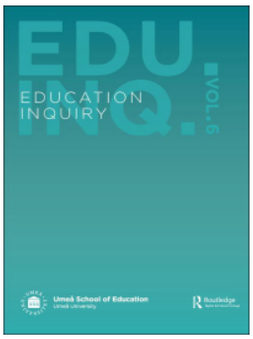

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Describing teacher educators' metatalk moves enacted for teaching how to teach concepts

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ABSTRACT

Higher education settings necessitate reflective decision-making through metacognitive thinking. As teacher educators prepare prospective teachers responsible for enhancing their students' metacognitive abilities, they must employ metacognitive prompts that encourage students to engage in metacognitive thinking. This study aims to analyse and exemplify the talk moves used by teacher educators to stimulate metacognitive thinking among their students. The research delved into 22 teacher educators, scrutinising 36 in-class teaching sessions totalling 4536 minutes using a multiple case study approach. Through classroom discourse analysis, the study reveals that participants employed 24 distinct types of moves organised around eight overarching themes (framing, wrapping up, consistent and contingent thinking, monitoring cognition, apparent and elicited oral communication, transferring understanding, experiencing, legitimating, and justifying thinking and reasoning) to foster metacognitive thinking among students. The study's implications emphasise how teacher educators can leverage talk moves to promote various metacognitive thinking processes in students. Notably, the research establishes a data-based coding framework facilitating examining educators' metacognitive moves, indispensable tools in university-level instruction. The findings underscore the significance of instructional noticing for teacher educators, particularly in cultivating metacognitive thinking.

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Metacognitive thinking; classroom talk; teacher educator; prospective teacher; how to teach

Introduction

Higher education classrooms have a distinct purpose – to nurture advanced cognitive skills like critical thinking, analysis, creativity, and reflection (Hart, Da Costa, D'Souza, Kimpton, & Ljbusic, 2021; Van Damme & Zahner, 2022). Reflection is especially significant among these skills, as it involves contemplating and regulating one's cognitive processes (Guo, 2022). In higher education, metacognition improves learning outcomes and academic success (Dennis & Somerville, 2022). Recent studies suggest that well-designed in-class activities enhance students' metacognitive processing (e.g. Li & Yuan, 2022). Metacognitive students in higher education are better equipped to

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employ effective learning strategies. Engaging in metacognitive discussions about learning enhances strategies like self-explanation, summarisation, and concept mapping, which promote understanding and retention (Rivas, Saiz, & Ossa, 2022). These discussions encourage students to consider multiple perspectives and evaluate their reasoning. Research highlights that metacognitive activities through metatalk can enhance problem-solving and critical thinking skills (Rivas, Saiz, & Ossa, 2022). Metacognitive awareness enables students to effectively analyse and tackle problems by breaking them down and developing solutions (Teng & Yue, 2023).

Metacognitive experiences enhance deep conceptual learning among higher education students. Encouraging metacognitive talks propels students beyond surface-level understanding (De Backer, Van Keer, & Valcke, 2022). Metacognitively stimulated students actively engage with the material, ask questions, seek clarification, and connect new information with existing knowledge (Daloos & Paderna, 2023). Introducing metacognitive talks prompts students to quickly assess task demands and adjust their strategies, fostering flexibility in learning approaches. Given the potential benefits of metacognitive activities in higher education, scholars explore ways to foster metacognitive thinking. One of the primary reasons for accumulating metacognition in higher education studies is that training students as metacognitive people has been problematic by perishing the gap between theory and practice (Dennis & Somerville, 2022). Explicit instruction is one approach to teaching students about their metacognitive resources (Li & Yuan, 2022). However, metacognitive thinking is not autonomous; scaffolded reflection, involving open-ended questions after lessons or assignments, has been proposed (Richardson et al., 2022). This prompts students to analyse their learning process and choices (Akcaoğlu, Mor, & Külekçi, 2023). Metacognitive modelling, where educators think aloud while solving problems, aids students in observing metacognition in practice (Munshi et al., 2023). Another method involves metacognitive prompts, like reflecting on learned material and challenges faced (Castronovo, Van Meter, & Messner, 2022). These prompts nurture metacognitive processes and self-awareness.

While prior research suggests pedagogical strategies, this study delves deeper into metacognitive scaffolding and talk-based prompts in higher education. In the current study, the participating teachers were "academic teachers" training prospective teachers who will be charged with fostering metacognition among elementary and secondary school students. Nurturing metacognitive skills during these stages significantly impacts learning, problem-solving, and academic success (Morón-Monge & García-Carmona, 2022). Elementary and secondary teachers significantly influence metacognitive skills, enhancing learning strategies, problem-solving, self-regulation, autonomy, transferable skills, and lifelong learning (Morón-Monge & García-Carmona, 2022). Prospective teachers play a pivotal role in shaping students' metacognitive experiences, depending on their engagement in metacognitive processes through teacher educators' in-class discussions. This study, therefore, explores how teacher educators' talk supports students' – prospective teachers' metacognitive thinking, analysing how discussions about learning and teaching concepts stimulate metacognitive thinking. Classroom discourse analysis reveals teacher educators' metatalk moves, documenting how they trigger students' metacognitive thinking.

Theoretical framework

Specific concepts are centralised in the present study: metacognition, classroom talk or discourse, teacher talk moves, metatalk or metadiscourse, and metadiscourse or metatalk moves. Metacognition has garnered significant attention in educational research and practice for its profound impact on learning outcomes and cognitive development, particularly in higher education (Sato, 2022). Rooted in cognitive psychology and educational psychology theories, the concept of metacognition was initially introduced by psychologists John Flavell and Ann Brown in the 1970s (Flavell, 1979; Kuhn, 2022). Aligned with constructivist learning theories, metacognition emphasises active knowledge construction through reflective thinking and self-regulation (Dökmecioğlu, Tas, & Yerdelen, 2022; Efklides, 2008).

Metacognition involves two primary cognitive processes: metacognitive knowledge and control (Akyol & Garrison, 2011; Thomas, Wulff, Landinez, & Bulevich, 2022). Metacognitive knowledge entails understanding one's cognitive processes and factors influencing learning, such as strategies, task requirements, and individual strengths and weaknesses. Metacognitive control involves actively monitoring and regulating cognitive processes, including planning, monitoring, and evaluating learning strategies (Thomas, Wulff, Landinez, & Bulevich, 2022).

As a second-order cognitive operation, metacognition encompasses monitoring, coordinating, planning, controlling, checking, evaluating, guiding, regulating, and experiencing (Rivas, Saiz, & Ossa, 2022). Closely linked to self-regulated learning, metacognition empowers students to actively manage their learning processes (Zohar & Ben-Ari, 2022). A functional tool, metacognition enhances conceptual understanding, higher-order thinking, and science process skills (van der Stel & Veenman, 2010; Veenman, 2011; Zohar & Barzilai, 2013). Metacognitive skills develop over time and can be cultivated at different educational stages, from essential awareness in young children to more advanced strategies as they mature (Zohar & Ben-Ari, 2022).

In higher education, metacognitive thinking is sustained through technological support such as online self-assessment quizzes, concept mapping software, and e-portfolios (Carvalho & Santos, 2022). Web-based courses explicitly employing metacognitive strategies foster higher-order metacognitive thinking (Topcu & Ubuz, 2008). However, interventions that stimulate metacognitive thinking may not consistently yield better results (Baltaci & Akpinar, 2011; Ng, 2016).

Incorporating metacognition into educational practices transforms how students approach learning, fostering more effective and independent learners equipped for academic success and future endeavours (Zohar, 2023). However, little is known about how academic teachers in higher education trigger and sustain metacognitive moments in their students. The characteristics of in-class implementations and implementer-based talk moves must be inspected to determine how metacognitive thinking is stimulated in higher education lessons.

Moving beyond metacognition, the study explores classroom discourse and teacher-led talk moves. Classroom discourse constitutes the dynamic realm of verbal interactions, discussions, and communication within a classroom, with teachers taking the lead and students actively participating (Markee, 2019). Here, discourse serves as a scaffold,

bridging the gap between students' current understanding and elevated comprehension through various interactions, from subtle hints to thought-provoking questions (Hu & Chen, 2023).

The orchestration of classroom discourse primarily relies on educators, facilitated by "talk moves". A strategic utterance, each talk move serves distinct discourse objectives and is observed in science and mathematics education at elementary and secondary levels (Bansal, 2018; O'Connor & Michaels, 2019). Effective questioning is a pivotal talk move, pushing the boundaries of student thought and encouraging a more profound exploration of conceptual landscapes (Soysal, 2022). Open-ended questions extend dialogues into uncharted realms while rephrasing and summarisation validate comprehension and invite elucidation (Bansal, 2018; Kayima & Jakobsen, 2020). Talk moves also include soliciting elaboration, aiming to transform student thoughts into eloquent expressions, and summarising to encapsulate the essence of discourse (Houen et al., 2022).

This study distinguishes itself by delving into metatalk moves, a rare exploration in educational scholarship (Tang, 2021). It also focuses on academic teachers or teacher educators' efforts to engender metacognitive engagement within students through discourse. The research aims to bridge a significant gap in the literature by offering a pioneering depiction of how teacher educators, whether consciously or not, awaken metacognitive activity within the classroom setting.

The study further explores the tangible distinctions between classroom discourse and classroom metadiscourse. Metadiscourse, within the classroom context, encompasses strategic and linguistic manoeuvres by educators and learners to shape, navigate, and introspect upon ongoing discourse and interactions (Tang, 2021). Metadiscourse provides clarity and orchestrates conversation flow by employing language to delineate the arrangement and evolution of ideas (Soysal, 2021; Tang, 2017).

