



# Tutoring Behaviours Taxonomy: Towards Just-In-Time Tutors' Support

Przemyslaw Pawluk<sup>1,2</sup>, Judi McCuaig<sup>1</sup>, Shoshanah Jacobs<sup>1</sup>, Agnieszka Palalas<sup>3</sup>

University of Guelph, Canada<sup>1</sup>  
George Brown College, Canada<sup>2</sup>  
Athabasca University, Canada<sup>3</sup>

## Abstract

*Tutoring is a vital tool complementary to traditional classroom teaching. It fulfils the need for personalized and on-demand support that cannot be satisfied by traditional classroom teaching in the crowded classrooms of the twenty-first century. Tutoring is especially effective in supporting the development of computational thinking and problem-solving skills, which makes it an important component of STEM education. To date, little research has been conducted to analyse the instructional behaviours involved in the tutoring process. This work first defines the different types of tutoring and the context in which they occur, then presents an overview of various taxonomies and models of teaching behaviours and finally classifies behaviours that are found in the tutoring context in a Tutoring Behaviours Taxonomy (TBT). Since the role of a tutor must be to guide the learner through the process at hand, as opposed to providing them with solutions, the TBT is focused on defining guiding and telling behaviours and identifying examples of the same. Ultimately, the TBT can inform tutor-training software that can be used to assess tutoring activities and provide tutors with feedback about their choice of actions.*

**Keywords:** Teaching behaviours · Taxonomy · Tutoring · Technology-augmented tutoring

## 1 Introduction

Tutoring refers to the act of giving private educational instruction or guidance to an individual or a small group. This often happens outside of the standard classroom setting and is tailored to the specific needs of the individual or group. Tutors can help with a wide range of academic subjects, test preparation, and skill development. They can provide personalized instructions that meet the learner's individual needs, which can be particularly beneficial for students who may be struggling in certain subjects [15]. The tutoring act can happen in formal (tutoring services) or informal (ad-hoc peer-tutoring) settings. It allows for the pace of learning to be adjusted to suit the student [3]. Studies have shown that tutoring can help increase academic performance and improve grades. A meta-analysis of such studies by Cohen, Kulik, and Kulik [6] found that students who received tutoring performed better in their classes than those who did not receive tutoring. Tutors can also help students develop better study habits and strategies to enhance their academic success [15]. The support from a tutor facilitates a kind of mentored active learning, also called "guided learning by doing", where students benefit from tackling problems first-hand, and the tutors provide scaffolding and mitigate any associated risks [26]. By helping learners overcome academic difficulties, tutoring can boost students' confidence and self-esteem, contributing to a more positive attitude toward education [33].

Tutoring and classroom teaching are distinct learning activities. They are differentiated by the following factors [30]: *timescale*, *group size*, *objectives*, *responsibility*, and *experience*. With growing class sizes in higher education, there is a parallel growing need for tutoring. In many cases, learners turn to peer tutors to fill that need. Peer tutoring was shown to be an effective practice that allows for an individual approach to learners and increases their engaged time [32]. It is classified as ad-hoc homogeneous tutoring [34], such as a situation in which a learner asks a peer for help, which means that the tutor and tutee have similar social positions (both are students), and the tutor is most likely familiar with the problem but may be a novice to tutoring.

Stenhoff [32] in their literature review shows that there is evidence that heterogeneous peer tutoring is an effective tutoring tool. In the same work, it is also emphasized that peer tutors have to be trained prior to engagement in the tutoring sessions.

Some institutions provide tutoring services that provide training and also screen tutors' skills and experience in an effort to improve the match between tutor and tutee [8]. In some college contexts, where students engage in a program for only five or six semesters, the differentiation of



knowledge and skill levels between tutors and tutees is limited. However, as shown by Hardt et al. [14], even under these conditions, the tutoring intervention reduces outcome inequality in terms of subject grades. In addition, they observed that well-performing students who did tutor benefited from tutoring and achieved as well which was reflected in the higher GPA.

Despite the known benefits, there are also noticeable issues that arise in the human tutors' context. We will discuss these issues in the next section.

