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Behavioural transitions in team teaching: Comparing low and high experience teachers via Transition Network Analysis

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As team teaching becomes increasingly common in higher education, understanding how teams of teachers coordinate their behaviours in the classroom is critical for effective instruction and instructional design. While prior research has examined teaching behaviours through classroom observations, much of this work has tended to treat behaviours as isolated categories. This is, focusing on what occurs rather than how behaviours transition over time. Moreover, whether teachers with different levels of teaching experience exhibit distinct behavioural transitions in team teaching remains underexplored. This study addresses this gap by investigating how teaching behavioural transitions differ between high and low experience teachers working as a team in the classroom. Drawing on human-coded observations from 36 team-taught university sessions, and analysed using Transition Network Analysis (TNA), we visualised and compared patterns of behavioural transitions. The results revealed significant differences in behavioural transitions between teachers of varying experience levels. High experience teachers were more likely to transition directly from lecturing into interactions with students, and subsequently into real-time instructional adjustments, demonstrating instructional responsiveness and adaptability. In contrast, low experience teachers demonstrated a stronger reliance on peer coordination. This finding highlights the role of teaching experience in shaping team teaching dynamics and offers implications for teacher pairing and professional development.

Keywords: Team Teaching, Teaching Behaviour, Teaching Experience, Classroom Analytics, Transition Network Analysis, Learning Analytics

Introduction

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As higher education institutions increasingly adopt team teaching to respond to growing class sizes, interdisciplinary curricula, and distributed delivery models (Minett-Smith & Davis, 2020), understanding how teaching teams function has become an important topic. Team teaching is defined as two or more teachers collaborating in all aspects of course design, instruction, and assessment (Haag et al., 2023). It can offer several benefits, such as pedagogical innovation, shared workload, and enhanced student engagement (Zach & Avugos, 2024). Evidence also suggests that team teaching can support pedagogical change, especially when implemented through structured frameworks like cognitive apprenticeship (Haag et al., 2023).

However, the internal dynamics that shape how teaching teams communicate, coordinate, and make decisions remain underexplored (Morelock et al., 2017). Much of the existing literature focuses primarily on teaching outcomes or the structural configurations of team teaching arrangements, often neglecting the nuanced interpersonal processes that can influence team effectiveness in real time (Morelock et al., 2017; Dang et al., 2022). Without a deeper understanding of these dynamics, institutions risk treating team teaching as a logistical necessity rather than a complex collaborative practice. Among the factors shaping these dynamics, one crucial yet insufficiently examined influence is the teaching experience of teachers (Mariën et al., 2023). Although prior research has demonstrated clear distinctions in instructional approach between low and high experience teachers, these insights have typically emerged from studies of individual teaching contexts rather than collaborative scenarios (Sebald et al., 2022; Mariën et al., 2023). This study addresses that gap by examining how teaching experience shapes the behavioural dynamics within teaching teams in real-world settings, with the aim of informing more intentional and effective team teaching design.

Background

Teaching experience plays a pivotal role in shaping teaching behaviour (Dijkema et al., 2019). Low and high experience teachers differ not only in how they organise classroom activities (Wolff et al., 2015; Torabzadeh & Hashamdar, 2022), but also in how they respond to challenges, interact with students, and adapt their instruction (Burkhauser & Lesaux, 2017; Stahnke & Blömeke, 2021). Low experience teachers often enter the classroom feeling underprepared, particularly in managing student behaviour (Shank, 2023). Consequently, they may resort to teacher-centred instruction and heavily structured routine (Karasova & Nehyba, 2025). However, such rigid strategies can disrupt lesson flow and make it challenging to maintain attention across the entire class (Nadelson et al., 2024). In contrast, high experience teachers tend to rely on a broader and more flexible instructional repertoire that enables them to respond dynamically to classroom demands (Wu et al., 2024). Rather than exerting overt control, they can cultivate routines that promote student autonomy and self-regulation, which in turn support a smoother instructional flow and more consistent student engagement (Stahnke & Blömeke, 2021). Their teaching is marked by an ability to improvise, grounded in deep pedagogical knowledge and sensitivity to classroom cues, allowing them to adapt strategies in real time as situations evolve (Tajeddin & Bolouri, 2023). Moreover, feedback handling and instructional adaptability further illustrate how experience can transform teaching behaviour (Stahnke & Blömeke, 2021). Low experience teachers also tend to seek frequent feedback and often value mentorship and social support from peers (Ben-Amram & Davidovitch, 2024). While they may offer individualised comments to students, they often struggle to integrate that feedback meaningfully into future instruction (Wenzel et al., 2023). In addition, their responses are often reactive and focused on short-term behavioural control (Karasova & Nehyba, 2025). In contrast, high experience teachers engage in more student-centred interactions (Stahnke & Blömeke, 2021). Furthermore, they tend to strategically balance immediate corrections with long-term developmental goals, such as guiding students' metacognition and promoting self-regulation (Sølvik & Glenna, 2022). In this way, high experience teachers view feedback as a tool not just for managing classroom activity, but for fostering meaningful and

