

The way Technology Teachers Think: The Role of Metaphor and Reflection for Technology Education practice

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Abstract

This study investigates how technology teachers reflect on their practice by examining the metaphorical structures that underpin their reasoning. Drawing on Conceptual Metaphor Theory and supported by an AI-assisted Metaphor Identification Procedure (MIP), the analysis focuses on recurring metaphorical themes that shape how teachers make sense of challenges, plan instruction, and imagine future classroom scenarios. The results reveal a set of interrelated themes – such as time as a resource, learning as motion, teaching as burden, and structure as cohesion – that reflect and reinforce a view of teaching as a managed and goal-oriented activity. These metaphors are not merely descriptive devices; they function as cognitive tools that organise experience and support pedagogical decision-making. By framing teaching through metaphors of motion, containment, construction, and effort, teachers can navigate complex classroom dynamics and articulate a coherent sense of professional agency. The findings suggest that metaphor plays a dual role in reflection: both representing experience and guiding prospective reasoning. In this sense, metaphors support what is often described as reflection-for-action, where familiar conceptual frames are used to simulate possible futures. By surfacing these metaphorical patterns, the study contributes to a deeper understanding of how teachers conceptualise their work and offers a foundation for professional dialogue and development in technology education.

Keywords

Conceptual metaphor theory, Metaphorical thinking, Teachers' reflection, Technology education

Introduction

Research into the metaphorical nature of teachers' reflections has become a well-established approach to understanding how language influences the way teachers perceive their curricula (Worden-Chambers, 2020), professional identity (Authors-a; Martínez-de-la-Hidalga & Villardón-Gallego, 2017; Thomas & Beauchamp, 2011), and their underlying pedagogical beliefs (Alger, 2009; Authors-c; Martínez et al., 2001). For example, Alger (2009) found that teachers often revise their metaphors for teaching throughout their careers, reflecting changes in their professional experiences and educational settings. Similarly, Russell and Johnston (1988) identified patterns of conceptual re-framing as teachers respond to classroom challenges and organisational demands. Even short-term interventions, such as teacher education courses, can influence metaphor use, shifting language from general clichés to more process-oriented reasoning (Kartal, 2020). Therefore, to explore these dynamics in greater depth, it is essential to uncover the underlying frameworks that shape teachers' perceptions of their practice – that is, the teachers' use of conceptual metaphor (Larsson, 2023).

Reflection – understood here as the mental processes involved in solving problems or understanding complex situations before (reflection-for-action), during (reflection-in-action), and after (reflection-on-action) teaching – has long been recognised as a valuable resource for understanding and improving professional practice (e.g., Clarke & Hollingsworth, 2002; Henze & Barendsen, 2019; Larsson & Stolpe, 2024; Schön, 2017). Reflection, however, is not a neutral or purely rational process. Instead, it can be understood as a tool through which teachers access, interpret, and reconfigure different forms of professional knowledge. When teachers describe teaching as “building¹ a foundation” or “navigating obstacles,” they are not merely using figurative language; they are engaging in a form of knowledge organisation, drawing on prior experiences, relating them to disciplinary norms, and imagining future classroom actions (see, e.g., Gibbs, 2006b; Grady, 1997). Nevertheless, little is known about how these reflective processes operate across time—before, during, and after teaching—or how they function in the specific context of technology education.

There are several reasons why technology education offers a particularly compelling context for examining the metaphoric nature of teachers’ reflection. Firstly, it evolves swiftly as new digital tools and pedagogical methods are introduced, demanding that teachers continually update their professional knowledge and skills. At the same time, those teaching programming and technology often come from highly diverse educational and professional backgrounds (Larsson & Stolpe, 2024; Reinsfield & Lee, 2021). Furthermore, technology education is characterised by fuzzy disciplinary boundaries, as it draws on knowledge from fields as varied as engineering, computer science, and the social sciences, without a single, well-defined disciplinary core. This combination of rapid technological change, diverse teacher profiles, and ambiguous disciplinary borders makes reflection on one’s practice—and an understanding of the metaphors shaping this reflection—significant. Therefore, this study aims to explore the cognitive structures that influence how technology teachers reflect on their practice. The following research questions have guided this investigation:

In what ways are conceptual metaphors associated with teachers’ experiences of teaching compulsory technology education?

In what ways do these metaphors shape shared or collective understandings of technology education?