In the classroom landscape, metadiscourse deployment takes two forms: reflective analysis post-classroom encounters and specific discourse techniques to prompt on-the-fly metacognitive reflection during instructional moments (Newman, 2017; Soysal, 2021; Tang, 2017). Metadiscourse is a multi-faceted tool for educators to contextualise discussions, formulate queries, provide elucidations, and shepherd students through intricate subject matter (Myhill & Newman, 2016). It cultivates metacognitive consciousness, empowering individuals to regulate and monitor their comprehension, thereby augmenting learning outcomes (Alt & Raichel, 2020). In conclusion, metadiscourse transcends being a linguistic tool; it emerges as an architectonic force guiding communication currents while nurturing deeper engagement, critical thinking, and metacognitive mindfulness in higher education (Rivas, Saiz, & Ossa, 2022). The study emphasises the relatively unexplored territory of how instructional design by teacher educators intertwines with metadiscourse manoeuvres to catalyse heightened metacognitive involvement.

The position of and justification for the study

In previous sections, this study addresses gaps in research concerning efforts to promote metadiscourse instances through verbal interactions in higher education classrooms. Within this context, teacher educators who serve as academic instructors grapple with two instructional challenges. The first involves crafting lesson designs

that initiate, maintain, and conclude productive academic settings. These lesson designs may encompass argument-driven inquiry, collective argumentation, problem-based or challenge-based education, and explicit instruction (Hervas & Medina, 2022). These designs are inherently intertwined with teacher-led discussions within the classroom's social plane (Hervas & Medina, 2022), thereby shaping the flow of the instructional process. This study delves specifically into a distinct layer of teacher-led discussions: metadiscourse moves.

This prototype study aims to develop methodological tools for thoughtful analysis, presented as validated data-based catalogues of metadiscourse moves. These tools can help identify an academic teacher's capacity to stimulate metacognitive thinking in the classroom through scaffolding dialogues. For comprehensive higher education systems and exceptionally robust teacher preparation programmes, the foundational tools of "reflection-in-action" (engaging in critical thinking and decision-making during real-time activities) and "reflection-on-action" (analysing teaching practices, decisions, and outcomes post-lesson) are indispensable (Cattaneo & Motta, 2021). These tools necessitate reflective judgement and metacognitive actions by prospective teachers (Cattaneo & Motta, 2021). However, the extent to which prospective teachers exhibit reflective judgement through teacher-led initiations, such as metatalk moves, remains uncertain.

This study contends that in preparing prospective teachers as reflective and metacognitive individuals, it is pivotal to cultivate a classroom discourse environment that strongly encourages metacognitive actions. It is imperative to investigate how academic teachers facilitate metacognitive engagement among prospective teachers through metadiscourse moves. Another overarching pedagogical concept in higher education classrooms is fostering students' active involvement in the learning and teaching processes to cultivate reflective judgement (Bond, Buntins, Bedenlier, Zawacki-Richter, & Kerres, 2020). This engagement entails creating an adequate learning space where students consistently monitor and assess the ongoing classroom discourse within specific time frames (Bond, Buntins, Bedenlier, Zawacki-Richter, & Kerres, 2020). This productive engagement is closely linked to the cognitive framing concept, which pertains to how information is presented and structured to influence learners' understanding (Soysal, 2021). It involves moulding learners' mental frameworks through diverse instructional strategies to enhance comprehension, retention, and application of lesson content (Soysal, 2021).

In this context, it is postulated that metatalk moves can prompt prospective teachers to evaluate their thinking and communication by reflecting on conceptual and procedural aspects. Furthermore, metatalk moves might guide students to pose pertinent questions to sustain cognitive framings, such as inquiries about their level of knowledge, monitoring strategies, key concepts, idea selection in discussions, and the teacher's emphasis on specific ideas. Cognitive framing necessitates reflective actions, requiring educators to allocate time for learners to contemplate lesson content (Soysal, 2021). Nonetheless, a gap exists in research regarding teacher educators' talk-based endeavours to promote on-the-fly metacognitive operations through cognitive framing.

Consequently, this study explores the qualitative components of teacher educators' metatalk moves. These instructional efforts to foster prospective teachers' metacognitive actions are evident within the classroom discourse. The most effective means of nurturing metacognitive thinking involve establishing socially organised

learning environments where learners assess, manage, and regulate their cognition (Heyes, Bang, Shea, Frith, & Fleming, 2020). Metacognitive thinking is a social-cognitive-cultural activity entailing verbal interactions between educators and students (Heyes, Bang, Shea, Frith, & Fleming, 2020). Practical metacognitive thinking is cultivated through social interactions guided by teacher discourse, which aids students verbally and cognitively in experiencing metacognitive thinking (Heyes, Bang, Shea, Frith, & Fleming, 2020). Teacher educators' conversations are mediating tools, facilitating an interactive process where students monitor, evaluate, and regulate their cognitive processes through verbal exchanges (Heyes, Bang, Shea, Frith, & Fleming, 2020).

Accordingly, this study seeks to delineate various talk moves teacher educators employ to promote metacognitive thinking within the social dynamics of classroom discourse. While previous work has outlined science teachers' metatalk moves (Soysal, 2021; Tang, 2017), a comprehensive catalogue of teacher educators' metatalk moves based on empirical data is yet to be developed. In the context of teacher preparation, the knowledge underpinning effective teaching is ripe for nurturing metacognitive instances through dialogue. Teaching pedagogical concepts demands nuanced verbal interactions that inherently involve metacognitive aspects due to the subject matter's cognitive nature (e.g. learning, memory, attention, cognitive development, pedagogy, etc.). Thus, it is timely to investigate how teacher educators maintain metacognitive harmony through their metatalk moves.

Methods

Research approach, context, and participants

As mentioned earlier, it is purposed to capture every piece of the teacher educators' metatalk (metadiscourse) moves (MTMs). Thus, a multiple case study was conducted. The main aim of employing a multi-case approach was to enhance the study's internal validity and validate the consistency of findings (such as patterns of metatalk moves) across different cases (Miles et al., 2014). As such, it becomes essential to clearly define the unit of analysis within the scope of multiple case studies (Stake, 2008). In the current study context, each lesson that underwent analysis constituted the unit of analysis. Stake (2008) emphasised that a multi-case study approach should incorporate deliberate and informative replication of this unit of analysis. These multiple case studies should extract all potential areas of convergence and divergence, forming a comprehensive framework (Stake, 2008). To elaborate further, within this specific multiple case study, it was imperative to encompass various cases occurring in diverse exploratory contexts. Stake (2008) argues that multi-case research commences with the core. Qualitative research delves into some of its cases – its sites or manifestations. By comparing these cases, the qualitative researcher gains a deeper comprehension of the core. Therefore, within the context of the present study, it became vital to diversify the instructional scenarios to unveil qualitatively distinct metatalk moves. Stake (2008) highly recommended exploring a minimum of 4–10 cases (such as lessons) to comprehend how the investigated phenomenon responds to the various contexts in which it unfolds.

A total of 22 teacher educators participated in the study, with 17 (77%) female and 5 (23%) male. These educators were affiliated with eight universities, where 5 (62.5%) were foundation-supported, and 3 (37.5%) were public institutions situated across three cities in Turkey. Among the foundation-supported universities, greater technological resources were available to support educators' teaching methods, allowing for a more nuanced integration of technological pedagogical content knowledge. This resource diversity may have influenced the range of observed instructional practices.

All the educators held doctoral degrees, encompassing various fields such as educational sciences, elementary/secondary mathematics/science education, Turkish and social sciences education, and classroom teaching. The differences in their academic backgrounds could have contributed to the variation in their in-class teaching methods, thereby influencing the typologies of the observed metatalk moves (MTMs). The participants possessed teaching experience ranging from 2 to 11 years. Differences in the amount of in-class teaching experience might have led to variations in the metatalk moves exhibited by the participants.

Furthermore, the participants were employed at universities in different cities, each with distinct demographic characteristics. These varying demographics could have contributed to diverse in-class educational experiences, affecting the types of captured metatalk moves. The participants also exhibited differences in academic orientation, professional characteristics, capabilities, and capacities. Notably, five participants were associated with research-intensive universities, which may have influenced their tendency to contribute more significantly to scholarly research than those employed in teaching-oriented universities. This distinction could have further contributed to the diversity of observed metatalk move typologies.

Regarding instructional beliefs, the participants held divergent and convergent views on effective teaching practices in higher education classrooms. Despite this, all participants emphasised constructivist or student-centred approaches when demonstrating their pedagogical content knowledge in higher education settings. These differing beliefs likely influenced their approaches to in-class teaching and the potential range of metatalk moves they demonstrated.

