From Resistance to Reflection: The Interplay of Support, Reflection, and Practice Change

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This study examines the impact of a professional learning (PL) project on secondary mathematics teachers' professional growth in their knowledge, beliefs, and instructional practices. Initially attributing teaching challenges to external constraints, some teachers gradually recognised the need for pedagogical development through reflection and researcher-guided discussions. The study highlights the dual role of challenges as both constraints and affordances, shaping engagement through structured support and positive student relationships. The findings reveal that teachers' perceptions of outcomes significantly influence their sustained involvement in professional learning.

Introduction

The research project provides collaborative professional development opportunities for secondary mathematics teachers in Iran and explores their participation and professional learning, setting the stage for the investigation of how these teachers engage with the opportunities and the outcomes of their involvement. The main part of the study involved a collaborative PL opportunity with nine secondary mathematics teachers who expressed interest in examining changes in their instructional practices and identifying affordances and constraints in their teaching contexts. Throughout and after the intervention, several interviews—both individual and group-based—were conducted to capture teachers' experiences and reflections. While six teachers quit in various stages of the research, three of them stayed and engaged with the project until the end. This paper focuses on the participation of Arman, a teacher from the latter group. The focus is to explore how individual engagement with a PL opportunity and interpreting the outcomes of implementing lesson plans may support shifts in his perspective and practice.

Literature Review

This study, Similar to studies such as Hughes (2020) and Wilkie (2019), applied the Meta-Didactical Transposition (MDT) (Arzarello et al., 2014) model alongside IMPG as a complementary framework. The inclusion of MDT helps address two key aspects: Institutional influences on teacher change, and recognizing how school policies, assessment structures, and broader educational frameworks impact teachers' ability to implement new practices. Social interactions among teachers and between teachers and the researcher, drawing on Hughes' (2020) perspective to examine how collaboration and discourse shape professional learning experiences.

To analyse teachers' change sequences and key outcomes during their participation in professional learning (PL), this study adopts the Interconnected Model of Professional Growth (IMPG) (Clarke & Hollingsworth, 2002). The IMPG provides a cyclical and multi-entry framework that acknowledges the complex and individualized nature of teacher development. This approach highlights that teacher growth occurs through multiple pathways, shaped by external influences, personal beliefs, and professional experiences. Additionally, it underscores that teacher learning is an ongoing process, where feedback loops and reflection play a vital role in sustaining professional growth.

IMPG maps teacher learning and changes across four interrelated domains as follows. External Domain: Formal PL experiences, institutional support, and policy mandates. Domain

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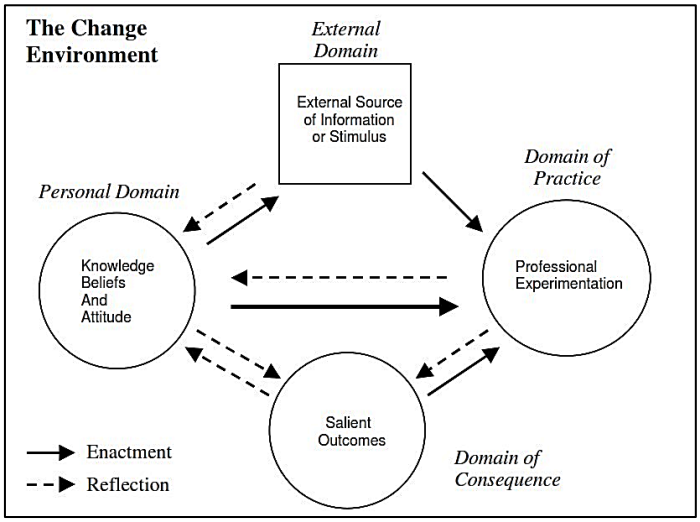
of Practice: The application of new knowledge and instructional strategies in the classroom. Domain of Consequence: The impact of changes on student learning, classroom dynamics, and teacher perceptions. Personal Domain: Teachers' knowledge, beliefs, attitudes, and evolving professional identity. This study drew on Hill et al. (2008) framework of the two core elements of Mathematical Knowledge for Teaching (MKT) to conceptualise the Personal Domain, emphasizing teachers' attitudes and beliefs about teaching and learning mathematics, as highlighted by Cooke (2015).