Theoretical framework

The present study uses Conceptual Metaphor Theory (CMT) as described by Lakoff and Johnson (1980). Cognitive metaphor theory (CMT) proposes that knowledge originates from mappings between sensorimotor experiences in the real world and abstract concepts, which are then expressed through metaphorical language (Gibbs, 2006a, 2006b; Grady & Johnson, 1997; Lakoff & Johnson, 1999). Furthermore, CMT contends that some features of a conceptual metaphor are emphasised while others are de-emphasised - known as selective mapping. This results in what Koller (2020) describes as a “highlighting and hiding” in discourse, which affects perceptions of what is relevant, problematic, or possible in their teaching practice (Larsson,

¹ Metaphoric expressions will henceforth be noted using underlined font.

2022). Empirical research indicates that conceptual metaphors reflect fundamental aspects of professional knowledge and beliefs (e.g., Alarcón et al., 2019; McGarr, 2022; Munby, 1987).

One powerful role of conceptual metaphors is to develop a broader narrative (Falck & Okonski, 2022). A metaphorical scene involves actors, motivations, and actions taking place on a stage with backdrops and props. Depending on how the stage is arranged, some roles and actions are more likely to be performed than others. For example, when teachers view the classroom as a “garden” or a “battleground,” scenes are triggered that direct their attention, influence their interpretation, and shape their instructional choices based on their personal beliefs (see Koller, 2020). By supporting the flow of pedagogical knowledge, conceptual metaphors affect both the content and form of teacher reflection, helping teachers to understand ongoing situations, envision future practice, and articulate professional judgment (Larsson & Stolpe, 2024).

Methodology

Data collection

The study used data from semi-structured interviews (N = 10) with Swedish practising technology teachers, focusing on participants’ material preconditions for teaching technology education. All teachers were licensed to teach grades 4-6 (n = 6) and 7-9 (n = 4). Each interview lasted between 30 and 45 minutes. The interviews were conducted during and transcribed in real-time using Microsoft Teams (Nov-Dec 2023). The transcripts were then manually compiled into a single .txt file, resulting in a dataset of 29,134 words. No personal or contextual metadata was included in the analysed dataset. As a result, specific excerpts or coded units cannot be traced back to individual informants or interview sessions, ensuring the informants’ complete anonymity. Before the interviews, all informants received detailed information about the study’s purpose, including assurances of complete anonymity. They were also informed—in writing and verbally—about the study’s objectives, potential risks of participation, procedures for withdrawing, and data management, to which they all provided oral informed consent. Consequently, the study complies with the ethical guidelines outlined in *Good Research Practice* by the Swedish Research Council (2024).

Inspired by the PCK map approach, a theory-informed interview guide emphasising (1) the teacher’s educational background and vocational experiences, (2) the material and organisational preconditions for teachers’ practice (the learning environment), and (3) their planning, teaching, assessment, and reflection practices was developed to reflect the Refined Consensus model of PCK (RCM) (Carlson et al., 2019).

Analytical framework

The study’s analysis is based on the idea that “metaphors can be described by their position in a hierarchy according to the level of abstractness at which they are classified” (Charteris-Black, 2004, p. 244). Recognising such hierarchies can help in understanding why certain metaphors are used in specific discourses and their role in shaping, for example, pedagogic ideology and practice (Larsson & Stolpe, 2024; Charteris-Black, 2004; Koller, 2020). Therefore, the analysis will offer insights not only into what the informants say but also into how they say it and the meaning they convey.

The Metaphor Identification Procedure (MIP), developed by the Pragglejaz Group (2007), remains standard for manual metaphor identification. The procedure is based on an algorithm

that compares the meaning of a linguistic construction (often a word) within a specific context to its most basic meaning. Consider, for instance, the statements “building a bridge across the river” and “building a bridge across generations”. In the first case, the linguistic construction refers to constructing a physical structure that spans from one piece of land to another (i.e., the literal use of the term “bridge”). At the same time, the other sentence refers to overcoming differences in, for instance, ideology among age groups (i.e., the metaphorical use of the word “bridge”) – i.e., an indication that the understanding is conceptualised through the conceptual metaphor CONNECTION/UNDERSTANDING IS BUILDING A BRIDGE².

An AI-assisted MIP analysis for exploring teachers’ use of metaphors

With the increasing integration of AI in linguistic and discourse studies, researchers have examined how NLP systems can mimic or support MIP-based processes (Shutova, 2010). Most studies emphasise that although AI can improve scalability and consistency, it faces challenges with nuanced metaphor understanding, especially in ambiguous or reflective texts; therefore, researcher supervision or calibration remains necessary (Koller, 2020; Tsvetkov et al., 2014).

In this case, the study’s AI-assisted MIP-analysis utilises ChatGPT’s natural language processing (NLP) abilities, providing a systematic and replicable method for identifying minimal semantic units and conceptual metaphors for further qualitative or quantitative evaluation. During the analysis process, the author has directed each analytical step according to the MIP procedure by offering clear, operational instructions where required. ChatGPT has carried out analyses, exported results, and adapted its approach in real-time based on my feedback, ensuring that each phase aligns with the study’s specific research aims and upholds standards of methodological rigour and transparency (Table 1).