The participants' in-class instructional activities and data collection

The aim of the present study, regarding data collection, was to amass a comprehensive and in-depth corpus of talk-based data, ensuring the inclusion of all analytical instances of metatalk moves. Thus, collecting classroom data where substantial verbal interactions occurred between participating teacher educators and prospective teachers, particularly during discussions about instructional techniques, was imperative. Based on this purpose, a snowball sampling strategy (Geddes, Scott, & Parker, 2018) was used to collect more relevant data to address the research questions of the present study. This qualitative sampling method – chain referral or network sampling- involved initially selecting a few participants who met the research criteria, and then we relied on their help to identify and refer additional participants who shared relevant characteristics or experiences. The process continued like a snowball rolling down a hill, gaining momentum and size as it

progressed. We first identified initial participants ($n = 6$) with the characteristics or experiences relevant to the research topic (e.g. substantial verbal interactions occurred between participating teacher educators and prospective teachers). Second, the researchers asked the initial participants to refer others suitable for the study. These referrals were teacher educators within the initial participants' academic networks sharing similar in-class instructional experiences. The referred teacher educators were contacted and invited to participate in the study. If they agreed, they might also be asked to refer additional participants, continuing the chain. Consequently, the participants were required to contribute to the data collection process by referring appropriate teacher educators to participate in the study, recording videos of their in-class instructions, and prioritising situations that involved extensive verbal exchanges and interactions. Upon initial review by the researchers, the gathered data, containing numerous talk-based exchanges, appeared suitable for analysis. The preliminary examination of participants' video-recorded sessions revealed various instructional strategies employed in their lessons. These strategies encompassed direct lecturing accompanied by Socratic questioning, small and whole group discussions, problem-based teaching, case-based teaching, argumentative discourse involving socioscientific issues, and dialogic argumentation.

The participants focused on pivotal moments of conceptual change, introducing descriptive events to prompt students to consider alternative and competing viewpoints ($n = 22$). This implies that during all the observed in-class implementations, the participants attempted to initiate and maintain the lesson centred around conceptual challenges regarding teaching concepts. Additionally, during their lectures, some educators ($n = 3$) utilised semi-fictional scenarios to enhance students' intellectual engagement, resulting in increased verbal interactions that facilitated the identification of metatalk moves. Conversely, other participants opted for direct lecturing and elaborate brainstorming sessions to encourage student participation ($n = 11$). Furthermore, some participants ($n = 5$) conducted whole-group and small-group discussions with students to stimulate meaningful classroom discourse. Notably, three participants adopted a unique teaching approach involving students in web-based video analysis and interpretation to collectively discuss and enhance in-class teaching performance indicators.

Data for the study were gathered through meticulous video recording, resulting in 49 videos capturing 6419 minutes of classroom interactions. The involvement of all participants was confirmed as they willingly provided their consent to participate in the research. They signed a consent form including the details about anonymity (by not collecting any identifying information about participants or by using pseudonyms in research materials), data protection (taking steps to store and protect collected data securely), data sharing (removing any information that could identify participants), and confidentiality (ensuring the participants adhere to strict confidentiality agreements to protect their data). Upon initial video examination, a careful assessment was conducted to determine each video's suitability for classroom discourse analysis. Among the 49 recorded videos, it was discovered that 13 videos (accounting for 26.53% of the total) were deemed irrelevant due to an imbalance in the number of educator-led voices compared to student voices. These eliminated videos lacked robust discussions where diverse

viewpoints were explored and elaborated upon. Additionally, the excluded videos exhibited fewer instances of interaction between educators and students. For instance, 1013 sentences emerged during the lesson in one participant's classroom. Within these, the participant contributed 816 sentences, while the remaining 197 came from 39 students. Out of the participant's 816 sentences, 213 were identified as questions. Among these, 199 were closed-ended, while 14 took the form of open-ended inquiries. Consequently, this lesson exhibited limited student verbal engagement, with the participant taking a more directive and controlling role. Consequently, it lacked the verbal exchanges necessary to foster students' metacognitive thinking. These patterns in terms of percentages and classroom discourse tendencies were similarly observed in the teaching practices of 12 other participants.

Consequently, 36 videos (constituting 73.47% of the original recordings, equivalent to 4536 minutes) were considered suitable for the analysis. Beyond verbal content, nonverbal aspects such as the educators' gestures, facial expressions, intonations, and gazes were meticulously transcribed, acknowledging their role as affective dimensions in the overall exchange of ideas (Pianta & La Paro, 2003). The analysis centred around identifying sub-topical episodes where the participants' metatalk moves (MTMs) were observed and analysed. This approach allowed for a focused examination of instances where educators engaged in reflective discussions about teaching strategies and pedagogical content knowledge.

Data analysis

An iterative and inductive approach guided the development of a comprehensive coding scheme to identify different Metacognitive Talk Moves (MTMs) types. Two coding techniques were used herein: open and axial. These coding techniques helped the researchers organise and make sense of the verbal data in identifying broader patterns.

Open coding: Open coding involves the initial stage of data analysis. The coding scheme was designed by drawing insights from the latest research literature on MTMs. Vande Kopple's (2012) metadiscourse framework was employed to capture these MTMs. Tang (2017) and Soysal (2021) also utilised Vande Kopple's (2012) framework when analysing MTMs of science teachers, despite its initial construction for analysing written compositions. Adjustments were made to adapt the scheme for oral communication, as recommended by Tschan, Zimmerman, and Semmer (2018), to avoid the lengthy process of developing a new catalogue. Since each study context is unique, prior coding schemes could not be directly applied, underscoring the need for a tailored approach. The fundamental unit of analysis was the teacher educators' utterances. To categorise a teacher-led utterance as a metatalk move, the move is needed to trigger specific moments within classroom discourse, such as discussions about discussions, cognition or thinking processes. An illustrative example clarifies this process:

Student: I don't believe there will be a change in mental state every time. Because sometimes, even if people encounter claims outside of their mental state, they can still maintain their existing but perhaps deficient or incorrect concepts.

Teacher educator: You've all heard what your classmate just shared – a viewpoint that goes against our discussion. Could this be seen as a counterargument? Does this truly align with our understanding of how our mental processes operate? Or is what your friend said not relevant to our current topic?

This dialogue snippet shows that the teacher educator actively prompts students to engage in metacognitive/reflective processes. To elucidate, focusing on the teacher's response, initially, the educator aims to encourage the students to evaluate the overall direction the class conversation has taken ("goes against what we've been discussing"). This can be seen as a metacognitive prompt, as it necessitates students to compare and contrast two cognitive elements: (i) the prevailing consensus on mental processes and (ii) the distinctions between this consensus (comprehensive cognition) and the recently introduced notion (analytical cognition). Additionally, the teacher educator directs students to critically evaluate the viability of the newly presented argument concerning the established conceptual agreement ("a counterargument?"). When addressing this query, students are required to differentiate between the similarities and differences between the recently proposed concepts and the established consensus, which constitutes a metacognitive endeavour. Moreover, through the teacher's question, "Or is what your friend said not relevant to our current topic?" students are prompted to engage in a decision-making process via metacognition. Consequently, students need to assess the appropriateness of the newly introduced concept based on the accumulated conceptual insights generated from prior class discussions.

Axial coding: Axial coding came after the open coding described above and involved a more structured and systematic exploration of the relationships between the initial codes identified during the open coding process. In the axial coding, the researchers started grouping related codes into broader themes characterising the observed MTMs. These categories were further refined and connected by identifying subcategories and exploring their connections and interrelationships. Axial coding helped the researchers uncover the data's underlying structure and develop a more comprehensive and organised understanding of the phenomena – the participants' MTMs- under study.

Validity and reliability

Three researchers were responsible for applying the codes from the scheme, which are presented as distinct tables (Tables 1–8) within the Findings section. The coding scheme encompasses over 20 analytical codes, making it challenging to attain high inter-coder reliability swiftly (initially 62%). However, through rigorous discussions and deliberations to resolve discrepancies, this rate increased significantly to 88%. For internal consistency assessment, an X-code (where X represents a label selected from

Table 1. MTMs for *framing the classroom happenings.*

Code/Description	Example utterances*
Retrospective: Educator guides students to retrieve an earlier conversation, demonstration, discussion point, pedagogical move, case, cognitive/learning process, or concept.	**E**: How did I make you wonder? So, what have I done? **Oliver**: You asked interesting questions. **E**: What else have I done? Try to say pedagogical ones. Try to say more analytical ones.
On-moment: The educator highlights emerging discussion points, actions, ideas, cognitive processing, or work processes to be carried out to sustain student-led online awareness.	**E**: This is what I want. I am trying to ask what prompts us to learn. I am asking what you are doing mentally and physically makes you act and learn? **Jake**: Motivation. **E**: What kind of motivation? **Jake**: So, internal motivation. If I like something, I will learn it better. "Like something" means you need to know or have this.
Focusing: Educator signals the importance of a specific idea, response, point of view, proposition, or case.	**Joe**: Actually, I say that the student has both learned and not. He learned the subject because our pupils grow in the dark, as he says. So, this point seems to be learned. Nevertheless, he is unaware that he cannot see in the dark. So, he is not aware of the accommodation. I think he is confused about those situations. Even if there is a little light, vision begins after a certain period. However, if there is no light, vision will not occur. **E**: That is a great explanation! You know why? Why do you think I liked this answer so much?
Purpose: Educator invites students to comment on the end goals of all discussions, talks, demonstrations, negotiations, and acts of the educator, provided cases about instruction.	**E**: So, you know what I was trying to do here? Why do you think I tried to compare two other extreme examples with the heart attack condition? **James**: You tried to explain that one is not more important than the other. **E**: But what we are discussing here is: "Why do we start learning something?", "Is this an automatic initiation?", "Why and when do we decide* to learn something?"

*"E" represents the educator who handled the in-class implementation regarding teaching how to teach.

the catalogue as a specific move) assigned to a talk move was consistently compared with other moves within the exact transcription of the in-class implementation. Similarly, external consistency was examined by comparing the X-code with other instances of the same X-code found across all transcriptions and different implementations. To ensure the validity of the data collection, analysis, and interpretation processes, external audits (Lincoln & Guba, 1986) were engaged. These external auditors were entirely detached from the study and meticulously scrutinised the preliminary findings. Additionally, a member-checking approach was employed. The identified types of MTMs were shared with ten randomly chosen educators, who then verified the accuracy of the assigned codes, interpretations, and narratives constructed by the researchers based on the data corpus.