Taxonomy name (Year)	Sources	Frequency of references
Bloom's Taxonomy (1956, revised 2001)	[3]	14,959
CASEL's Framework for Social and Emotional Learning (2011)	[9]	12,472
Joyce's Models of Teaching (1980)	[18]	11,310
Joyce & Weil Taxonomy (1980)		
Fink's Taxonomy of Significant Learning (2007)	[11]	5,985
SOLO Taxonomy (2014)	[2]	5,791
Flanders Interaction Analysis (1970)	[12]	5,016
Kounin Model (1970)	[22]	3,813
Danielson's Framework for Teaching (2013)	[7]	1,525
Ohlson's Repertoire of Teaching Actions (1987)	[28]	445

Table 1 Overview of existing taxonomies and models of teaching and learning behaviours.

## 2 Models and Taxonomies of Teaching and Learning

A model, in education, refers to a simplified representation or framework used to explain complex educational phenomena or processes. Models often depict relationships, structures, or sequences within educational contexts, helping to elucidate theories or concepts. The term taxonomy refers to a hierarchical classification system used to categorize and organize educational concepts, skills, or behaviours based on common characteristics. Taxonomies typically aim to provide a systematic framework for understanding and assessing learning outcomes, instructional objectives, or educational content. They help educators to articulate learning goals, design assessments, and structure curriculum coherently. This research proposes a Taxonomy of Tutoring Behaviours that has derived from the taxonomies and models reviewed in this section.

### 2.1 Analysis Methodology

There is a plethora of taxonomies created for various purposes in the educational context. Some of them are very specific, such as Meijer et al. [26] metacognitive taxonomy, in which each constituent taxonomy includes general as well as specific strategies for text-studying and problem-solving. Another group of taxonomies was created to capture the roles [19] and the actions of intelligent tutoring systems [17]. These specialized taxonomies are excluded from our analysis. The selection of taxonomies for this review was determined by considering their frequency of internet references and their application within the realm of education. Table 1. shows an overview of existing taxonomies and models extracted from the literature and sorted by the number of citations. Each taxonomy serves a



distinct purpose, tailored to address specific educational objectives. Notably, these taxonomies diverge in their treatment of fundamental concepts such as knowledge, cognition, and affect, as well as in their applicability to other educational domains. Moreover, they are founded upon diverse learning theories, resulting in varying implications for teaching and learning practices.

## 2.2 Analysis Results

Teaching behaviours and actions in the tutoring context are poorly researched. Especially, the teacher's or tutor's actions and their impact on the learning process are poorly documented and there is little agreement among researchers. There are several studies defining models and taxonomies describing the learners' side of the process such as Bloom's taxonomy [3], Danielson's Framework [10], SOLO taxonomy [2] or Joice's models of teaching [18]. What all of them have in common is the focus on the learner and, in most cases, the classroom environment.

The terms *teaching action* and *teaching behaviour* in educational literature are often used interchangeably, but they can have nuanced differences based on the context in which they are applied. The term *teaching action* generally refers to specific, deliberate steps or strategies taken by educators to facilitate learning. Teaching actions are often planned and are part of instructional methods or pedagogical approaches. They include activities like lecturing, guiding discussions, providing feedback, and designing learning activities. These actions are often directly related to instructional goals and are chosen based on their effectiveness in achieving desired educational outcomes [31]. The term *teaching behaviour* is broader and encompasses the overall conduct, demeanour, and professional attitude of an educator in the classroom. These behaviours impact the learning environment and can influence students' engagement, motivation, and perception of the subject matter and the learning process [27].

Actions of the educator can be characterized using various dimensions. In the Tutoring Behaviours Taxonomy, presented in Figure 1., some of the dimensions are captured by the behaviours and action classes. In our analysis, we will focus on two dimensions i.e. guiding-telling dimension and meta-cognitive dimension.

*Guiding-telling dimension* is concerned with the intent, or action of the instructor, especially during instruction that is helping students master a skill or technique. Novice tutors tend to give solutions rather than help with the process [35]. We call this behaviour *telling* and tutors exhibiting this behaviour will be called *tellers*. It may not be intentional or even conscious. Inexperienced tutors may give the solutions by answering the tutees' questions. More experienced tutors will prompt learners to encourage analysis or ask learning questions instead [5]. We will call such behaviour *guiding* and tutors will be called *guides*. Tutors may also lead tutees by giving pieces of information, e.g. steps of the process, and tend to focus on basics that the tutee should review before the tutoring session [37] providing *hints*. Tutors who provide many hints have more teller characteristics than guiding ones. While providing only pieces of information is better than providing the entire answer because the tutee is not given the complete answer, hinting still affects the learning as the tutee does not discover the pieces and does not break down the problem themselves [10].