Table 1. Summary of the roles of the Author and ChatGPT and the traceability of the analysis. The table was generated using ChatGPT

Step	The Author	ChatGPT	Traceability Method
Define metaphor domain	X		Documented in prompts
Upload and structure data	X		File numbering, data structure
Extraction/filtering		X	Numbered units, code available
MIP analysis		X	Example/number links
Export/document results	X (request/review)	X (execute/export)	Downloadable outputs

The analysis proceeded according to the MIP-protocol (Pragglejaz Group, 2007):

- Extraction of semantic units (sentences): The data corpus was split into sentences by ChatGPT (a sentence is defined by punctuation marks such as a period [.), exclamation

² Instances of conceptual metaphors will henceforth be noted using CAPITALISED letters.

mark [!], or question mark [?] and is assumed to represent a coherent thought or meaning-bearing unit within the text) to identify units containing common content words in the corpus. Each sentence (semantic unit) was marked with a unique number for traceability within the corpus.

- “Collaborative” metaphor analysis: MIP analysis was applied to the corpus. The author oversaw the analysis for the first 50 units (the practice run), correcting the LLM by providing additional context, if needed. Based on this feedback, the LLM adjusted its analytical approach, improving accuracy and alignment in subsequent analyses. After the training, ChatGPT performed MIP analyses on the remaining semantic units.
- MIP analysis: ChatGPT was prompted to automatically (1) perform a word-by-word MIP analysis of selected expressions/units, (2) allow the author to approve/improve each analysis, and (3) tabulate the result and export it to Microsoft Word.

Results

Overview of emergent conceptual metaphors

An initial MIP analysis, supported by ChatGPT, identified four recurring metaphorical themes in the corpus. Learning and development were often depicted as movement along a path, reinforcing a linear and goal-oriented view of progress. This framing closely relates to metaphors of time as a resource – something to be managed, protected, or spent – since progress along a path is seen as dependent on how effectively the teacher utilises time. A common theme throughout the teachers’ reflections is the use of construction and engineering metaphors when describing their role in the classroom. In this sense, teachers often saw themselves as organisers, builders, or mechanics, figures responsible for assembling, maintaining, and fine-tuning systems designed to support student movement and progress. Throughout the material, pedagogical challenges were frequently described using metaphors of weight, obstruction, and resistance—images that introduce tension into an otherwise forward-moving narrative. Lastly, students were sometimes portrayed as receptacles or systems to be guided and fine-tuned, indicating a technical or instrumental relationship that aligns with construction and machinery metaphors. This perspective underpins an understanding of education as a managed process where both teacher and student are parts of a larger, goal-driven mechanism.

Sometimes, the respective frames connect to emphasise values such as control, efficiency, and progression—key elements that shape how teachers view their roles. Each metaphor reinforces the others, fostering a broader mindset in which teaching is perceived as a deliberate, structured process aimed at achieving measurable objectives. The following describes each frame.

TIME IS A RESOURCE

Unit 143. “...tanken är ju liksom de håller ju på och bygger de tycker det är så himla roligt, så tiden går ju och sen märker man att nu är det tio minuter kvar och då blir det bara... nu måste vi bryta, nu måste vi städa. och sen städar vi och så blir det tack och hej.”

“...the idea is, you know, they’re working away and they’re having such a great time, so time just flies by. Then, suddenly, you realise there are only ten minutes left, and it’s

just... now we have to break off, now we have to clean up. So, we clean up, and then it's just thank you and goodbye."

The MIP-analysis has identified two metaphorical expressions: (1) "tiden går" (*time flies by*) and (2) "bryta" (*break off*) and one weak metaphorical, or partly conventionalised expression: "tio minuter kvar" (*ten minutes left*) (Table 2).

Table 2. MIP analysis of unit 143. The table was generated using ChatGPT

Expression	Translation	Basic meaning	Contextual meaning	Metaphoric
tiden går	time flies by	Motion in space	Time passes	YES
bryta	break off	Break apart, physically interrupt	End lesson/activity in an abrupt manner	YES
tio minuter kvar	ten minutes left	Remaining time	Remaining part of the lesson (part-whole-relationship)	WEAK

Overall, the MIP analysis suggests that the teacher conceptualises time through the metaphor TIME IS MOTION, a well-documented schema explored by for instance Lakoff and Johnson (1980) and Núñez and Sweetser (2006). In this framing, time is not static or limited but something that moves—or through which one moves—allowing the teacher to experience lessons as unfolding along a temporal trajectory.