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sustained learning outcomes (Stahnke & Blömeke, 2021; Sølvik & Glenna, 2022). They are also more likely to adjust their strategies mid-lesson, recalibrate pacing, or use emerging student questions as teachable moments (Stahnke & Blömeke, 2021). These behaviour differences may also reflect deeper cognitive mechanisms (Feldon, 2007; Lin et al., 2024). High experience teachers are more likely to draw on internalised routines and shared mental models when collaborating with team members, enabling smoother and less verbalised coordination, whereas low experience teachers often rely on more explicit negotiation, increasing cognitive load during instruction (Kirschner et al., 2018).

Despite extensive insights into how teaching experience shapes teaching behaviour, existing literature suggests that most studies have primarily focused on individual teaching contexts rather than collaborative, team teaching settings (Mariën et al., 2023; De Weerd et al., 2024). Most studies have explored how low and high experience teachers independently manage their classrooms, with comparatively less attention given to how such differences may manifest when teachers collaborate (Mariën et al., 2023). Moreover, even when collaborative contexts are examined, existing team teaching studies typically involve brief or small-scale scenarios with teachers of varied experience levels, rather than systematically examining sustained, ongoing team teaching collaborations (Kervinen et al., 2022). Such sustained collaborations could involve multiple lessons, entire instructional units, or even extended periods such as a semester. Thus, there is a critical gap: we know far less about how teaching experience affects teaching behaviour in collaborative settings. Although limited, existing studies of authentic team teaching contexts suggest promising trends in how teaching experience shapes collaborative interactions. In genuine team teaching situations, teaching experience often shapes how roles and supports are distributed (Sebal et al., 2022). High experience teachers routinely scaffold low experience teachers during lessons (Haag et al., 2023). Furthermore, recent studies of team teaching scenarios have found that low experience teachers working alongside high experience teachers engage in more adaptive, student-centred practices than when teaching on their own (Mariën et al., 2023). Despite initial indications of the value of authentic team teaching contexts, empirical evidence directly linking experience to real-time behavioural transitions in such settings also remains limited. Consequently, it remains unclear exactly how teaching experience influences behavioural transitions in genuine team teaching contexts. To address this gap, this study addresses the following research question: How do teaching behavioural transitions differ between high and low experience teachers in team teaching classroom scenarios?

Method

Participants and Context

Twelve teachers participated in this study, with teaching experience ranging from no prior experience to 9 years (Mean = 3). Based on experience levels, participants were classified as either low experience (≤ 2 years, $N = 6$) or high experience (> 2 years, $N = 6$). The data were collected from 36 authentic, team-taught classroom sessions within a two-hour database course in the Faculty of Information Technology at Monash University, conducted over four weeks. The study was approved by the Monash University Human Research Ethics Committee (Project number 28905). Each classroom session involved three teachers working in rotating triads, following naturally occurring configurations that were not altered for the study. Teaching behaviours were recorded through human-coded observations using a structured coding scheme adapted from the Alfredo et al. (2025). This scheme is grounded in the theoretical constructs of spatial pedagogy (Lim et al., 2012) and team teaching (Cook & Friend, 1995), encompassing nine behaviour types (see Table 1). To ensure the reliability of the coding process, two observers independently annotated the first two pilot sessions. Coding discrepancies were discussed and used to refine the scheme. Inter-rater agreement on the second pilot session

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reached a Cohen's Kappa of 0.75, indicating good reliability. Following this, all remaining sessions were coded in real time by one trained observer using the finalised scheme.