Figure 1

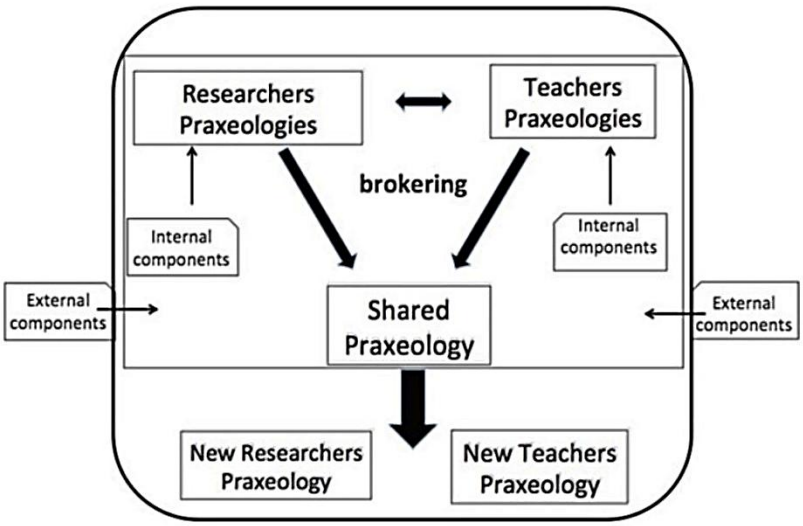
The Interconnected Model of Professional Growth (Source: Clarke & Hollingsworth, 2002)



The MDT model provides a structured lens for understanding how knowledge, teaching practices, and professional identities evolve through researcher-teacher interactions. MDT explicitly captures bidirectional exchanges between researchers and teachers, making it particularly valuable in collaborative professional learning contexts.

Figure 2

The Meta-didactical Transposition Model (Arzarello et al., 2014, p. 355)



A central concept in MDT is praxeology, which includes both 'know-how' (practical techniques) and theoretical knowledge used in instructional tasks. The model emphasises how praxeologies evolve as teachers and researchers interact, negotiate instructional strategies, and reinterpret pedagogical innovations within their unique school settings.

Table 1

MDT model features (Arzarello et al., 2014)

Feature	Definition
Institutional aspects	The social context of the school where the intervention is conducted can influence either the plans of the researchers or the teachers' practice. These aspects also can provide opportunities or constraints to help teachers or prevent them from changing their personal domains.
Meta-didactical praxeologies	Includes tasks, approaches, and theories behind them that develop during the intervention, which can influence both teachers' and researchers' praxeologies.
Internal and external	How the external praxeologies, which the researcher brings to the project, can be a part of the teachers' praxeologies by the process of internalisation.
Brokering processes	The act of transferring the concepts from one community to another by the process of brokering. In the PL projects, since the researchers belong to both the community of teachers and researchers, they can play the role of a broker who belongs to more than one community.
Double dialectic	When teachers and researchers express contrasting interpretations (meta-didactical level) of students' personal meanings that are attached to the teaching situation (didactic level), the teachers' praxeologies tend to develop and modify to align with those of researchers.

Methodology

To explore teachers' responses to the PL intervention, their adoption of new practices, and the constraints they faced, the study employed a multiple case study methodology. A case study approach was chosen because it allows for an in-depth examination of real-world experiences within their natural setting (Stake, 2006; Yin, 2018). Given that teachers' practices are deeply embedded in their school environments, this approach enabled a context-sensitive investigation of their professional learning. Each teacher was considered a distinct case, bounded within the Iranian secondary school context, making this study an instrumental case study that sought to understand broader issues related to professional learning in this educational setting.

Data Collection

The data for this study were collected from nine lower secondary mathematics teachers working at a multi-campus private school in Tehran, Iran. In the first group meeting (the first PL session), all nine participants attended. I explained the rationale of the study and introduced example tasks designed to promote mathematical proficiencies. In the second group meeting (the second PL session), I completed the introduction and provided additional examples. I asked participants to select a problem from their prescribed problem set and modify it to better support mathematical proficiencies. Additionally, I requested that they complete a lesson plan incorporating the modified problem and share it with their colleagues and me for discussion. We had the third and fourth group meetings to reflect on teachers' participation and share our concerns. The fifth group meeting was the last one in which teachers shared their thoughts and we concluded the project. Table 2 details Arman's participation.