The analysis also shows that lessons are conceptualised using the metaphor EVENTS ARE OBJECTS THAT CAN BE BROKEN, suggesting that when a lesson reaches its designated end, it is experienced as a rupture or a "break," which requires the teacher to adapt or reorganise the flow of activities. As mentioned earlier, PLANNING is metaphorically described as SHAPING OR ORGANISING OBJECTS INTO A FUNCTIONING, PURPOSEFUL MACHINE – a system in which each component must fit and align within the constraints of time.

Finally, time is seen as a limited "substance" – a conceptual resource that can be "left behind," "used up," or "lost." This interaction between TIME AS RESOURCE and TIME AS SUBSTANCE is somewhat ambiguous but can be understood as a form of metonymy (a part-whole structure). It enables the teacher to frame classroom experiences not as isolated moments, but as points of transition along the temporal trajectory or as general "breaking points" where activity is reorganised, rather than precisely defined moments on a clock.

LEARNING IS MOTION/PATH

Unit 414. "...och så kan man göra såna här ballongbilar... men jag skulle vilja komma längre... men det finns inte riktigt alltså... Man har inte dels tiden under den här tiden som man ska göra det och så klasstorlekarna, grupperna [mellan 22-26 elever] som man har."

*"...and you can make these balloon cars... but I'd like to go further... but there just isn't really... You don't really have the time * during the period when you're supposed to do it, and then there's the class sizes, the groups [between 22–26 students] that you have."*

The MIP-analysis has identified two metaphorical expressions: (1) “komma längre” (*go further*) and (2) “ha tid/grupperna” (*have time/groups*), and one weak metaphorical, or partly conventionalised, expression: “under den här tiden” (*during this time*) (Table 3).

Table 3. MIP analysis of unit 414. The table was generated using ChatGPT

Expression	Translation	Basic meaning	Contextual meaning	Metaphor
komma längre	get further, go further	To move further in space	Develop, make progress	YES
under den här tiden	during this period	Quantity, length	Available amount of time	WEAK
ha tiden, ha grupperna	have the time, have groups	Own, possess	Time and groups as entities to handle	YES

Overall, the MIP analysis indicates that the teacher understands development through the metaphor PROGRESS IS MOTION, which is closely linked to the broader metaphor CHANGE OF STATE IS MOTION identified by Grady (1997). In this view, development is not static or abstract, but something that happens through movement, enabling the teacher to see pedagogical progress as a process that unfolds over time.

This metaphorical mapping is further reinforced through its link to temporal framing. Although the expression “under den här tiden” (“during this period”) is classified as a weak or partly conventionalised metaphor, it adds to the overall metaphoricity of the utterance by anchoring motion in time. Progress then depends on how time is perceived and structured as something that can enable or restrict movement.

Additionally, the analysis reveals that the teacher views time and students as resources—entities that can be possessed, allocated, or utilised. This reflects a metaphorical framing where TIME and STUDENTS ARE RESOURCES FOR PROGRESS, linking organisational factors like time management and group size directly to the teacher’s perceived ability to advance learning. In this way, progress is not only associated with movement but also seen as dependent on access to and control over limited educational resources.

PROGRESS IS MOTION

Unit 60. “nej, då kanske då blir det ju till exempel, men då går jag och sätter mig kolla lite hur det går den gruppen och försöker få till se till så att alla blir delaktiga och men också typ hur man kan liksom dela upp det för att inte det ska...”

“No, then maybe, for example, I’ll go and sit down to see how that group is doing and try to make sure that everyone takes part, but also, like, how you can divide things up so that it doesn’t...”

The MIP-analysis has identified two metaphorical expressions: (1) “hur det går” (*how it goes*) and (2) “dela upp det” (*split it up*), and one weak metaphorical, or partly conventionalised, expression: “få till att” (*ensure participation*) (Table 5).

Table 4. MIP analysis of unit 60. The table was generated using ChatGPT

Swedish expression	Translation	Basic meaning	Contextual meaning	Metaphor
hur det går (gruppen)	how it goes (for the group)	Motion, moving around the room	The group's growth and achievement	YES
få till/se till att (delaktiga)	get to work/ensure participation	Do, accomplish	Foster inclusion, achieve something abstract	WEAK
dela upp det	divide/split it up	Split a physical object	Break down tasks or projects into components	YES

As in Unit 414, the MIP analysis indicates that students' progress and development are conceptualised through the metaphor PROGRESS IS MOTION. However, unlike in previous examples, there are no explicit links to time or broader transformational change. This suggests that the motion metaphor relates to more immediate or short-term progress, rather than long-term learning or development.