Table 1

Behaviour Coding Scheme

Behaviour	Definition
Assisting	One teacher supports or assists another teacher.
T–T interaction	A teacher communicates with another teacher during the session.
Lecturing	The teacher delivers content through direct explanation or presentation.
T–S interaction	The teacher engages in one-on-one interaction with an individual student.
T–Ss interaction	The teacher addresses a group of students to provide guidance or clarification.
Monitoring	The teacher moves around the classroom to broadly observe student activities, without focusing on any particular individual student.
Watching	A teacher watches another teacher's instruction without actively participating.
Surveillance	The teacher closely observes a specific student's activities or work, typically without indicating openness to direct interaction.
Personal	The teacher engages in individual activities (e.g., preparing materials, checking devices).

Analysis

To examine how teaching behaviours varied by teaching experience and unfolded over time, we applied TNA using the *tna* R package (Tikka et al., 2025). TNA allows behavioural transitions to be modelled as directed, weighted networks, supporting both visual and statistical comparisons across conditions (Saqr et al., 2025). In these networks, each node represents a distinct teaching behaviour and includes a donut chart indicating its initial probability. Edges represent transitions between behaviours; arrows indicate direction, while edge thickness and embedded numbers reflect the corresponding (conditional) transition probabilities. In our study, behavioural sequences were recorded as time-ordered sequences for each teacher and used to construct separate transition networks for high and low experience groups. To quantify and compare transition patterns, we subtracted both networks and applied a permutation test with 1,000 iterations. The subtraction analysis visualised directional differences in transition probabilities between groups, while the permutation test identified statistically significant transition differences beyond random variation.

Result

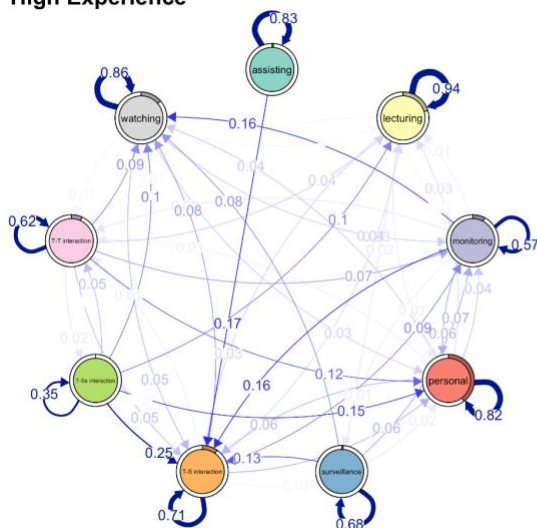
To examine how teaching behaviours unfolded across different teaching experience levels, we constructed separate transition networks for teachers with low and high experience (see Figure 1). In both groups, self-loops were dominant. For high experience teachers, the highest self-loops were found in Lecturing (0.94), Watching (0.86), and Assisting (0.83). Among teachers with low experience, the most likely self-loop occurred in Lecturing (0.95), followed by Watching (0.81) and T–S Interaction (0.80). Differences also appeared in how teachers moved between behaviours: for example, T–T Interaction to Watching (0.09) and T–T Interaction to Personal (0.12) were more likely in the high experience group, whereas Assisting to Watching (0.14) and Assisting to T–T Interaction (0.11) were more likely in the low experience group.

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High Experience



Low Experience

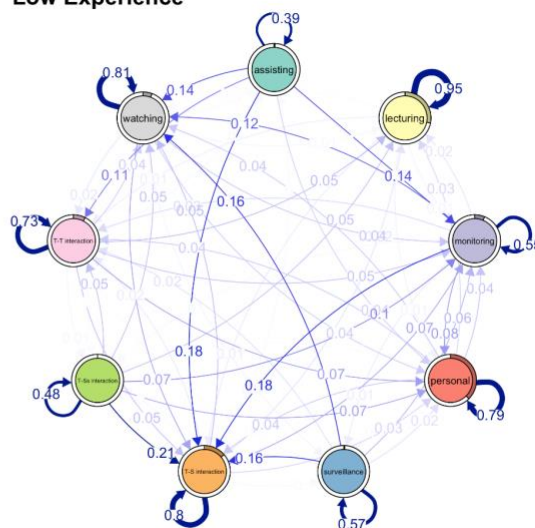


Figure 1. Transition networks of teaching behaviour for teachers with high (left) and low (right) teaching experience.