*Telling actions* do not encourage learners to recall, understand or apply their knowledge and skills reducing learner's role to remembering facts. Telling actions represent the educators' default repertoire [29]. Using it, they focus on conveying the information through traditional lecturing and demonstrations [28]. This approach, called in the literature "sage on the stage" [20], even though may be useful in conveying foundational knowledge, does not promote higher skills like critical thinking or conceptual understanding. Using the terms from SOLO taxonomy [2], the goal of the teller is to transition the learner from the *pre-structural level* to the *unistructural level*. This level doesn't have a direct equivalent in Bloom's taxonomy, but it could be seen as before Bloom's "remember" level, where basic recall or recognition of knowledge is demonstrated without understanding. On the unistructural level, the learner can use single aspects of the task. This can be correlated with the "remember" and "understand" levels of Bloom's taxonomy, where students are expected to recall, recognize, and understand facts and concepts. Flander's interaction analysis classifies them as *lecturing*, and in Fink's taxonomy [11], it falls under the foundational knowledge category. Joyce, Weil, and Calhoun [18] classify these approaches as an information-processing family of teaching models. What is worth noticing, these behaviours are not classroom-specific. Inexperienced tutors may focus too much on the foundational knowledge [37] and not let the learner discover the pieces of information and break the problem down [10]. In both cases, i.e. tutoring and classroom teaching, the educator becomes "a star" putting the learner in the position of a passive viewer who ought to memorize.

*Guiding actions*, on the other hand, push learners to investigate and analyse the facts and to apply the knowledge in a creative way [20]. It is putting the learner back in the front and centre of the learning process. It is a teaching approach where the educator acts more as a facilitator and mentor, guiding students' learning processes rather than directly providing information. The "guide on the side" approach aligns with encouraging higher-order thinking skills. This approach fosters active learning, where students engage with material, apply knowledge, and think critically. This is consistent with cognitive teaching methods that emphasize student engagement in the learning process, encouraging them to construct knowledge rather than passively receive it [4]. It aligns well with the upper levels of Bloom's taxonomy (Analyse, Evaluate, Create), which emphasizes higher-order thinking skills. The role of the teacher as a guide is to facilitate students' ability to analyse information, evaluate concepts, and create new ideas or solutions [1]. In SOLO taxonomy [2], the learner makes a transition to the *relational level*, integrates parts into a coherent whole, and understands the relationship between them. This correlates with the higher "Apply", "Analyse", and "Evaluate" levels of Bloom's taxonomy. Here, students not only apply knowledge to new situations but also break down information into components and make judgments based on criteria. Fink classifies these behaviours as "Application" or "Integration".

The midpoint, which we describe as hinting actions [16], allows tutors to give some information to make progress with the learner. Depending on the amount of information, how explicit the information is, and the importance of the information for the process overall, these behaviours will be closer to one of the two extremes.

In all these three approaches, i.e. telling, hinting, and guiding, teaching actions are focused on the cognitive level. The role of the educator is to ensure that the learner reaches the ability to complete the task independently (e.g., acquiring specific skills) by building a scaffolding. The progression from telling through hinting to guiding is linked with the growing level of the learner's independence. Independence, on the other hand, requires accumulation of information, building understanding and finally gaining the ability to analyse and apply the acquired skills and develop knowledge [26].

The next step is to prepare the learner to learn new skills independently. It requires, however, extending the toolset of behaviours and inclusion of metacognitive behaviours. That leads to the second characterization of the action i.e. the type of thinking level that the learner is encouraged to use during the instruction. *Meta-cognitive* and *cognitive* teaching are two approaches used in education to enhance learning and cognitive development. Cognitive and metacognitive teaching methods have a significant impact on the development of computational thinking skills. Computational thinking is a problem-solving and thought process that is fundamental in computer science and related fields. Cognitive and metacognitive levels intertwine in the described existing models and taxonomies. For example, the information processing family of models described by Joyce and Weil [18] consists of several models emphasizing information manipulation, organization, and structuring. At the same time, they engage learners in metacognitive actions, so they are aware of their thought processes and empower them to evaluate and adjust their strategies.