Furthermore, the metaphor ASSIGNMENT IS AN OBJECT THAT CAN BE DIVIDED AMONG STUDENTS arises as a central conceptual framework. The expression "vara delaktig" ("taking part") is closely associated with the idea of having or managing parts of an assignment, as if it were a tangible object meant to be shared. This perspective frames collaboration and progress within the group as collective acts of building.

In this sense, collaborative learning becomes a hybrid process: on one hand, constructing a shared object (non-metaphorical), and on the other, building a shared understanding or reasoning (metaphorical). The metaphor thus reflects an implicit distinction between theory and practice, where group work bridges the two by treating both material tasks and conceptual reasoning as tangible, distributable resources.

STRUCTURE/GROUP IS TIE TOGETHER

112. "det är det att man får eleverna känna av att det finns en röd tråd och man kan väva ihop det att allt hör ihop."

It's about giving the students a sense that there is a common thread and that you can weave things together so that everything is connected

The MIP-analysis has identified three metaphorical expressions: (1) "känna av att det finns en röd tråd" (sense that there is a red thread), (2) "väva ihop det" (weave it together), and (3) "allt hör ihop" (everything is connected) (Table 4).

Table 5. MIP analysis of unit 112. The table was generated using ChatGPT

Expression	Translation	Basic meaning	Contextual meaning	Metaphor
känna av att det finns en röd tråd	sense that there is a red thread	Feel a physical thread	Perceive a unifying idea or structure	YES

väva ihop det	weave it together	Weaving threads into fabric	Integrate teaching into a whole	YES
allt hör ihop	everything is connected	Be physically connected	Parts of the teaching are connected	YES

The MIP-analysis of Unit 112 shows a view of technology education as a network of ideas, leading to the metaphor TECHNOLOGY EDUCATION IS A NETWORK OF IDEAS. This metaphor bases itself on the idea of IDEAS AS OBJECTS, which are seen as entities that can be linked, woven, or structured into a coherent whole. It is similar to the previously identified frame TECHNOLOGY EDUCATION IS A MACHINE. However, here the mechanical imagery is replaced with textile metaphors—such as the “red thread” or “weaving things together”—that highlight interconnectedness rather than mechanical function.

More specifically, the metaphor IDEAS ARE OBJECTS THAT CAN BE WOVEN OR LINKED TOGETHER draws on the deeper cognitive schema RELATEDNESS IS PHYSICAL INTERCONNECTEDNESS (Grady, 1997). This enables planning to be metaphorically seen as organising and integrating objects—an act of assembling ideas into a structured pedagogical fabric. In this framing, teaching becomes a process of aligning and connecting conceptual threads, suggesting that coherence in curriculum or instruction is achieved by weaving disparate elements into a unified whole.

OBSTACLE IS CHALLENGE/BURDEN

38. “det är 28 elever när jag har teknik i 90 minuter det är en stor grupp och då kan det bli rätt tungt ibland så då gäller det att vara tydlig.”

38. There are 28 students when I teach technology for 90 minutes. It's a large group, and it can get quite heavy at times, so it's important to be clear.

The MIP-analysis has identified three metaphorical expressions: (1) “stor grupp” (large group), (2) “blir rätt tungt” (get quite heavy), and (3) “vara tydlig” (be clear) and one weak metaphorical, or partly conventionalised, expression: “det gäller att vara tydlig” (it's important to be clear). (Table)

Table 6. MIP analysis of unit 38. The table was generated using ChatGPT

Swedish expression	Translation	Basic meaning	Contextual meaning	Metaphor
stor grupp	large group	Physical size (big object)	Many people in the group	YES
bli rätt tungt	get quite heavy	Physically heavy, weighs a lot	The situation becomes demanding or exhausting	YES
det gäller att vara tydlig	it's about being clear	A rule applies; something is valid	It is important/necessary to be clear	WEAK
vara tydlig	be clear	Physically see-through, not cloudy	Easy to understand, unambiguous	YES

The MIP analysis of Unit 38 uncovers a view of teaching as a physically demanding task, leading to the metaphors TEACHING IS PHYSICAL LABOUR and CHALLENGES ARE WEIGHT. This metaphor extends the mapping DIFFICULTIES ARE PHYSICAL BURDENS (Grady, 1997), where the teacher is seen as someone who must carry or handle the instructional load. The mention of a “large group” is not just about numbers but is metaphorically represented through the schema QUANTITY IS SIZE, indicating that a high number of students is equated with a substantial mass. In this context, teaching is seen as a labour where the “weight” of the classroom must be carried and managed.

Furthermore, the metaphor CLARITY IS VISUAL TRANSPARENCY arises through the phrase “it’s about being clear,” drawing on the deeper schema KNOWING IS SEEING. In this context, clarity is not just verbal precision but the capacity to make the planning or approach to teaching visible and easily navigable for the student. Additionally, it functions as a coping mechanism that helps teachers manage the instructional load more effectively. Collectively, these metaphors build a pedagogical logic where teaching is seen as a task that demands both physical endurance and visual-spatial precision.