Findings

Eight higher-order categories and 24 analytical codes were extracted for the educators' MTMs. The higher-order categories are framing, wrapping up, consistent and contingent thinking, monitoring cognition, apparent and elicited oral communication, transferring understanding, experiencing, legitimating, and justifying thinking and reasoning. Below, the observed MTMs are elaborated and exemplified.

MTMs for framing the classroom happenings

The educators employed talk moves strategically to shape students' cognitive perspectives, enhancing their awareness of classroom dynamics ($n = 9$). This process of cognitive framing (as illustrated in Table 1) was facilitated through four distinct talk moves: retrospective ($n = 2$), on-moment ($n = 3$), focusing ($n = 2$), and purpose ($n = 2$). The retrospective and on-moment talk moves predominantly revolved around prior and ongoing classroom activities. The retrospective move prompted the students to recall preceding verbal interactions, encouraging them to reflect on previous discussions. For instance, in the following example, the teacher educator prompted the students to provide specific instances, employing instructional techniques to capture their attention (as indicated in Table 1). The students were tasked with recollecting the instructional sequence and identifying the critical analytical aspects instrumental in capturing their focus.

An on-moment move facilitated students in maintaining an immediate awareness of ongoing classroom interactions. The participants ($n = 3$) emphasised that this move pertained to a particular discussion period. This is evident in the example where a participant deliberately directed attention to a specific timeframe within the classroom discourse, aligning with her instructional objectives. This approach prompted the students to actively monitor their cognitive and physical engagement, thus fostering a conscious learning process. As Jake elaborated, the students were encouraged to re-evaluate the motivations that drive their learning efforts. Through this metacognitive prompt, the educator established transparency in her instructional intentions.

Two teacher educators delineated the conceptual scope of classroom discussions by implementing focusing moves, which prompted specific cues for further exploration. These moves aimed to emphasise the development of student responses. For instance, after Joe provided a comprehensive explanation of a pedagogical case, the participant underscored the significance of his idea (as indicated in Table 1). Subsequently, the participant paused the conversation and encouraged the students to contemplate why she endorsed Joe's contribution. The implicit message conveyed was that the students were expected to elucidate the significance of the provided response within the context of the ongoing discussion. Consequently, the students were prompted to concentrate on the thematic content of the response and ascertain its relevance for advancing the classroom discourse.

Using purpose moves, two teacher educators directed the students to be immediately aware of significant discussion points. These moves allowed the students to offer insights into the educational intentions behind the conversations, including demonstrations, negotiations, educator's actions, and instructional case studies. This allowed the students to evaluate the group's educational objectives. For instance, the participant aimed to refine the immediate instructional purpose by prompting the students to contemplate why she presented two opposites regarding effective in-class communication. This process required the students to discern the educator's thought and conceptual trajectory. James contributed one aspect of why the educator encouraged comparing these extreme examples. However, the teacher educator found James's response unsatisfactory and elaborated on the metacognitive aspect of students' thinking, particularly concerning the pre-organisational mechanisms of their learning.

MTMs for wrapping up the classroom conversations

During the implementations, the participants engaged in brainstorming activities with low-interanimation of ideas, where the answers were presented without elaboration. This approach potentially imposed a cognitive load on the students as they had to process and analyse multiple viewpoints. Consequently, the students required metacognitive support, which involved summarisation. The 14 participants identified and clarified the essential themes derived from the students' responses during this process. To illustrate, as shown in Table 2, the teacher educator introduced the primary thematic categories during discussions by summarising. Subsequently, she organised the responses into three overarching themes (Table 2). Ultimately, she guided the students' attention towards the highlighted points and provided comments. This process made the students conscious (as evidenced by Emma's response) of the critical categories within their thoughts, enabling them to compare diverse perspectives effectively.

Table 2. MTMs for *wrapping up the classroom conversations.*

Code/Description	Example utterances
Summarising: After gathering ideas, the educator pools ideas and summarises the key points in students' diversifying opinions.	**E**: Three ideas that I deduced from your answers. One: "he has learned, but it is incomplete". Two: "he does not know anything about the subject; he never really learned it". Three: "I think let us not look at this simple mistake as he learned well". Which? Which one do you agree with or not? **Emma**: I think he commented without deeper thinking. Since he assumed he knew the answer, he decided without thinking and made a reasoning error. He is very confident. He will find the answer if he thinks a bit, but …
Selecting-eliminating: The educator features some contextually more relevant ideas for unfolding classroom discourse.	**E**: So, Maslow has, of course, got to do with our subject, but now we are talking about teaching theories. So, we need to deepen our learning theories. Maybe we may refer to Maslow when we talk about motivational constructs.
Labelling: The educator prompts students to create labels to cover their thoughts, proposals, propositions, generalisations, and explications.	**E**: Was the narration (… direct teaching) part at the end? Was it in the first place? Where was it in our lesson? Where was the narrative part? When did we start explaining (… directly lecturing) something? **Mary**: In the final. **T**: How would you label that process? **Emily**: Summarising? **T**: No … I mean, "how should we name that process?" **Megan**: Naming, labelling. **Michelle**: So, the important thing is thinking; our talk is a whole jargon. So, it is just labelled … It is just words. The process was necessary. So, we have to name it something like that.
Concluding: The educator prompts students to draw generic conclusions by considering premises that emerged during conversations.	**E**: Is anyone aware of what we have spent all this process for now? What can these all be for? **Lily**: It is about the learning process. **Barbara**: Something about how learning begins. **E**: So, how does the student decide to learn? Are you aware of what they all show? **Isabella**: Curiosity. **Joanne**: The relationship between negotiation, contradiction, learning and teaching… **Victoria**: To find out, we must be cognitively linked to the lesson through contradictions.

Some teacher educators ($n = 9$) let the students differentiate contextually relevant opinions from irrelevant ones (selecting-eliminating). They injected the message that the student's ideas might not be connected to the content under on-moment discussion. In other words, they implied that the provided response might not be logically improper, or even though the proposition is intellectually acceptable, it should be focused on later in the talks. The students, therefore, had to compare their response's content with the on-moment content of the accumulative conversation. It was needed to determine whether they might propose a contextually incompatible idea that should not be inserted in the current talk. For example, the teacher educator gave the meta-message that the concepts of Abraham Maslow may be used later (Table 2, eliminating/ignoring). She indicated that the group was now talking about the theories of teaching/learning.

Through labelling, a subgroup of participants ($n = 4$) prompted students to generate thematic labels that could succinctly capture the essence of the discussions. This process required the students to revisit the conceptual and procedural exchanges and formulate concise titles that encapsulated the key themes. As depicted in Table 2, the participant's employment of labelling tactics served to stimulate metacognitive engagement. This approach demanded that students not only re-evaluate and enumerate the analytical points they had explored but also establish categories for the proposed concepts and suggest overarching titles. Crafting these labels compelled students to engage in a content analysis of the conversational content, as evident in Table 2.

Concluding actions prompted the students to deduce the essence of their discussions. A subset of the participants ($n = 2$) encouraged the students to formulate conclusive statements using their exchanges' premises. For instance, as exemplified in Table 2, the teacher educator guided the students in reflecting on the instructional processes they had participated in, culminating in concluding remarks. This approach was observed in the contributions of Lily and Barbara, who re-evaluated the content and highlighted specific aspects they had focused on. The teacher educator rephrased the question to encourage the students to explore how a student might decide to acquire knowledge, considering the prevalent themes in the discussions. Isabella's conclusion revolved around nurturing curiosity as a catalyst for initiating learning, a topic extensively discussed. Joanne introduced additional elements to elucidate the factors influencing effective learning. Finally, Victoria synthesised a comprehensive concluding statement, delving into the intricate relationship between meaningful disciplinary engagement and cultivating an enriching learning environment.

MTMs for consistent and contingent thinking

Within this classification, the teacher educators ($n = 15$) strategically employed their interventions to provoke critical assessment of the student's ideas. This prompted the students to evaluate their reasoning by contrasting alternative explanatory frameworks catalysed by the educators' probing inquiries. For instance, as illustrated in Table 3, the teacher educator promptly identified discrepancies within her assertion following Margaret's response. This deliberate approach urged Margaret to substantiate her reasoning and necessitated her consideration of opposing perspectives or incorporating the educator's probing question into her response. This dynamic interaction fostered online cognitive awareness and prompted adaptive adjustments in response to the educator's insights.

Table 3. MTMs for sustaining *consistent and contingent thinking.*

Code/Description	Example utterances
Logical consistency (challenging): Educator reminds students that they may propose conflicting claims and invites them to be compatible in reasoning. Educator points out counterarguments, contradictions, and logical flaws in students' claims.	**Margaret**: He is theoretically successful; he knows about the content. Yes. Nevertheless, he seems not to adapt it to practice. He may not interpret the information provided to him. **E**: How did he learn the knowledge without applying it to practice? How did he get it? Is it possible? I hardly understand. **Margaret**: By reading, memorising, rehearsing. **T**: Did he memorise it? So, the most successful student of the system has memorised all lesson contents? Have you ever seen someone who has a significantly more profound knowledge by memorising it like this? I have never seen it!
Guaranteeing linkages between proposed predicates: The educator invites students to clarify how they connect a proposed idea and the general content of the classroom talk.	**Isla**: The child has more or less knowledge on the subject. We, therefore, should plan to teach to add layers to it. **E**: Have you responded to your friend, or did you want to say something different? Because we have expected you to answer him.
Consensus: The educator encourages students to check whether a conceptual/procedural agreement was achieved further in the discussion.	**E**: First, the contradiction (writes on the board). Are we in agreement about this? Is there anyone who disagrees? What kind of contradiction is this contradiction? **Lauren**: It contradicts what we say, what we know. **E**: Then? So, we have our concepts; however, alternative explanation systems may contradict them. For example, a conceptual contradiction. Deal? Shall we continue from here?