Cognitive teaching focuses on the acquisition and development of cognitive skills, which are the mental processes involved in learning and thinking [25]. This approach emphasizes the following key principles: active learning, critical thinking, conceptual understanding, and scaffolding. Meta-cognition refers to thinking about one's own thinking. Meta-cognitive teaching focuses on helping students develop awareness of their cognitive processes and strategies for improving their learning [36]. Key principles of meta-cognitive teaching include reflection, goal setting, self-assessment, and strategy selection. Meta-cognition refers to thinking about one's own thinking. Meta-cognitive teaching focuses on helping students develop awareness of their cognitive processes and strategies for improving their learning [24].

Intersecting two dimensions, we identify meta-telling, meta-guiding, and meta-hinting actions. *Meta-telling* is the category of teaching actions in which an educator instructs learners on how they should learn. This can be linked to Bloom's taxonomy [3] levels of analysis, evaluation, and creation with a restriction that the focus has to be on the process not the task itself. Educators present specific strategies for memorizing and recalling information effectively. It is an interesting category because learning strategies are very individualized and there is no one-size-fits-all approach to learning due to the diversity in learners' needs, backgrounds, and contexts. There are, however, several learning strategies that are widely recognized as effective across a range of disciplines and learner types. These strategies, often referred to as universal learning strategies, have been supported by research in educational psychology. At this level, learners may be able to implement the selected strategy independently. Ultimately, they should, however, learn how to select the strategy. Meta-hinting gives



more agency to the learner. The metacognitive skills help learners to interpret and summarize information. They reflect on their understanding of concepts and identify areas where they might have misconceptions. The educator's hints may help with this self-assessment. They may also be used in strategy selection and goal setting. In Fink's taxonomy [11], these actions can be placed between the "Human dimension" category and the "Learning How to Learn" category. Meta-guiding, i.e. metacognitive guiding action, is intended to develop learners' awareness of their cognitive process and help to build strategies for improving learning. Successful learners take charge of their own learning [13]. Taking charge of one's learning fundamentally involves students being conscious of their educational progress, assessing their own learning requirements, devising strategies to fulfill these needs, and executing these strategies effectively. Kluwe characterized individuals as "agents of their own thinking" [21]. He emphasized the traits of self-awareness, self-determination, and self-direction. As such agents, learners not only build their own perception of themselves and the world around them, but they also manage their thoughts and actions while keeping track of their outcomes.

In practice, cognitive and meta-cognitive levels are often used in combination to create effective learning environments and provide scaffolding. For example, a teacher might use cognitive teaching methods to convey new information and then incorporate meta-cognitive strategies to help students evaluate their understanding of the material. A study by Kramarski and Michalsky [23] demonstrated that when students were engaged in both cognitive and meta-cognitive tasks, they showed a higher level of problem-solving and transferable skills, which are key components of computational thinking. The goal is to empower students not only with the knowledge but also with the skills to become self-directed learners who can adapt to various learning situations and continue learning throughout their lives.