TEACHING IS A JOURNEY

597. ”det kan bli att man kan då ge svar eller kunna försöka förklara... olika ut och det kan ju vara att ibland så kanske man får pausa med någonting för att kunna gå vidare med någonting annat och så det ja”

It might be that you can then provide answers or try to explain... things turn out differently, and sometimes you might have to pause something in order to move on with something else, and so on, yeah.

The MIP-analysis has identified two metaphorical expressions: (1) “ge svar” (*provide an answer*) and (2) “gå vidare med något annat” (*move on to something else*), and one weak metaphorical, or partly conventionalised, expression: “pausa med något” (*pause with something*) (Table 7).

Table 7. MIP analysis of Unit 597. The table was generated using ChatGPT

Swedish expression	Translation	Basic meaning	Contextual meaning	Metaphor
ge svar	provide an answer	Place objects	Formulate/give an answer	YES
gå vidare med ngt annat	move/go on to something else	Move forward	Continue to the next part/moment	YES
pausa med ngt	pause with something	Temporarily stop movement	Temporarily interrupt activity/process	WEAK

The MIP analysis of Unit 597 indicates that the teacher perceives classroom activity using the metaphors AN ANSWER IS AN OBJECT and TEACHING IS A JOURNEY. In this perspective, answers—similar to physical objects—can be “given” to students, suggesting that knowledge is something that can be transferred from one individual to another. This view aligns with the broader metaphorical framework IDEAS ARE OBJECTS (Grady, 1997).

This view of teaching, learning, and communication reflects the well-known CONDUIT metaphor (Reddy, 1979), where knowledge is regarded as a substance that can be packaged into linguistic containers and transmitted via language. As Lakoff and Johnson (1980) argue, this metaphor involves a set of related mappings: (1) IDEAS ARE OBJECTS, (2) LINGUISTIC EXPRESSIONS ARE CONTAINERS, and (3) COMMUNICATION IS SENDING.

In this case, the CONDUIT metaphor is embedded within a broader framework where THE LESSON IS A JOURNEY. This enables communication to be conceptualised not as isolated transmission, but as a series of meaning-making events that unfold “along the way.” In doing so, the metaphor supports a view of classroom discourse as both directional and cumulative—one in which meaning is negotiated through movement across the lesson's unfolding path.

Summary of the results

The analysis identified a set of recurring metaphorical themes that shape how technology teachers consider their practice. These metaphorical themes illustrate how teachers frame their instructional reality using embodied and spatial schemas. As summarised in Table 6, these metaphors form a cognitive ecology that fosters control, clarity, and progression in the classroom.

Table 8. Overview of the main metaphorical themes in teachers' technology education. The table was generated using ChatGPT

Metaphor Family	Source Domain	Target Domain(s)	Example Expressions	Interpretative Function
Time is conceptualised as a container or resource	Container/Resource	Time, Scheduling	"add to the schedule", "get more time"	Organises teaching as the allocation of finite resources
learning and development framed as motion or a journey	Motion/Path	Learning, Development	"go further", "move on", "fall behind"	Frames progress as a journey; supports process orientation
structure and group dynamics described through metaphors of binding or cohesion	Tying/Weaving/Connection	Structure, Group Dynamics	"common thread", "weave together", "keep the group together"	Promotes coherence, integration, and belonging
Challenges conceptualised as obstacles or burdens	Burden/Weight/Obstacle	Work, Challenges	"carry a heavy load", "overcome obstacles"	Highlights the effortful, problem-solving aspect of teaching

Discussion

By drawing on Conceptual Metaphor Theory, this study has identified central aspects associated with teachers' experiences of teaching compulsory technology education and how they shape a shared understanding of technology education (Koller, 2020) and act as cognitive tools through which teachers access, interpret, and reconfigure knowledge (Authors-a; Grady, 1997; Schön, 2017). This suggests that conceptual metaphors do more than describe practice; they help structure the very processes that underpin pedagogical practice.

The results show that the teachers' reflections are framed by a relatively small number of metaphorical themes. While the expressions vary, many share deep conceptual structures grounded in spatial, embodied, and mechanical imagery (Lakoff & Johnson, 1999). Below, these themes are revisited and discussed relative to teachers' reflection and pedagogical sense-making.