The teacher educators ($n = 3$) utilised the thematic content of the students' responses to navigate the trajectory of classroom discourse. They aimed to ensure coherence between the provided answers and the ongoing discussions, guiding students towards collaborative and cohesive interactions. For instance, as depicted in Table 3, following Isla's contribution, the teacher educator inquired whether she intended to introduce a new topic for discussion or contribute in a way that connected to prior ideas. This prompted Isla to critically assess her statement and determine its alignment with the ongoing conversation. Consequently, this query encouraged Isla to monitor her and her peers' cognitive processes and harmonise her response with the ongoing dialogue.

Two participating teacher educators prompted students to verify whether the group had achieved a shared conceptual understanding through a consensus move. This can be illustrated in Table 3, where the teacher educator urged students to assess whether they had reached a common ground regarding the efficacy of challenging learning contexts in fostering higher-order thinking among students (Table 3). Upon receiving Lauren's input, the teacher educator succinctly summarised the crucial aspects the groups had already discussed. Subsequently, the students were encouraged to revisit their shared conceptual consensus before initiating a subsequent sub-topic discussion to delve further into the preceding point(s).

MTMs for monitoring cognition

By employing these moves – monitoring of cognition – the teacher educators encouraged students to empathise with the cognitive processes of their peers. This encouraged the students to evaluate their thought processes carefully and those of others,

comprehending the individual's immediate and evolving cognitive journey. Several teacher educators ($n = 9$) directed the students to trace their evolving conceptual shifts using the mind change move. This required the students to contrast their earlier and evolving concepts, which might encompass distinct or partially overlapping cognitive states. Subsequently, the students were prompted to articulate whether they had revised or completely transformed their initial understanding.

As illustrated in Table 4, a participating teacher educator prompted students to contemplate the evolution of their mental models. Charles observed his shifting mental state and acknowledged a partial alteration, as he still upheld the notion that traditional teaching methods should impart certain curriculum concepts. Conversely, Ethan referenced his prior school-based experiences, influenced by conventional instructional approaches. Upon introspection, Ethan seemed to amend his initial understanding of education somewhat. Ethan elaborated on obstacles to skill-centred teaching, referencing the educator's past lessons. Joe disagreed with Ethan's perspective, prompting the educator to delve into the underlying meaning of Joe's statement. Joe explained that his viewpoints had undergone partial change post-implementation. Drawing a comparison with Ethan's standpoint, Joe concluded that adjusting one's beliefs might be persuasive, given the nuanced interplay between pedagogical beliefs and self-efficacy beliefs.

A subset of the participating teacher educators ($n = 4$) prompted students to delve into their peers' cognitive processes using the checking moves. In the illustrative dialogue provided in Table 4, the students were encouraged to peer into their classmates' minds to comprehend their thought processes. For instance, during a classroom experiment where two plastic water bottles (one full and the other half full) were dropped from the same height and hit the ground simultaneously, challenging the students' existing mental frameworks, a participating teacher educator utilised this scenario to convey the pedagogical notion that preconceptions should be open to improvement when faced with challenges, leading to a sense of dissatisfaction. Subsequently, the teacher educator directed George to evaluate his mental state and consider whether it harboured a conceptual conflict. George connected this to the familiar comparison of a freely falling one-kilogram iron object and cotton. Following William's response, the teacher educator posed a precise question probing the process of gaining understanding, particularly in situations necessitating the resolution of contradictions. William highlighted that critiquing one's mental framework to reconcile cognitive conflicts facilitates learning, as George demonstrated. The teacher educator graphically depicted George's cognitive processing on the blackboard to enhance comprehension. William emphasised that George sought novel perspectives to address cognitive dissonance. The teacher educator then directed a query towards George's cognitive approach in the face of cognitive discrepancies. Harry noted that George engaged in comparing alternative viewpoints to resolve the disagreement. Thomas offered an additional perspective. The teacher educator prompted George to expound on his cognitive processing in addressing the cognitive conflict. Ava elucidated George's mental process by referencing self-exploration and self-questioning as tools for managing cognitive dissonance.

MTMs for sustaining apparent and elicited communication

Several teacher educators ($n = 19$) guided the students to assess the clarity of their statements and determine whether they were comprehensible. They then employed the revoice

Table 4. MTMs for *monitoring cognition.*

Code/Description	Example utterances
Mind change: The educator encourages students to compare and contrast their previous and recent ideas (concepts) to check whether they altered, revised, modified, or expanded their ideas (concepts).	**E**: Is there anyone who says, "I have changed my mind with these conversations about teaching?" May not completely change? So, what are you feeling? **Charles**: I still cannot accept the need for direct instruction for some curricular outcomes. **Ethan**: So, I remember my own school life filled with direct lecturing. However, we mentioned it could be complicated to implement the other, more student-centred one due to student-based factors, classroom facilities, teacher-based competencies, etc. **Joe**: No, I disagree with you. **E**: So now you think differently? **Joe**: Partially. I think it is all about our beliefs about instruction, as we read from the article you provided. I have checked my beliefs about teaching as a prospective classroom teacher. Furthermore, I am of the idea that I will be delivering the content directly to my students. But, if my self-efficacy is higher for student-centred teaching strategies, I will be coping with the barriers Ethan mentioned. It is very dangerous to conclude quickly.
Checking: The educator prompts students to control their or others' knowledge bases, mental models, or cognitive schemes, or "aha" moments, "aha" experiences, or online cognitive processing.	**E**: Can you explain the situation? Or does your contradiction continue? **George**: It does. For example, consider cotton and iron. Both are one kilogram. They do not hit the floor simultaneously if we drop them at the same height. **E**: First, the contradiction (writes on the board). Are we in agreement about this? Is there anyone who disagrees? What kind of contradiction is this contradiction? **Lauren**: It contradicts what we say, what we know. **E**: Then? So, we have our concepts; however, alternative explanation systems may contradict them. For example, a conceptual contradiction. Deal? Should we continue from here? **William**: The process continues by criticising. **E**: So, you met with it (draws a representative shape on the board for the "contradiction"). What do you have to do with it? You have to solve it. Otherwise, you cannot get the knowledge. Your friend, for instance, started to solve it. He is doing something, but what is he doing? **William**: He is proposing new ideas. **E**: It is the reasoning. What else is he doing? **Harry**: He does compare different opinions. **E**: What else is he doing? **Thomas**: He is interrogating his ideas. **E**: George! What else are you doing? We are talking about you! (Are you aware?). What is on your mind right now? **Ava**: He is actually questioning, exploring, and being disturbed but not changing his ideas right now.

moves to rephrase the response in alternate forms, such as an expanded or modified version. This metatalk manoeuvre prompted the students to contrast two semantically distinct expressions. As depicted in Table 5, a participating teacher educator initially delved into the distinctions between the processes of thinking and verbalising when constructing a concept. Subsequently, upon receiving Bethany's response, the teacher educator amended the phrasing to underscore that articulating a thought does not necessarily guarantee its

Table 5. MTMs for *sustaining apparent and elicited oral communication.*

Code/Description	Example utterances
Revoice: Educator signals another way to help students interpret information or introduce straightforward ways of externalising their ideas.	**E**: Let me give you an example. Can everyone memorise a poem written in French in a certain amount of time? **Jessica**: Of course, we can memorise. **E**: What does that mean? What does memorisation mean? **Bethany**: We can't memorise their meanings. We can only memorise how the words are said. Pronounced. **E**: Does that mean I speak like French, but I can't think like French. Memorising and saying words do not mean knowing or learning or thinking. **Daniel**: Then this is an act without thinking. However, learning is a result of thinking. So then, we can say that there is no learning in this example.
Embodying: The educator requests students to provide personal experiences/observations regarding an instructional phenomenon, case, or event.	**Damian**: Learning needs to take something (implies information) from the outside and internalise by assimilating the information. **E**: Can you explain this a little bit? **Damian**: So, we make sense of the information we receive from outside or make sense of all our observations. Furthermore, as a result, learning occurs, which we call the educational process. **E**: Do you have a clear example for your thoughts? For instance, do you have an observation showing that one receives information from a source and internalises it?

comprehension. Notably, lexical and semantic variations existed between Bethany's (more observation-centric) and the teacher educator's (leaning towards pedagogical emphasis) statements. Consequently, Bethany and her peers were tasked with comparing these distinct renditions and grasping the additional meaning conveyed through the teacher educator's verbal reformulation.

The educators ($n = 5$) also prompted students to furnish pertinent examples that would lend concreteness to their concepts. They guided students to bolster their arguments through illustrative applications. As illustrated in the dialogue presented in Table 5, Damian posited that learning primarily involves assimilating external knowledge and internalising it for personalised purposes. The teacher educator then prodded Damian to furnish a tangible example substantiating his standpoint. Consequently, Damian was required to engage in a metacognitive process involving a comparative evaluation of his ideas to select contextually suitable instances and strengthen his assertions. This cognitive endeavour embraced metacognitive dimensions as Damian needed to discern apt examples from inadequate ones, thus rendering his arguments more crystalline.