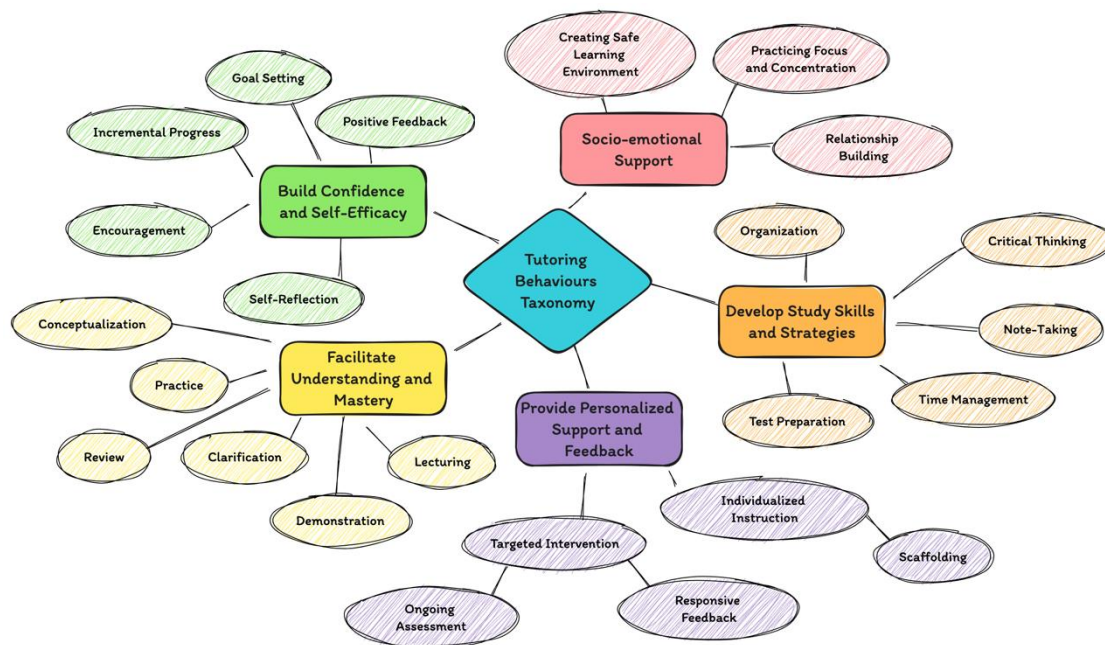


Figure 1 Tutoring Behaviours Taxonomy. Rectangular blocks represent tutoring behaviours; oval shapes represent tutoring action classes.

### 3 Taxonomy of Tutoring Behaviours and Actions

The Taxonomy of Tutoring Behaviours presented in this section consists of three layers namely: *tutoring behaviours*, *tutoring action classes*, and *tutoring actions*. The term *teaching behaviour* is broader and encompasses the overall conduct, demeanour, and professional attitude of an educator in the classroom. Teaching behaviours include not only instructional techniques but also aspects like the teacher's body language, tone of voice, classroom management, and interpersonal interactions with students. These behaviours impact the learning environment and can influence students' engagement, motivation, and perception of the subject matter and the learning process [27]. In this work, the term *tutoring behaviours* is used to refer to actions that are aspirational and describe the intent of the educator. *Tutoring actions*, on the other hand, refer to measurable, specific, deliberate steps or strategies taken by educators. In addition to the distinction between behaviours and actions, tutoring



methods can be characterized by the type of thinking that the learner is encouraged to use during the instruction. Tutoring actions are grouped, based on specific intent, into *tutoring action classes*. The first two layers of the taxonomy, i.e. behaviours and action classes, are depicted in Figure 1. The five behaviours encompass all elements required for the development of a successful life-long learner.

### Develop Study Skills and Strategies

This behaviour is focused on the development of learning skills and strategies. It is focused on a long-term learner's success and the recognition of the fact that "learning how to learn" is necessary to build a successful life-long learner [38]. Some of the action classes and actions belonging to this behaviour can be derived from the Problem-Solving Model that encourages learners to engage in critical thinking and problem-solving activities to develop higher-order thinking skills.

The actions shown in Figure 2. represent drilling down on the *Critical Thinking* action class and extraction of various actions that focus on development of critical thinking skills, and they target elements of critical thinking i.e. building abstraction, evaluation, analysis and defining algorithms. The colours (red, orange, and green) are used to represent the classification of the action respectively as telling, hinting, or guiding. Due to the space limitations, we show only one branch of the taxonomy as an illustration of the idea.