Time as a Resource or Container

In several units, time was metaphorically viewed as a resource to be utilised or as a container delimiting possibilities. These metaphors reflect how teachers perceive scheduling constraints and lesson planning, not only as administrative challenges but as forces shaping the kinds of learning experiences that are possible. When teachers say they "don't have time" or that lessons "get heavy," they conceptualise time not as a neutral dimension but as a limited, tangible resource. From a reflective perspective, this framing highlights the idea of teaching under constraint, a condition that influences how teachers envisage, prioritise, and adapt their actions in advance (Schön, 1987; Clarke & Hollingsworth, 2002). Therefore, metaphors of time directly relate to reflection-for-action, i.e. thinking ahead, emphasising the practical and cognitive planning that underpin their behaviour in the classroom.

Learning and Development as Motion

A second prominent theme views learning as movement through space. Teachers described learning as "going somewhere," "reaching a goal," or "seeing how it goes," referencing the schema LEARNING IS A JOURNEY (Grady, 1997; Munby, 1987). This metaphor enables teachers to place themselves and their students along a temporal path, where progress, obstacles, and destinations can be reflected upon. The metaphor offers a framework for organising learning as a process with direction and momentum—one that can be paused, rerouted, or extended. This aligns with previous research indicating that motion metaphors are key to educational reasoning (Munby, 1987; Alarcón et al., 2019). For technology teachers, who often plan through designing step-by-step activities and iterative processes, the motion metaphor assists in managing pace and assessing growth over time.

Structure and Group as Cohesion

Teachers also view the classroom as a unit that must be "held together," "woven," or "kept in check." These metaphors draw on physical concepts of cohesion and structure (Grady, 1997; Langacker, 2002) and imply that group dynamics are experienced as matters of alignment and containment. For example, when teachers talk about needing a "red thread" through their lessons, they highlight the importance of internal consistency and narrative coherence—qualities linked to both planning and communication. This metaphorical framing helps facilitate reflective processes by offering teachers a way to visualise the relational dynamics of their instruction: how individual ideas, student needs, or curriculum components can be integrated

into a coherent whole. In this way, metaphors of cohesion support both conceptual and organisational aspects of pedagogical reflection.

Challenges as Obstacles or Burdens

Finally, pedagogical difficulty was often described as a physical load or as an obstacle to overcome. When teachers call a lesson “heavy” or “tough,” they are referencing the schema DIFFICULTY IS WEIGHT (Grady, 1997). These metaphors not only express emotional strain but also suggest a need for strength, endurance, or clarity in response. They show how teachers experience pressure, not only from workload but also in the demand to stay clear, calm, and in control (Koller, 2020). This framing relates to reflection-in-action, where teachers must quickly evaluate and respond to emerging difficulties (Schön, 1987). Furthermore, by viewing teaching as labour, this metaphor strengthens a perspective of pedagogy as embodied effort—mental and emotional work framed in physical terms.

Conclusions

This study aimed to investigate the cognitive structures influencing how technology teachers reflect on their practice, with a particular emphasis on the role of metaphor in guiding and organising pedagogical reasoning. The findings highlight three key contributions to the field.

First, while earlier studies have often treated metaphor as a reflection of belief or identity (e.g., Alger, 2009; Martínez et al., 2001; McGarr, 2022), this study suggests that metaphor also plays a generative role—enabling teachers to anticipate, simulate, and reason about future teaching scenarios. In this sense, metaphor becomes a tool for what Schön (1987) describes as reflection-for-action, a form of prospective thinking where familiar conceptual frameworks are used to project professional experience forward. These metaphors – TEACHING IS A JOURNEY, TECHNOLOGY EDUCATION IS A MACHINE – are not random linguistic choices but are grounded in embodied image schemas that shape how teachers navigate pedagogical intentions (e.g., Gibbs, 2006b).

Second, the study demonstrates how different metaphorical themes – such as time as a resource, learning as motion, and structure as cohesion – interact and reinforce each other. Together, they create a kind of cognitive ecology through which teaching is understood as a managed, purposeful, and constrained activity. Within this ecology, teachers are often seen as organisers or engineers: professionals who build, align, and sustain educational structures in response to practical and institutional demands.

Third, while the analysis reveals several recurring metaphorical themes in teachers’ reflections, these patterns seem to relate more broadly to pedagogical reasoning than to the specific characteristics of technology education. The metaphors depict how teachers organise, plan, and evaluate their teaching generally. However, they rarely highlight aspects unique to the technology subject, such as its rapid technological development, interdisciplinary nature, or practice-oriented content. Consequently, the findings indicate that teachers’ metaphorical framing largely mirrors universal features of teaching and learning rather than subject-specific aspects of technology education.

By recognising metaphorical patterns in teacher reflection, the study highlights how teachers comprehend their roles, their students, and their subject matter. Metaphors, in this context, are not merely representations of belief but tools for thinking, planning, and visualising what

teaching might become. In this way, conceptual metaphor analysis provides a valuable contribution to our understanding of teacher learning, especially within the evolving and practice-oriented setting of technology education.