MTMs for transferring understanding

Nine participating teacher educators prompted students to translate their conceptual comprehension from discussions into unfamiliar instructional contexts, whether internal or external. This approach required students to formulate generalisations incorporating the ideas arising from their negotiation of teaching strategies. Within this group, three educators urged students to apply the concepts they had been working on to comprehend a real-

time in-class (internal) pedagogical scenario, employing what we can term the internal situation move. As illustrated in Table 6, the group recognised the potential existence of divergent understandings among class members for a given concept. Alma highlighted the challenge teachers might face in addressing these differing preconceptions about knowledge concepts. Alfred concurred with Alma, suggesting that these distinct perceptions could be framed as alternative conceptions. Subsequently, the teacher educator encouraged the students to extend this idea by depicting potential instructional scenarios within a classroom context or by analysing the educator's current teaching case.

The students were challenged to apply the content of their in-class discussions in an external context by utilising external situation moves (employed by 6 out of 9 participating teacher educators). Illustrated in Table 6, a participating teacher educator inquired about potential barriers hindering Wendy's significant learning. In response, Ashley identified Wendy's struggle to discern relevant and irrelevant points. The teacher educator then prompted the students to draw upon their prior in-class experiences to analyse Wendy's case, particularly her memorisation approach. Thus, the students transitioned from the immediate classroom context to their previous schooling

Table 6. MTMs for *transferring understanding*.

Code/Description	Example utterances
Internal situation: The educator prompts students to use newly acquired knowledge to address a pedagogical problem, case, or situation.	**E**: Now, what will be the teacher's most severe problem here? **Alma**: Definition of knowledge. **E**: What will the teacher teach the children now? **Alfred**: What knowledge is and how it is produced. **E**: But? **Alfred**: We have alternative concepts, and you may have them too. **E**: So, there are numerous definitions of knowledge, as you said. What will the teacher do with them? How to start or … Is this a problem? (differentiating "knowledge" definitions of the "prospective teachers") Is it a good thing? Is this an advantage for me ("for the teacher educator")?
External situation: The educator provides examples or representations of additional cases, ideas, actions, and propositions to guide students to handle the situation more generically and broadly.	**E**: Why do you think Wendy's learning was a problem? **Ashley**: Wendy does not filter external data through its cognitive filter. **E**: I will say a sentence that all of you will remember quickly. "The teacher asked the question in this way, not that way. However, we could do it if he asked the question 'another' way". Does anyone remember this sentence? What would be your pedagogical comment to explain this sentence?
Projection: The educator directs students to estimate the cause(s) of instructional cases, events, and consequences.	**E**: Why would a student be active in learning a topic? I have never seen any organisms begin to learn by myself or automatically. For example, what if I did the atmosphere of this lesson would be different? **Bacon**: You must make us like this lesson. **E**: I am dividing the class from there into two. The students on this side decided not to learn, and this side decided to learn. Why did these students decide to learn, and those on this side decide not to learn? **Bacon**: First, attention is required. For example… Even if you do countless experiments, sometimes you cannot get an invention quickly. You must do millions of experiments. If there is no desire in the scientist, it is meaningless if there is no interest and relevance to the experiment.

experiences (external situation) to contextualise Wendy's predicament. This required the students to engage in a cognitive back-and-forth, comparing Wendy's scenario with their educational experiences to shed light on her challenges.

As depicted in Table 6, a teacher educator prompted the students to engage in probabilistic reasoning within the context of transferring understanding. The task at hand was to identify instructional factors that could potentially enhance the quality of the lesson process. This required the students to conduct a triadic comparison encompassing three elements: the teacher educator's instructional approach, the theoretical foundations governing the quality of a lesson's process, and the students' proposals to improve the educator's instructional methodology. After receiving Bacon's brief response, the teacher educator expounded on their request, urging projection by introducing a hypothetical scenario involving two distinct classroom segments-one prepared to grasp the subject matter and the other unprepared. This compelled Bacon and other students to estimate outcomes for both segments, fostering an understanding of their decisions concerning learning and unlearning.

MTMs for experiencing

Two participating teacher educators motivated the students to grasp the underlying atmosphere of classroom interactions, encompassing emotions and viewpoints upheld by both educators and other participants. By employing the "affect move", these teacher educators encouraged the students to apprehend the emotional and contextual backdrop of the classroom conversations. For instance, one teacher educator subtly conveyed the notion (the ethos of mutual respect) that all individuals should feel empowered to express their opinions, irrespective of their immediate relevance or progression within the classroom discourse context ("I just want to hear your voice".). This served as a reminder that the discourse environment should be one of comfort and adaptability, as evidenced in Table 7.

Table 7. MTMs for *experiencing*.

Code/Description	Example utterances
Affect: The educator invites students to experience the atmosphere of the situation they are engaged in.	**E**: In the meantime, I asked many questions. Be very comfortable. You can say whatever you want to say or contribute as you wish. We are not looking for the proper responses. I just want to hear your voice!
Obstacle: The educator defines which aspect of the specific content is most tricky to imagine, perceive or comprehend.	**E**: Now, it cannot be easy to understand or accept this at first. Suppose you are a teacher; you have always asked open-ended questions requiring comments from your students. Is this good? It is intuitively reasonable. But when you look at the data, you may see that it is not. If you load the students with too much cognitive load, the lesson may not continue. Therefore, we may ask first closed-ended questions that are not open to interpretation and require lower cognitive demands, and then open-ended questions that require more cognitive efforts on the side of the students. This balances the cognitive load, but it can be compelling to accept this idea rapidly. Perhaps you will have to experience this to accept.

Through the utilisation of obstacle moves, one of the participating teacher educators aimed to foster in the students a metacognitive understanding that they could encounter challenges in acknowledging that open-ended questions might not always be effective in maintaining productive classroom dialogues. As an illustration, this teacher educator presented a counter-intuitive statement regarding the instructional efficacy of open-ended questions. She conveyed the meta-message that the students might not readily grasp this research-based concept. In response to this prompt, the students would discern the metacognitive essence of comprehending the genuine role of teacher questions, necessitating the amalgamation of theoretical perspectives (such as cognitive load theory) with the practical implementation of questioning strategies.

MTMs for legitimating and justifying thinking and reasoning

The teacher educators ($n = 19$) prompted the students to critically analyse and evaluate their peers' thinking while justifying their reasoning. This was achieved by encouraging the students to substantiate their ideas related to instructional approaches (as shown in Table 8). Three sub-types of prompts emerged to motivate the students to validate their rationale. Firstly, the students were urged to assess the ideas put forth by their classmates, educators, or presented cases. Illustrated in Table 8, a participating teacher educator persuaded the students that a fundamental aspect of effective teaching involves practically integrating subject matter knowledge, pedagogical knowledge, and teaching strategies. The teacher educator initiated the discussion with a thought-provoking question highlighting discrepancies in their university education. Berry expressed a negative perspective on the education she had received. Subsequently, the teacher educator encouraged Berry to deliberate on whether her educational efforts were futile. Berry justified her standpoint by asserting that acquired knowledge serves its purpose when needed. The teacher educator then invited Berry's peers to evaluate her assertion.

Berry's peers were tasked with comprehending the implication of Berry's viewpoint and subjecting her idea to critical analysis. Amanda then contributed to the discussion by asserting that individuals learn by discerning essential information from less significant details. This prompted the students to evaluate a teaching scenario: teaching adjectives with a deep understanding of the subject matter versus teaching adjectives with solid pedagogical expertise. The students were required to pass judgement based on predetermined criteria and established standards. Notably, Wendy and Amanda held differing opinions on this matter. Amanda emphasised the significance of effective teaching techniques alongside subject knowledge. The ensuing dialogue between the teacher educator and Wendy underscored that Wendy possessed a surface-level understanding of the adjective concept despite prior instruction. Ultimately, the teacher educator prompted the students to assess Wendy's learning experience, highlighting her limited grasp of the adjective concept. However, as indicated by the teacher educator, their teachers had exerted efforts to teach the concept effectively. This prompted the students to scrutinise Wendy's educational journey, identifying incongruities or flaws in the process or outcome (such as Wendy's superficial learning) and evaluating the efficacy of the instructional approach employed in Wendy's previous schooling.

Table 8. MTMs for *legitimating and justifying thinking and reasoning.*

Code/Description	Example utterances
Evaluation (type-1): Educator guides students to analyse, evaluate, judge, or critique the educator's utterances, instructional orientations, and pedagogical actions.	**E**: What percentage of what you learned here, for example, about literature, will you use? Or what percentage will you use when you go to school as a teacher? **Berry**: We will be using a very small part of it. **E**: Very few of them. Are these processes wasted then? What is it, can you tell me a little bit?
Evaluation (type-2): The educator asks students to evaluate, judge, or critique their own or classmates' ideas.	**Berry**: Actually, we do remember when needed. **E**: Do we remember when we need the learned knowledge in the case of needing it as she had proposed?
Evaluation (type-3): Educator promotes students to analyse, evaluate and interpret a given or emerging instructional case, event, discursive exchange/interaction, conclusion, statement, generalisation, or point of view.	**Amanda**: We can see some information as unnecessary. It is … It stays in sensory memory. However, a poem that we like very much or touches us so much seems imprinted in our long-term memory. Thus, there is pruning. **E**: Does everybody here know what the adjective is? Do you remember how you learned the adjective? **All students**: Yes, we know. **E**: Then I would like to ask this question: who teaches the adjectives well: one who holds a considerable amount of subject matter knowledge or has a substantial amount of teaching knowledge to instruct the subject matter knowledge? **Wendy**: Of course, one holds considerable subject matter knowledge. **Amanda**: But what about teaching then? **E**: Do you remember how you learned the adjective? Or how you were taught? **Wendy**: The teacher taught us by writing and practising on the board. **E**: For example, what did the teacher do? **Wendy**: He wrote the adjective definition, listed a few examples on the blackboard, and solved the adjective questions at home. **E**: Can you tell me something about the adjective if I ask about it now? **Wendy**: I can give a general definition. However, I cannot figure it out. **E**: Well, hasn't Wendy learned the subject? Because she took time to learn. Her teacher also spent time teaching adjectives. What is the matter here?
Epistemological commitments	The educator guides students to conceive how science knowledge is constructed and socially validated.	**E**: What else? By the way, does the rest of the class agree with these ideas? Of course, everyone in this classroom should say his/her idea, but it could be great if you support it, right? … **E**: So, what is this thing we have observed now? Let us evaluate it. Or am I going to believe what I see right here or believe what is in the books?