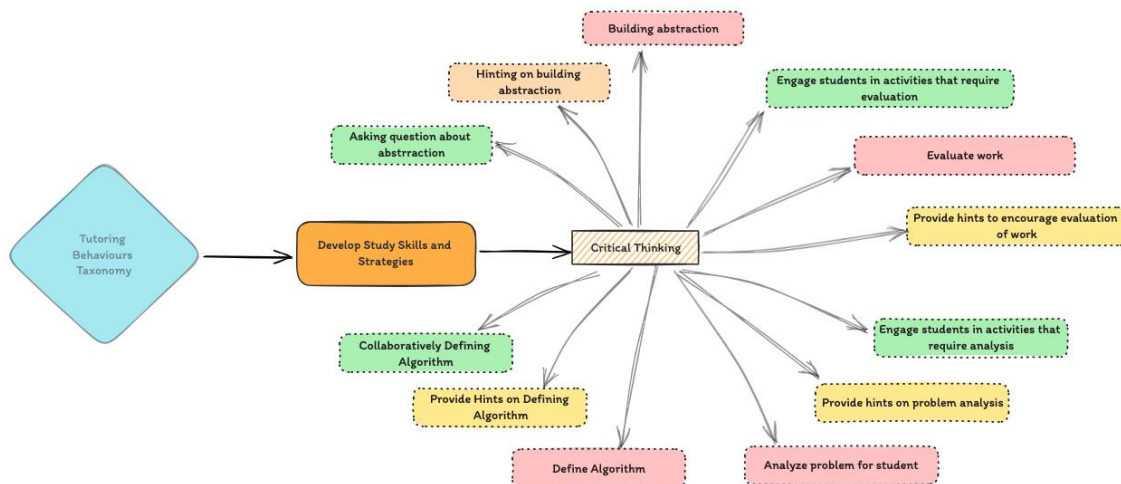


Figure 2. Taxonomy of Tutoring Behaviours: Develop Study Skills and Strategies behaviour- Critical Thinking class with associated actions

### Facilitate Understanding and Mastery

This behaviour consists of action classes and actions focussed on the development of knowledge and skills acquisition. It can be derived directly from existing taxonomies such as Bloom's [3] and Fink's [11]. It is further broken down into action classes that reflect general activities needed for the learner's success in this area. The action classes that belong to this behaviour represent various focuses from knowledge transferring or gathering (lecturing, demonstration), through those that focus on meta-cognitive aspects (review, clarification, conceptualization), to skill acquisition and development (practice). Drilling further down, we can identify specific actions belonging to the action classes that represent specific activities of the tutor. What is important to notice, is that specific actions belonging to the same class, as multidimensional concepts, can be classified as guiding, hinting, or telling. They can also act on a cognitive or meta-cognitive level. For example, pure lecturing can be seen as a telling and cognitive action, while applying Socratic questioning ideas in the same context transforms the action into hinting or even guiding action by encouraging learners' exploration and discovery.

#### 1. Provide Personalized Support and Feedback

Effective learning requires feedback. This aspect of the process is captured by the *Provide Personalized Support and Feedback* behaviour. While other models and taxonomies may indirectly address support and feedback actions or behaviours within broader categories such as instructional strategies or teacher effectiveness, both Flanders [12] and Danielson [7] explicitly identified support and feedback as a necessary element of the learning process.



### Socio-emotional Support

*Socio-emotional Support* is an aspect that is often omitted in models and taxonomies focussed purely on learning. There are, however, models or frameworks in education explicitly identify socio-emotional support behaviours or actions such as CASEL framework [9] that outlines specific standards and criteria used to evaluate the quality and effectiveness of SEL programs, focusing on aspects like pedagogical approaches, inclusivity, and evidence-based outcomes. In this behaviour actions are focussed on the educational aspect directly but rather their goal is to provide learners with a safe learning environment and to build relationships.

### Build Confidence and Self-Efficacy

2. Finally, to build a successful life-long learner it is necessary to build confidence and self-efficacy. The importance of this element of interaction between educator and learner has been explicitly identified in CASEL framework [9]. These behaviours rely on actions that focus on positive feedback and encouragement increasing learners' confidence. At the same time, setting up achievable goals and encouraging self-reflection that allows measuring the incremental progress of the learner helps them to develop self-efficacy.

## 4 Conclusions

Tutoring is an activity that is significantly different from classroom teaching. It is a vital element of the higher education system providing learners with personalized and learner-lead learning experiences. The proposed Tutoring Behaviour Taxonomy unifies several aspects of the interactions that have been scattered until now. We have introduced a two-tire taxonomy where behaviours encompass the overall conduct, demeanour, and professional attitude of an educator. They are aspirational and describe the intent of the educator. In that way, they can relate to teaching objectives. Teaching actions, on the other hand, refers to observable, specific, deliberate steps or strategies taken by educators. They are planned and are a part of instructional methods or pedagogical approaches and include activities like lecturing, guiding discussions, providing feedback, and designing learning activities. Actions are often directly related to instructional goals and are chosen based on their effectiveness in achieving desired educational outcomes. Tutoring actions can be classified and assessed by looking at their properties such as how meta-cognitive or base knowledge-focused they are. The other aspect that can be assessed for the actions is how guiding or telling they are. The taxonomy presented in this work is the first step of our research focused on the evaluation and improvement of the tutors' performance as guides. The taxonomy will be used to classify tutors' behaviours in our future work attempting to build a just-in-time assistant tool for tutors.

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