Data Analysis

For this qualitative study, I adopted a descriptive and interpretive approach (O'Toole & Beckett, 2013, p. 38), which aligns with my social constructivist worldview. Following Miles et al. (2014), this process involved organising, simplifying, and reducing the data to transform it into meaningful and understandable findings that could address my research questions.

In analysing the data, I employed both inductive and deductive analytic approaches. Since the study was informed by the Interconnected Model of Professional Growth (IMPG), I began with deductive analysis by utilizing the model's various elements to create a coding framework to code the data. Additional codes related to the affordances and constraints that teachers might encounter during their practice changes were derived from both the IMPG and Meta-didactical Transposition (MDT) models, as well as empirical findings from previous research (Groves et al., 2016; McCormick, 2022; Wang, 2011).

Table 2

Arman's Participation Details

Events	Date	A brief description
Group meeting 1 (PL session 1)	24/10/2018	Describing the project as well as part of the data that I have collected from the questionnaires
Group meeting 2 (PL session 2)	31/10/2018	Elaborating on details of the project and introducing a format for designing lesson plans
Observing a typical class	12/11/2108	Observing a session of his normal class, taking some notes and reflecting on it after class
Reflecting on his normal class	12/11/2108	I attempted to link what I observed to the concepts that I had proposed in the group meetings.
Group meeting 3	19/11/2018	Reflecting on the experience of a teacher who had implemented his designed lesson plan
The first implementation of the designed lesson	24/11/2018	He designed a lesson plan individually and sent it to me the night before the implementation session.
A brief reflection	24/11/2018	Reflecting on the first implementation session
Interview	24/11/2018	After a brief reflection on the Implemented session, on the same day, I did an interview with Arman about the whole project.
The second implementation of the designed lesson	3/12/2018	Again, he had sent the lesson plan the night before the implementation session. We had the opportunity to discuss it before attending the class.
Group meeting 4	3/12/2018	Three teachers attended and we had some conversations on any issues that teachers suggested previously or in that session.
Third implementation of the designed lesson	7/1/2019	I suggested to him a few tasks related to that day's topic. He included one of those tasks in his lesson plan.
A brief reflection	7/1/2019	Reflecting on the first implementation session
Group meeting 5	23/1/2019	This was our last meeting, which five teachers including Arman attended.

Findings and Discussion

As mentioned, this paper focuses on the participation of Arman one of the teachers who engaged in the project until the end. Arman, a 27-year-old secondary mathematics teacher with a background in mechanical engineering, entered the teaching profession without formal training or exposure to structured professional development. Arman attended all group meetings and eagerly participated in discussions (Figure 1 shows his change sequence).

At the beginning of the project, Arman attributed students' learning challenges primarily to external factors rather than reflecting on his teaching practices. He believed that systemic

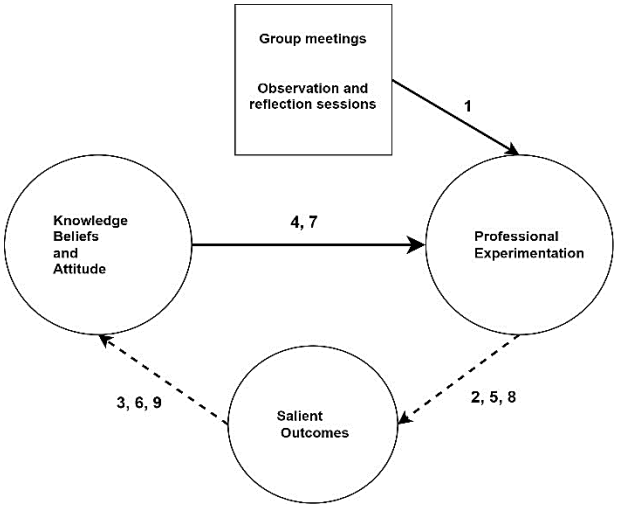
constraints, curricular limitations, and student-related factors played a greater role in shaping learning outcomes than his instructional methods. While the external factors were reported impactful (Bhutto & Rind, 2022; Chen, 2008; Wilkie, 2019), when I observed Arman's teaching, I noticed some potential areas for professional growth. During the debrief session, I talked about these aspects of his teaching and shared with him some research-informed suggestions for conducting a student-centred class such as using challenging tasks (Sullivan et al., 2015), applying group work and the five practices for orchestrating the class discussion (Stein et al., 2008). Arman mentioned finding the reflection session useful, saying,