Two participating teacher educators prompted the students to engage in an operation rooted in epistemology, aiming to develop internally convincing assertions via moves that encouraged epistemological commitment. For example (as seen in Table 8), one teacher educator directed the students to articulate their foundational understanding, emphasising the value of substantiating their statements. Subsequently, the students were tasked with revisiting their assertions, ensuring they could withstand potential challenges or counterarguments from the community. The teacher educator guided the students towards conducting an epistemological assessment when faced with conflicting observations (refer to Table 8). Ultimately, the students were required to compare two distinct systems of explanation and arrive at an epistemological judgement regarding the credibility and dependability of their knowledge claims.

Discussion

The findings of this study underscore the importance of employing a multi-faceted approach for metacognitive guidance through verbal communication in higher education. The research reveals that the dynamics of talk-based meta-guidance are instrumental in fostering a comprehensive and nuanced learning environment within the higher education context. The term "multi-faceted" implies diverse strategies, indicating that successful metacognitive guidance goes beyond a singular or linear approach. By exploring varied talk-based methods, this study sheds light on the intricate nature of facilitating effective metacognition in higher education settings.

Framing the classroom happenings

Firstly, the retrospective moves seemed to encourage the teacher educators to guide the students in revisiting and recalling earlier elements such as conversations, demonstrations, discussion points, pedagogical moves, cases, cognitive processes, or concepts (Soysal, 2021; Tobias & Everson, 2009). This retrospective reflection seemed to reinforce learning by drawing on the past educational experiences of the students during discussions. Simultaneously, the on-moment moves required the participants to actively highlight and address emerging discussion points, actions, ideas, cognitive processes, or work procedures in real time. These moves were crucial for sustaining student-led online awareness, ensuring they remained engaged and responsive to unfolding educational content (Soysal, 2021; Tang, 2017, 2021). Furthermore, the participants employed focusing moves to signal the importance of specific ideas, responses, points of view, propositions, or cases. By directing the students' attention to key elements, these moves fostered the concentration of the students on critical aspects while arguing about how to teach concepts. Lastly, the purpose moves involved the participatory teacher educators inviting the students to comment on the ultimate goals of all discussions, talks, demonstrations, negotiations, and the actions taken by the educator. This encouraged the students to reflect on broader objectives and instructional outcomes, promoting a deeper understanding of the purpose behind various educational activities. Together, these strategies seemed to contribute to a comprehensive and well-guided talk-based educational experience for the students, incorporating reflection, real-time engagement, focused attention, and a clear understanding of overarching goals (Dökmecioğlu, Tas, & Yerdelen, 2022; Efklides, 2008).

Wrapping up the classroom conversations

In metacognitive talk within classroom discussions, the teacher educator adopted a systematic and intentional approach to foster a dynamic learning environment. The metacognitive moves employed under this category were strategic tools to enhance students' cognitive processes and self-awareness. The use of summarising as a metacognitive move (e.g. Soysal, 2021; Tang, 2017, 2021) aimed at pooling and distilling the key points emerging from the diverse opinions of the students. This aided in synthesising information and prompted the students to think critically about

the various perspectives presented. By summarising, the teacher educator encouraged the students to extract the essential elements of the discussion, promoting metacognitive awareness of the discourse's core concepts.

Similarly, the selecting-eliminating move contributed to metacognitive regulation (Thomas, Wulff, Landinez, & Bulevich, 2022) by featuring contextually relevant ideas that guide the trajectory of classroom discourse. The teacher educator facilitated a focused and purposeful discussion by emphasising specific ideas over others. This metacognitive strategy might encourage the students to evaluate the significance of their contributions, fostering a sense of cognitive control and regulation within the learning process (Akyol & Garrison, 2011; Rivas, Saiz, & Ossa, 2022; Zohar & Ben-Ari, 2022). Labelling, as an observed metacognitive move, prompted the students to create labels that encapsulated their thoughts, proposals, propositions, generalisations, and explications. This labelling process encouraged them to articulate and categorise their ideas, contributing to metacognitive knowledge development (Mason, Boldrin, & Ariasi, 2010; Soysal, 2021; Tobias & Everson, 2009). It might enable the students to organise and structure their thoughts consciously, fostering a deeper understanding of their cognitive processes (Thomas, Wulff, Landinez, & Bulevich, 2022). The concluding moves in metacognitive talk served as a capstone, urging the students to draw generic conclusions by considering the premises that emerged during the conversations. This might encourage a metacognitive reflection on the overarching themes and insights derived from the discussion (Akyol & Garrison, 2011; Carvalho & Santos, 2022; Cattaneo & Motta, 2021, 2021). The students were prompted to connect the dots, identify patterns, and engage in higher-order thinking, promoting metacognitive thinking and regulation (Biasutti & Frate, 2018; Hervas & Medina, 2022; Rapchak, 2018). These metacognitive in-class talk moves collectively created a structured and purposeful discussion environment in higher education classrooms. They seemed to empower the students to actively participate in shaping the trajectory of the conversation but also to engage in metacognitive thinking, reflection, and regulation throughout the discourse.

Consistent and contingent thinking

The teacher educators employed a strategic approach to foster rigorous and intellectually stimulating discussions. The use of logical consistency moves represented a metacognitive strategy aimed at promoting critical thinking among students. By reminding them of the potential for conflicting claims and urging compatibility in reasoning, the teacher educator prompted students to engage in metacognitive processes to evaluate the coherence of their own and their peers' ideas (Alt & Raichel, 2020; Carvalho & Santos, 2022). The logical consistency moves also involved the teacher educators in pinpointing counterarguments, contradictions, and logical flaws in students' claims. This metacognitive intervention might encourage the students to reflect on the robustness of their arguments, promoting self-awareness and analytical thinking (Hervas & Medina, 2022; Jeong & Hmelo-Silver, 2016). By addressing potential weaknesses in reasoning, the students might be prompted to refine and strengthen their cognitive processes.

Moreover, the metacognitive move to ensure coherence prompted the students to clarify the connections between proposed ideas and the broader context of classroom

discussions. This might contribute to the development of metacognitive knowledge (Thomas, Wulff, Landinez, & Bulevich, 2022) and aid in regulating cognitive processes. The students were encouraged to explicitly articulate the relationships between concepts, enhancing their ability to organise and structure their thoughts. The consensus moves were employed to foster collaborative understanding, encouraging the students to assess whether conceptual or procedural agreements were reached during the discussion. This metacognitive strategy might promote a shared understanding and collective regulation of cognitive processes, defined in the current literature as joint metacognitive activity (Biasutti & Frate, 2018; Hervas & Medina, 2022; Rapchak, 2018). By engaging in consensus-building activities, the students actively participated in metacognitive reflection (Cattaneo & Motta, 2021) on the evolution of ideas and the achievement of common ground. These metacognitive moves collectively shape a dynamic and intellectually stimulating classroom atmosphere. Through these moves, the students were prompted to engage in thoughtful, coherent, and collaborative discussions and encouraged to participate in a culture of rigorous intellectual inquiry.

Monitoring cognition

The teacher educators enacted strategic moves that focused on fostering the students' metacognitive development and self-awareness. The use of the mind change moves represented a deliberate metacognitive strategy that prompted the students to engage in reflective processes labelled in the previous studies as the evolution of their ideas over time (Akyol & Garrison, 2011; Cattaneo & Motta, 2021). By urging the students to compare and contrast their past and current ideas or concepts, the teacher educators encouraged metacognitive thinking related to cognitive flexibility, adaptability, and the recognition of intellectual growth as the leading indicators of metadiscourse (Soysal, 2021; Tang, 2017, 2021). Simultaneously, the checking moves deployed by the teacher educators involved prompting the students to monitor and evaluate various aspects of their cognitive processes actively. This included knowledge bases, mental models, cognitive schemes, and moments of insight. By fostering awareness and reflective engagement in online cognitive processing, these moves contributed to metacognitive regulation as a core representation of metadiscourse in higher education classrooms (Thomas, Wulff, Landinez, & Bulevich, 2022). The students were encouraged to assess the effectiveness of their cognitive strategies, identify areas for improvement, and refine their approaches to learning.

In summary, these purposeful metacognitive moves collectively created an environment that encouraged the students to actively reflect on the evolution of their ideas and cultivated a deeper understanding of their cognitive processes. The deliberate integration of mind changes and checking moves contributed to the students' metacognitive development by promoting reflective practices, adaptability in thinking, and an enhanced awareness of their cognitive strategies. This metacognitive focus might enrich the learning experience, empowering the students to become more self-regulated learners with a heightened awareness of their cognitive processes.