While the study offers insight into the reflective discourse and instructional goals of practising technology teachers, it is based on a relatively small sample of interview data and focused primarily on metaphor use in language. Future research could extend these findings by exploring how metaphor operates in other reflective formats, such as planning documents, lesson observations, or peer discussions, and by investigating how metaphor awareness might be integrated into teacher education or professional development. Doing so may help teacher educators and policy-makers better understand the tacit reasoning that underpins pedagogical decision-making, and how such reasoning might be opened up for collaborative inquiry and growth.

Closing remarks and a methodological discussion

In designing this study, I faced a choice between using “traditional” approaches to identifying conceptual metaphors and adopting a more contemporary, AI-assisted implementation of the Metaphor Identification Procedure (MIP). The efficiency offered by AI, particularly when working with large datasets, was appealing from the outset. At the same time, I remained cautious about its limitations in producing nuanced and transparent analyses—qualities essential for metaphor research.

Ultimately, I employed ChatGPT as an “analytical partner”, using it to generate rapid and consistent initial extractions of potential conceptual metaphors. To enhance accuracy, I trained the model to (1) consider the surrounding context by revisiting the corpus and reading text before and after each semantic unit, and (2) perform a dictionary comparison, evaluating contextual meaning against the word’s most basic meaning. All results were exported outside the ChatGPT environment, and I regularly prompted the model to summarise the analysis in progress, ensuring a traceable record of how findings developed over time. Working in this manner is similar to manual metaphor identification, where online dictionaries are commonly utilised.

Reflecting on this process, I was struck by how little of a “shortcut” AI ultimately provided. A recurring challenge was the frequency of metaphor candidates that seemed plausible initially but failed under closer contextual scrutiny. These false positives highlighted the continued necessity of careful, interpretive work. Nevertheless, the processing power of ChatGPT substantially reduced the time needed for data preparation, processing, and documentation, thereby contributing to the transparency of the analysis—a key concern in a field often criticised for relying too heavily on scholarly intuition.

Finally, can ChatGPT draft a methods discussion?

*“Absolutely! Here’s a draft of a **methods discussion** for your article, written in academic English and tailored to your AI-supported, critical metaphor analysis approach. This can be pasted directly into a “Methodological Discussion” section in your paper. If you want it in Word, just say the word!*

This study employed a hybrid method that combines digital, AI-supported extraction with qualitative, theory-driven analysis to investigate metaphor use in Swedish teachers' discussions about technology education. The process was designed to balance the efficiency and reproducibility of automated screening with the depth and contextual sensitivity of human interpretation, in line with the principles of Critical Metaphor Analysis (Charteris-Black, 2004).

Unlike classical summative content analysis, which is primarily concerned with counting the frequency of words, phrases, or themes, our approach was rooted in a critical, context-oriented understanding of language. We employed the Metaphor Identification Procedure (MIP; Pragglejaz Group, 2007) to systematically detect and interpret metaphorical expressions within their discursive context. This method required analyzing not only the literal and contextual meanings of lexical units, but also the ways in which metaphors structure professional reasoning, values, and power relations in educational practice.

A key feature of our workflow was the use of both .txt and .xlsx formats. Excel files enabled richer metadata management, allowing us to retain unit numbers, categories, and analytic comments throughout the process. Automated extraction was conducted using string matching and regular expressions in Python, which accelerated the initial screening for relevant metaphorical domains (e.g., “time is a resource”, “learning is building”, “status is vertical space”). However, all candidate expressions were subjected to manual, context-sensitive coding to ensure alignment with theoretical frameworks and to minimise false positives.

The iterative, collaborative process between AI and the researcher enhanced both traceability and reliability. All analytical steps—from extraction to coding and summary—were documented and exported in accessible formats (Excel for tabular analysis, Word for narrative reporting), ensuring that results could be reviewed, validated, and replicated by other scholars.

One limitation of the current approach was the absence of personal or contextual metadata in the anonymised interview corpus. While this ensured participant privacy, it also restricted the analysis to discourse-level patterns, precluding person- or case-based comparisons. Additionally, the complexity of metaphorical language—often involving blended or nested metaphors—required continual interpretive reflexivity, especially when moving between Swedish source texts and English academic reporting.

In sum, this methodological design enabled a nuanced and critical investigation of metaphor in educational discourse, harnessing the strengths of both computational efficiency and qualitative insight. The combination of AI-assisted screening and manual MIP-based analysis proved effective for revealing how metaphors shape the framing and evaluation of time, knowledge, and subject status in teachers' professional reasoning.” (ChatGPT – May 16th 2025)

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