To quantify these differences, we conducted both simple comparisons and a permutation test. The simple difference plot (see Figure 2, left) visualises transition probability differences by subtracting the low experience group from the high experience group. Green edges indicate transitions that were more likely in the high experience group, while red edges indicate those more likely in the low experience group. The permutation test revealed statistically significant differences in transition probabilities (see Table 2). In the corresponding plot (see Figure 2, right), blue and red edges represent transitions that were more likely in the high and low experience groups, respectively. For example, transitions such as *T-T Interaction to Watching* (0.05) and *Lecturing to T-S Interaction* (0.02) were significantly more likely among high experience teachers. In contrast, transitions including the *T-S Interaction* self-loop (−0.08), *Personal to T-T Interaction* (−0.03), and *Watching to T-T Interaction* (−0.01) were more likely among low experience teachers.

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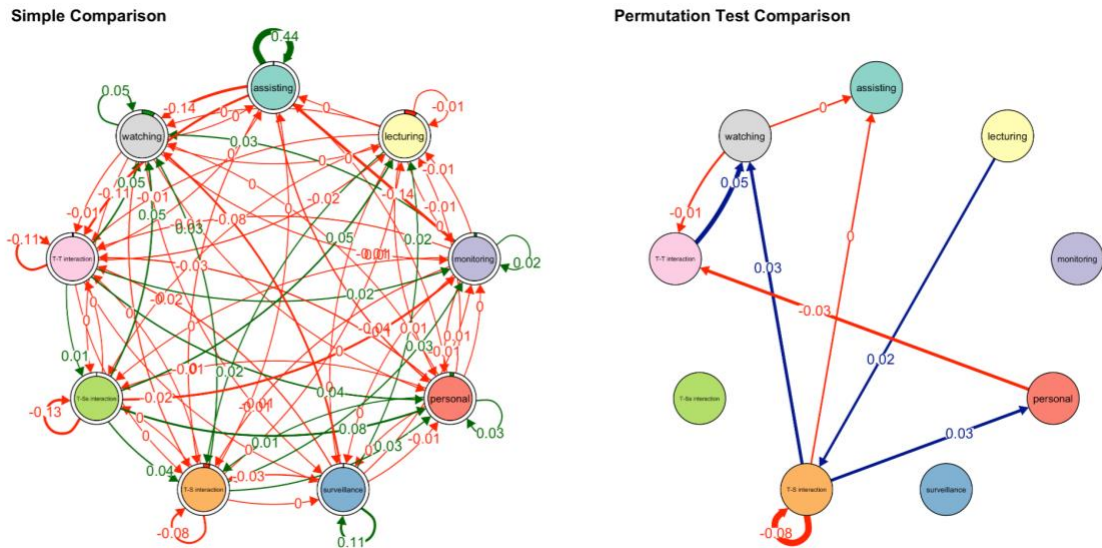


Figure 2. Comparison of teaching behaviour transitions between high and low experience teachers. Left: simple comparison (subtraction high–low). Right: permutation test comparison

Table 2

Significant permutation test results for differences in transition probabilities between high and low experience teachers.

Edge Name	Difference in Transition Probability	Effect Size	p-value
T-S interaction -> assisting	-0.004	-1.989	0.044
watching -> assisting	-0.003	-1.903	0.033
T-S interaction -> personal	0.025	2.495	0.011
lecturing -> T-S interaction	0.017	2.521	0.009
T-S interaction -> T-S interaction	-0.083	-2.495	0.014
personal -> T-T interaction	-0.028	-3.432	0.000
watching -> T-T interaction	-0.010	-2.195	0.025
T-S interaction -> watching	0.027	2.133	0.028
T-T interaction -> watching	0.052	2.078	0.035

Discussion

The present findings revealed clear differences in how high and low experience teachers transition between behaviours in a team-taught classroom. Specifically, high experience teachers exhibited more purposeful, context-sensitive transitions, fluidly shifting their roles in response to classroom needs. By contrast, low experience teachers relied more heavily on their team members and tended to repeat certain behavioural patterns. One striking contrast was in transitions centred around *Teacher–Student Interaction*. A clear illustration of this difference was the *lecturing to Teacher–Student Interaction*, which was more common among high experience teachers. In these instances, they would promptly engage individual students' questions or needs after delivering whole-class explanations. This behaviour suggests that high experience