Sustaining apparent and elicited oral communication

The teacher educators operated specific moves to enhance the students' understanding and expression of concepts. The revoicing moves, for instance, served as a metacognitive strategy to guide the students in interpreting information in alternative ways (Tang, 2017, 2021). By indicating different perspectives, the teacher educators encouraged cognitive flexibility, prompting the students to consider various viewpoints on the subject matter. This move seemed to foster metacognitive thinking (Akcaoğlu, Mor, & Külekçi, 2023; Zohar & Ben-Ari, 2022) by urging the students to reflect on the multiple facets of information. Simultaneously, the embodying moves prompted the students to draw from personal experiences or observations related to instructional phenomena, cases, or events. This metacognitive strategy added a layer of experiential learning to the discourse, allowing students to connect theoretical concepts with real-world situations (Soysal, 2021). The teacher educators' encouragement of sharing personal experiences contributed to metacognitive knowledge (Mason, Boldrin, & Ariasi, 2010) as the students reflected on how their experiences shaped their understanding. Collectively, these strategic moves contributed to a more nuanced and diverse exploration of concepts within the observed lessons. By encouraging the students to consider alternative interpretations and share personal experiences, the teacher educators cultivated a learning environment that valued varied perspectives. This approach enriched the overall comprehension of the subject matter and promoted metacognitive awareness (De Backer, Van Keer, & Valcke, 2022; Efklides, 2006). The students became more cognisant of the diverse ways information can be interpreted and the impact of personal experiences on their understanding.

Transferring understanding

It was observed that the teacher educators deployed a comprehensive set of moves to address instructional challenges. The internal situation move represented a metacognitive strategy that prompted the students to actively apply their newly acquired knowledge. By encouraging the students to utilise theoretical understanding in practical pedagogical scenarios, this move might be related to fostering metacognitive regulation contended in earlier studies (Biasutti & Frate, 2018;). The students were prompted to reflect on how theoretical concepts can be translated into real-world applications, enhancing their ability to navigate complex instructional challenges. Simultaneously, the external situation move broadened the scope by involving the teacher educators in providing examples and representations of additional cases, ideas, actions, and propositions. This move aimed to guide the students in approaching instructional situations more generically and broadly. It is well known that this move may encourage a metacognitive perspective (Rapchak, 2018) that transcends specific instances, promoting a holistic understanding of underlying principles. By engaging in this multi-faceted approach, the students might develop a metacognitive toolkit that extends beyond immediate contexts, enabling them to adapt their knowledge to various instructional scenarios (Hervas & Medina, 2022). The projection move enhanced the students' metacognitive capabilities by directing them to estimate the potential causes of instructional cases, events, and consequences. This forward-thinking approach might

encourage the students to anticipate challenges and consequences, promoting a proactive or metacognitively driven stance towards problem-solving (Zohar & Ben-Ari, 2022). These moves were enacted to navigate the pedagogical challenges aligned with the overarching goal of metacognitive talk – to empower the students with the skills and awareness needed to engage thoughtfully and effectively in the educational process.

Experiencing

With the experiential moves, the teacher educators strategically incorporated effective moves, inviting the students to immerse themselves emotionally in the learning environment. This metacognitive strategy went beyond the cognitive aspects of education, recognising the importance of emotional engagement in the learning process (De Backer, Van Keer, & Valcke, 2022; Efklides, 2006). The affective moves contributed to a rich and emotionally resonant learning environment by encouraging the students to connect with the situation's atmosphere. This emotional connection was vital for fostering a deeper and more meaningful understanding of the subject matter. Simultaneously, the teacher educators employed obstacle moves, identifying and articulating aspects of the specific content that might pose challenges regarding imagination, perception, or comprehension. These moves served as a metacognitive tool, providing students with a roadmap for recognising and addressing cognitive obstacles (Zohar & Ben-Ari, 2022). By acknowledging the potential challenges, the teacher educators promoted a reflective approach to learning (Akyol & Garrison, 2011; Cattaneo & Motta, 2021), empowering the students to navigate difficulties thoughtfully. Collectively, these metacognitive moves contributed to a more comprehensive and nuanced approach to learning. The affective moves created an environment where emotional engagement enhanced intellectual exploration, making the learning experience more holistic.

On the other hand, obstacle moves guided the students in overcoming cognitive challenges, promoting metacognitive regulation and reflection. The teacher educators' use of affective and obstacle moves in metacognitive talk created a learning space where the students were intellectually challenged and emotionally invested in their educational journey. This dual emphasis on emotional connection and cognitive obstacle recognition aligned with metacognitive principles (De Backer, Van Keer, & Valcke, 2022; Efklides, 2006), fostering a holistic and reflective approach to the learning process.

Legitimating and justifying thinking and reasoning

It was found that the educator educators displayed a variety of evaluation moves strategically aimed at cultivating and shaping students' epistemological commitments. These diverse evaluation moves served as metacognitive tools, guiding students to develop a deeper understanding of knowledge and knowledge acquisition. Type-1 evaluation involves the teacher educators guiding the students to critically analyse, evaluate, judge, or critique the educator's opinions, instructional orientations, and pedagogical actions (Akyol & Garrison, 2011; Cattaneo & Motta, 2021). This move prompted them to question and reflect on the authority and

validity of the presented information (Zohar & Ben-Ari, 2022) by encouraging the students to assess the teacher educators' propositions critically; type-2 evaluation took a more introspective approach, with the teacher educators prompting the students to evaluate, judge, or critique their or their classmates' ideas. This metacognitive move encouraged the students to take ownership of their thoughts and engage in self-reflection (Alt & Raichel, 2020), fostering a sense of responsibility for the quality and coherence of their contributions to the discussion. Type-3 evaluation widened the scope, urging the students to analyse, evaluate, and interpret various instructional elements, such as cases, events, discursive exchanges, conclusions, statements, generalisations, or points of view. This move extended beyond the individual ideas, prompting the students to engage critically with diverse aspects of the instructional content. It encouraged them to assess the validity, relevance, and interpretative nuances within the broader context of their learning (Carvalho & Santos, 2022). These moves collectively shaped the students' epistemological commitments – their beliefs and understanding of nature and acquisition of knowledge (Soysal, 2021). By engaging in critical evaluation at multiple levels, the students enhanced their analytical skills and developed a more nuanced and sophisticated approach to learning. This metacognitive talk might foster a culture of inquiry and reflection, essential to cultivating robust epistemological commitments among the students.

Limitations of the study

Despite its contributions, the study does have limitations that merit further investigation. Primarily, it is a descriptive study that identifies and exemplifies qualitatively different MTMs. However, it proposes that enhancing teacher educators' conscious awareness of talk-based initiations for triggering metacognitive thinking is not an automated or random process. Consequently, the research lacks intervention-focused findings. Additionally, the study solely examines teacher educators' MTMs, yet fostering reflective judgement practices through metacognitive thinking in higher education remains essential. Thus, whether the study's coding catalogues apply to other faculty members' instructional approaches is unclear. This highlights the potential domain-specific and domain-general nature of metacognitive prompts within talk-based approaches. Therefore, future research should consider the domain-specific nature of these prompts. Lastly, the presence of metatalk moves by teacher educators may not always result in students engaging in metacognitive activities. This discrepancy may stem from group dynamics, requiring further research exploration.

Conclusions and educational recommendations

The study's conclusion highlights how teacher educators can utilise talk moves to stimulate diverse forms of metacognitive thinking among students. Specifically, the research shows that educators can employ talk moves to guide, monitor, control, evaluate, experience, orient, and regulate students' cognition and learning. The study introduces a data-based coding catalogue that facilitates the analysis of educators' metacognitive moves, essential tools in university-level teaching.

Importantly, this research follows a naturalistic inquiry approach, avoiding external interventions to improve teacher educators' talk moves to enhance students' metacognitive thinking. Additionally, teacher educators often lack awareness of their metacognitive moves and their significance in effective teaching. The study hypothesises that teacher educators are not naturally inclined to consciously monitor and recognise their talk strategies that facilitate students' metacognitive thinking.

Hence, it becomes crucial to foster deliberate pedagogical noticing, as discussed by Soysal and Radmard (2020), to comprehend the interplay between metacognitive thinking and talk moves. To this end, the study poses a specific question: "Do you (the teacher educators) see what I (the researcher of this study) see?" This inquiry underscores the necessity of assisting teacher educators in comprehending the nature and structure of their metacognitive talk moves.

It is noteworthy that the observed typologies of the MTMs had already occurred in the educators' classrooms before this study. However, the extent to which educators consciously or randomly employed these moves to foster students' metacognitive thinking remains unexplored. The study suggests intentional, pedagogically oriented conscious awareness is crucial in using MTMs effectively. This research indicates that developing pedagogically oriented noticing regarding the impact of metacognitive talk necessitates reflective consideration of classroom conversations, as demonstrated in this study. Such awareness can be cultivated through professional development programmes, allowing educators to attribute their discursive potential to in-class teaching practices, thus promoting and sustaining metacognitive thinking.

This process requires being a reflective practitioner (Schon, 1983, 1987) who engages in deep introspection of classroom dialogues to determine the ability to deploy timely and contextually appropriate talk moves to uphold metacognitive thinking. Thus, this study can be a prototype for future exploration among teacher educators. The teaching community can use the developed investigative tool as a guide to monitor, analyse, and comprehend their ability to foster continuous metacognitive thinking in their practices.

Disclosure statement

No potential conflict of interest was reported by the authors.

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