pedagogy as a continuing professional development priority rather than a one-off training initiative.

5.9 Bridging Multilingual Policy and Classroom Practice Through Targeted Teacher Professional Development

The results from this research support the idea that the disconnect between the multilingual policy in Lebanese public schools and its implementation in the classroom is more a product of the limited support available for the teachers who are supposed to implement the policy than of flaws in the design of the policy itself. For as long as Lebanon has had a trilingual educational system that values Arabic, French, and English equally, the advantages promised by this policy have not always been experienced in the classroom owing to institutional, pedagogical, and socio-economic barriers (Karam, 2019; Shaaban & Ghaith, 1999).

One recurring problem is the implementation of multilingual policies in classes where the students vary in terms of proficiency in the languages used in instruction. The curriculum frameworks encourage the development of multilingualism but require teachers to deliver academically difficult lessons using the English and French languages to students who are still better in Arabic. In such a situation, the teaching method usually ends up being teacher-centered and focused on content acquisition, drilling, and rote learning. While these methods help the students to meet their short-term learning objectives, they do little to help develop concepts and critical skills in the classroom

The findings of the present study suggest that targeted professional development can help address these challenges. Teachers who participated in the intervention demonstrated substantial improvements in translanguaging, scaffolding, and differentiated instruction, indicating a shift toward more flexible and responsive approaches to multilingual teaching. These changes suggest greater willingness to draw on students' full linguistic repertoires as resources for learning rather than treating languages as separate and isolated systems. This interpretation is consistent with contemporary perspectives on multilingual education, which view language flexibility as an important means of supporting comprehension, participation, and academic development (García & Wei, 2014).

Evidence from this study supports the idea of creating a professional development system to meet the needs of teachers who work in multilingual education by providing teachers with instructional strategies that can be directly applied to their classrooms. Research has shown that when the professional development is: sustained, collaborative, applicable to real-life situations, and connected to the classroom, it has a much better chance of producing meaningful changes in instructional practices (Darling-Hammond, 2017; Desimone, 2009). The results of this study provide evidence that professional development focused on implementing instruction in practice and consistently reflecting upon it are critical in the implementation of multilingual education.

However, the context of multilingual instruction occurs within larger systemic factors. Factors such as economic struggles for schools, increased workload on teachers, limited resources available for teachers, and differences between public and private school settings can greatly hinder

the ability of teachers to implement innovative ways of teaching and learning. The results from the study provide evidence that when teachers have sufficient resources and support, they are able to exhibit a great amount of professional agency. The findings of the study revealed that there had been a marked increase in the amount of flexibility of teachers in their instructional approach, an increase in teachers' confidence regarding the implementation of multilingual education, and an increase in the level of teachers' inclusive participation in teaching and learning. Therefore, it appears that teachers can continue to effect change in their professional practice even in the face of significant challenges associated with implementing multilingual education.

In conclusion, as these findings show, the information gained from this study indicate that professional development for teachers should be considered a primary component of reform for multilingual education rather than simply an adjunctive program. Sustainable reform necessitates investment in multilingual pedagogies to their local contexts.

6. Conclusion

This study also provides evidence that the policy–practice gap in multilingual education in public schools in Lebanon can be narrowed when sustained and practical professional learning is provided to teachers. Both the teachers' performance in translanguaging, scaffolding, differentiated instruction and instructional self-efficacy increased in a significant manner, due to teachers' exposure to six weeks of continuous professional development, which is clearly observed in classroom teaching with more multilingual practices and more inclusiveness to multilingual students.

Moreover, not only did teacher practices in the classroom improve but also the experiences of the students within the classroom improved. As the results revealed, the level of perceived instructional clarity, instructional inclusiveness, academic support, and engagement among the students in the classroom after the program implementation increased, meaning that positive changes in teacher practices had an impact on how students perceived their experiences, which reflected in a more inclusive and responsive educational environment for students. All of the above mentioned supports the idea of the importance of continuous professional development and its effectiveness in bringing changes (Darling-Hammond et al., 2017; Desimone, 2009).

In summary, the article proves that professional development can play an effective role in helping teachers cope with linguistic diversity and also shows that for making progress in multilingual education teachers will prove to be successful in implementing policies if given the proper education and support.

Future research should pay attention to the issue of stability of the positive changes observed and also the possibility of transferability of the model of professional development to other settings in the MENA region.

DECLARATIONS

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics Approval: Ethical approval was granted by the Institutional Review Board prior to data collection (Approval No. IRB-2025-042).

Consent to Participate: Informed written consent was obtained from all participating teachers. For student participants, written parental/guardian consent was obtained in addition to student assent; students were informed that participation was voluntary and that they could decline without consequence.

Data Availability: Datasets are available from the corresponding author upon reasonable request, subject to appropriate data-sharing agreements. Anonymized data will be shared for non-commercial research purposes, subject to ethical approval and applicable data protection regulations.

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AI USE DISCLOSURE

In accordance with journal transparency policies, the author discloses that artificial intelligence (AI) writing-assistance tools were used during the preparation of this manuscript. Specifically, AI-assisted tools (grammar-checking software and diagram-generation tools) were employed to support language editing, grammar checking, and the creation of the taxonomy-tree visualisation (Figure 9). No AI tools were used for data collection, statistical analysis, or the generation of original research ideas. All intellectual content, including conceptualisation, research design, data collection and analysis, interpretation of results, and the construction of all arguments and conclusions, is the sole work of the author. AI-generated content was reviewed, edited, and verified by the author, who takes full responsibility for the accuracy and integrity of the published work. The use of AI tools did not involve the generation, fabrication, or manipulation of research data.

AUTHOR CONTRIBUTIONS

This article is the sole work of the author. All CRediT roles were fulfilled by Rola Ali Mohaidly.

CRediT Role	Rola Ali Mohaidly
Conceptualization	Lead
Methodology	Lead
Data Curation	Lead
Formal Analysis	Lead

CRediT Role	Rola Ali Mohaidly
Investigation	Lead
Writing – Original Draft	Lead
Writing – Review & Editing	Lead
Supervision	Lead
Project Administration	Lead

Note. Lead = primary contributor. All roles fulfilled by the sole author.

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