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teachers instinctively assess students' comprehension after delivering content, making their lectures more interactive rather than a one-way monologue. Indeed, such a pattern reflects a well-documented student-centred orientation of high experience teachers in individual teaching contexts (Stahnke & Blömeke, 2021). Our findings further extend this understanding by demonstrating that, in team teaching contexts, high experience teachers similarly pivot from direct instruction to individualised support to gauge understanding and foster engagement. This fluid shift is emblematic of adaptive expertise in teaching – the ability to go beyond routine delivery and adjust in real time to student input (Wetzel et al., 2015). In other words, whereas high experience teachers treated the lecture as a springboard into interactive learning, low experience teachers tended to treat their turn at lecturing as a self-contained task, potentially missing opportunities for immediate student feedback. Encouraging early-career teachers to intentionally build in these interactive checkpoints (e.g., asking a question after explaining a concept, or circulating briefly to check work) could be a valuable focus for professional development, given how strongly it featured in the experts' practice. Moreover, after engaging with students individually, high experience teachers were more likely to transition into *Personal* behaviours (*T-S interaction* → *personal*), reflecting real-time instructional adjustments. After addressing a student's query or noticing a misunderstanding, these teachers briefly paused interactions to adjust instructional materials or prepare alternative explanations. This immediate pedagogical adaptation underscores the improvisational skill characteristic of expert teaching, which has previously been documented in individual teaching contexts (Tajeddin & Bolouri, 2023). Our findings extend this understanding by demonstrating similar adaptations within team teaching contexts. In this way, the *Teacher–Student Interaction to personal* transition represents a micro-level example of adaptive teaching practice, illustrating how high experience teachers maintain coherence and responsiveness while addressing individual student needs. Rather than merely responding reactively to each student, high experience teachers strategically used these interactions to inform subsequent instructional moves, continually refining lesson trajectories to benefit the entire class. This finding further reinforces the critical role of adaptive expertise in enabling teachers to balance routine teaching with flexible, innovative responses to emerging classroom situations.

In contrast, the low experience teachers tended not to alternate between interaction modes as much as the high experience teachers; instead, they often stuck to one mode for extended periods. For example, *Teacher–Student Interaction* self-loop was significantly higher for this group. This aligns with Menninga et al.'s (2021) findings that low-experience teachers generally adopt a more rigid teaching style, characterised by procedural repetition, limited flexibility, and fewer frameworks of classroom interaction to guide adaptive responses. In our team teaching context, this rigidity manifested as low experience teachers consistently remaining in supportive roles, exemplified by transitions from *Teacher–Student Interaction to Assisting*. In such cases, low experience teachers primarily supported the lead teacher but rarely took on leading instructional roles themselves. Similarly, they were less likely to engage in reflective observation and planning, as evidenced by transitions from *Teacher–Teacher Interaction to Watching*. Specifically, high experience teachers were more likely to move from interacting with a team member to watching, whereas low experience teachers did this less often, suggesting they were less likely to step back and observe. This rigidity was also evident in other behavioural transitions among low experience teachers. Specifically, regardless of their preceding behaviour—such as *Personal*, *Watching*, or *Teacher–Student Interaction*—they were more likely to transition into *Teacher–Teacher Interaction* or *Assisting*. This underscored their reliance on collaborative support from their teaching partner. Notably, low experience teachers were far more likely to transition from passive watching to actively assisting their team members during instruction. This aligns with broader research indicating that team teaching models offer structured support for low experience teachers, reducing isolation and facilitating incremental participation (Zach & Avugos, 2024). This behavioural pattern highlights how low experience teachers typically look to their more experienced team members for instructional guidance and collaborative

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support. Such collaborative engagement is not inherently problematic; rather, it provides low experience teachers with valuable real-time learning opportunities, enabling them to gradually internalise effective instructional strategies. By closely observing high experience teachers' instructional decisions and actively assisting during lessons, low experience teachers gradually absorb effective practices and begin to emulate them. Indeed, recent research by Mariën et al. (2023) found that low experience teachers in mixed-experience teams achieved more complex teaching behaviours than they could on their own, precisely because the team context provided on-the-spot mentoring and shared responsibility. Our findings align with this perspective, showing that low experience teachers did engage in meaningful interactions, though predominantly guided by their experienced partners. Over time, these supported experiences can enable low experience teachers to independently apply adaptive strategies, gradually increasing their instructional autonomy and confidence.