> Now I have a better understanding of the concepts that you introduced in the group meetings [the PL sessions]. I will think about the details of my lesson plans and share a few of them with you before implementing them in my classes. Please come to my classes and let me know your feedback.

Over time, Arman's engagement in the project deepened, and he began to open himself to new perspectives. As we navigated through the project, other potential gaps in his knowledge and skills surfaced which created a ground for more discussions and fostering the process of learning and internalisation of the new praxeologies.

Figure 3

Arman's Change Sequence



One of the pivotal moments appeared when he implemented a more engaging task (the swimming pool task which I had introduced in one of our PL sessions). After implementing a designed lesson plan and a brief discussion during the break time, he went to another class to teach the class with his normal approach while I was waiting in the teacher's office to have a longer discussion after his second class. After that session, he stated,

> I already had started the equation topic and was willing to work on the related exercises in this session. However, after our small chat during break time and a quick reflection on my session, I realised that I only did the same teaching without any considerable change. So, I decided to include an engaging task in my teaching to see the students' reactions to it.

The noticeable improvement in student engagement in the second class led him to reflect on the impact of task selection on student motivation. He mentioned,

> While the engagement of the students in the first session was not satisfying, introducing the swimming pool task significantly impacted students' engagement and motivation in the second session. Students enthusiastically worked on the task, most of whom could make sense of it. They also realised how utilising algebra could make the solutions effective and feasible.

Arman considered the difference in students' engagement in the two sessions, as a salient outcome of his classroom experimentation. This experience initiated a shift in his Knowledge

of Content and Students (KCS)[2], as he recognized the importance of selecting tasks that connected mathematical concepts to real-world contexts. In his second lesson plan, he attempted to design an engaging activity based on a real-life scenario. Before observing his class, he stated,

> I realised that an engaging task such as the swimming pool task can be the core part of a class. Therefore, I picked up a problem from an auxiliary mathematics book that is popular among students and tried to modify it in a sense that makes students more engaged. I should use these challenging and engaging tasks more in my lesson plan in future.

It seemed that his disposition toward preparing lesson plans had been influenced by his experience of using a more engaging task. This resonates with the claim of Guskey (2002) that teachers' beliefs would be changed by experiencing students' engagement or success in the classroom. Although Arman had made an interesting opening story for this task in his second lesson plan, the limited structured guidance and formative monitoring led to moments of disengagement. This signals a gap in KCS, as teachers with strong KCS continuously assess students' understanding, ask probing questions, and provide timely interventions when students struggle or lose focus (Charalambous, 2010). By not regularly checking students' work, Arman missed opportunities to provide targeted support and adapt instruction in real-time.

Even though only some students eagerly listened to his talk and responded to his questions, Arman seemed satisfied with his actions in that class. When I provided feedback highlighting the distinction between emotional engagement and cognitive engagement, Arman was initially surprised since he seemed satisfied with the implementation of his designed lesson plan. This moment of discrepancy between his perception and mine served as a critical juncture in his professional growth, aligning with the double dialectic situation in the framework of Meta-Didactical Transposition (MDT) which could provide opportunities to develop teachers' professional competence. Through further discussions, he acknowledged that an engaging task alone was insufficient—how it was introduced, facilitated, and scaffolded played an equally crucial role in fostering deep learning. The contrast between my perception of the class and Arman's could be recognised as the salient outcome.

As Arman continued experimenting with new approaches, he showed a growing willingness to refine his lesson planning. He sought feedback on task selection, structure, and implementation strategies, demonstrating an emerging understanding of lesson orchestration. He expressed,

> It seems that to get the most benefit from changing our lesson plan, in addition to selecting an appropriate task and modifying it properly, I need to think about how to present it to students and how to lead the class. I would like to attempt designing a lesson plan and implementing it another time. I'll try to show my lesson plan to you and discuss the tasks and the approach before the implementation of the session.

Arman's reflections and willingness to rethink his lesson planning and instructional approach marked a deeper shift in his Mathematical Knowledge of Teaching (MKT), particularly in Knowledge of Content and Teaching (KCT)[3]. One of the most significant developments in Arman's KCT was his realization that selecting an engaging task alone is not sufficient; how the task is introduced and facilitated plays a crucial role in student engagement. In his statement, he recognized that besides task selection and modification, the launch phase of a task and lesson leadership are equally important components of an effective mathematics lesson. This awareness suggests an emerging understanding of lesson orchestration, where a

[2]Type of knowledge that integrates knowing about students as well as mathematics (Hill et al., 2008)

[3] Teachers proficient in KCT are skilled in making pedagogically informed decisions that integrate deeply with mathematical content.

teacher carefully plans the sequence of activities, scaffolds student learning, and ensures that engagement is maintained throughout the lesson (Stein et al., 2008).

Arman's professional growth was shaped by sustained engagement in reflective discussions and structured feedback. Arman required direct intervention and support to internalize new strategies and the brokering process, facilitated through one-on-one discussions and classroom observations, played a crucial role in helping him bridge the gap between theoretical insights and practical implementation. Arman was willing to design another lesson plan to reflect his recent view on it and see whether he could engage more students in his class. He stated,

> This time I need to consult you in all steps including selecting the tasks, designing the lesson plan and finding a proper approach to implement them. Please send me some tasks as a resource, then I will see and select a couple of them.

This request of Arman highlighted the requirement of a 'knowledgeable other' as expressed by Sharratt (2018) to support Arman with designing a lesson plan. By seeking guidance in task selection and lesson structuring, Arman acknowledged the need for external input to refine his practice, which reflects an openness to professional growth. Arman shared his perception of constraints in designing and implementing lesson plans,

> When I use my usual approach and tasks since I have taught them previously, I would be able to anticipate the difficulties that students may confront during the class. This anticipation helps me to be ready and deal with situations appropriately. However, for the new lesson plans, I am hardly able to foresee the problems and might not be ready to deal with unexpected situations and help stuck students.

As Arman mentioned in the above quote, when he encountered a new task, he found it difficult to identify which part of the task would be problematic to teach or to be understood by students. It could partially be related to the limited Specialised Content knowledge (KSC) which includes the competency of anticipating students' responses to a certain problem. Arman's statement suggests that while he feels confident using familiar tasks—where he has prior knowledge of student difficulties—he struggles to foresee potential challenges when implementing new lesson plans.

Conclusion

According to Clarke and Hollingsworth's (2002) model of professional growth, the way a teacher perceives the outcomes is shaped by their reflection on the change in practice or their personal development. However, the impact of these outcomes depends on the teacher's existing value system and how they interpret the classroom practices. The challenges Arman encountered during the project were not necessarily seen as negative; in some cases, these challenges acted as affordances for learning and growth. When the outcomes are perceived as negative or not strong enough, additional support, follow-up discussions, and encouragement appear beneficial to keep the teachers motivated and engaged with the learning process. Arman's availability of non-teaching hours, allowed for additional support and motivation to keep engaging in the project.

At the start of the project, despite being relatively inexperienced and unfamiliar with research-based pedagogical practices, Arman expressed confidence in his existing approaches. He primarily attributed his challenges to external constraints, such as standardized exams, limited time, and rigid school-set curricula, which he believed hindered their ability to adopt student-centred approaches. Over time, Arman moved from a stance of attributing student challenges solely to external factors toward a more balanced perspective—one that acknowledged the role of his instructional choices in shaping student learning outcomes. This shift was essential for his professional growth and led to self-reflection on areas where he wanted to improve. His journey underscores the importance of structured professional learning

opportunities that provide teachers with the time, space, and support needed to engage in reflective practice.

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