Our findings have important theoretical implications for understanding teacher expertise and team teaching dynamics. These observed behavioural differences can be further understood through the lens of team cognition and instructional coordination. Specifically, team teaching—particularly when roles are flexible—requires a shared mental model between teachers that enables them to clearly understand each other's roles and approaches and maintain instructional coherence (Hogikyan et al., 2019). In our study, high experience teachers demonstrated smoother coordination with fewer explicit instructional hand-offs. Such seamless coordination may suggest that high experience teachers had established a robust shared mental model, enabling them to intuitively anticipate each other's actions and determine when to lead or step back without overt communication. In contrast, low experience teachers were more likely to engage in *Teacher–Teacher Interaction* or *Assisting*, indicating they had yet to develop a clear shared mental model, thus relying more heavily on explicit negotiation of roles and actions in real time. From a cognitive load perspective, low experience teachers in team teaching contexts appear to shoulder a heavier mental burden. They must manage their own instructional tasks while also explicitly coordinating with team members, which adds extraneous “transaction costs” to their working memory load (Kirschner et al., 2018). Cognitive load theory indicates that beginners lack the rich schemas that streamline routine tasks, leaving them with higher intrinsic cognitive load during teaching (Gould et al., 2022). This helps explain why the low experience teacher in our study relied on frequent interactions with their team members. Such explicit coordination is essentially a strategy—by verbalising plans and decisions, they ensure real-time synchronisation (Aggarwal et al., 2019). In contrast, high experience teachers demonstrate more implicit coordination. With years of practice, they may have internalised many classroom routines and developed strategies to effectively build shared mental models, which can dramatically lighten their individual intrinsic load. This can free up cognitive resources for them to monitor both their partner's actions and the broader classroom dynamics simultaneously (Feldon, 2007). Indeed, greater expertise and prior team experience are known to reduce the extraneous load caused by collaborative transactive activities like communication and synchronization (Kirschner et al., 2018).

In addition, the differences observed between low and high experience teachers in team teaching carry several practical implications for teacher training, instructional design, and how institutions implement team teaching. First, the value of integrating low experience teachers into teams with experienced team members is affirmed. The low experience teachers in our study clearly leaned on their experienced team members for support, and this supported environment allowed them to practice teaching in ways they might not manage alone. This aligns with evidence that low experience teachers benefit significantly from on-the-job mentorship and collaborative models (Hong & Matsko, 2019). In fact, when low experience teachers team up with high experience teachers, they tend to adopt more student-centered and effective practices than when they teach alone (Mariën et al., 2023). School and university administrators should therefore consider structured team teaching programs as part of early-career development. Moreover, instructional designers and educators

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responsible for organising team-taught courses should carefully consider the teaching team's experience levels when designing lesson plans. For teams composed of both low and high experience teachers, lessons could incorporate clearly defined collaborative structures. For instance, a lesson plan might explicitly indicate that a high experience teacher introduces a topic, followed by a related activity or discussion led by a low experience teacher. Similarly, during practical sessions, low experience teachers might lead specific groups or instructional segments with high experience teachers providing flexible, responsive support. Clearly defining these roles beforehand can enable low experience teachers to better prepare and foster greater instructional autonomy, reducing reliance on reactive responses. At the same time, instructional plans should remain flexible to accommodate spontaneous instructional shifts, maximising the responsive advantage inherent in team teaching. Additionally, instructional designers should thoughtfully arrange classroom layouts and technologies to support smooth, non-disruptive team teaching interactions. Simple strategies, such as utilising separate teaching areas or pre-arranged non-verbal cues to facilitate seamless coordination between teachers, can significantly enhance instructional coherence and reduce the need for disruptive verbal communication. Although our study did not explicitly analyse these instructional design aspects, the observed necessity for effective coordination underscores their potential value in enhancing team teaching effectiveness.

Although our findings provide insights into differences between high and low experience teachers in team teaching contexts, our study did not examine teachers' instructional development across teaching phases. Future research could explore the temporal dimension of teacher learning, including how instructional roles, behavioural patterns, and coordination strategies evolve as teachers progress professionally in team teaching contexts.

Conclusion

This study suggests that teaching experience significantly influences behavioural transitions during team teaching. Teachers with low experience exhibited greater dependence on teaching team members and a more limited range of instructional behaviours. In contrast, high experience teachers demonstrated more fluid and purposeful transitions, indicating greater adaptability and instructional awareness. These findings underscore the importance of considering teaching experience in team teaching contexts.

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Future-Focused:

Educating in an Era of Continuous Change

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