"Like Driving in a Storm at Night":
How Students Use Metaphors to Describe
Confusion During Learning

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Abstract: Confusion during learning is complex as it can either deepen understanding or hinder progress, depending on its resolution. This study explored how students personally experience and conceptualize the feeling of confusion through metaphors. Fourteen students participated in a video-based learning task on introductory statistics, self-reported their confusion levels, and were prompted during interviews to use metaphors to describe what it feels like to be confused. Analysis of the collected metaphors revealed descriptions of confusion during learning often involving themes of "Lack of Familiarity", "Cognitive Overstimulation", and "Effort Against Impending Failure". These findings highlight the potential of metaphor analysis to access subjective emotional states in learning and suggest that current measurement tools may not fully capture the complexity of confusion.

Introduction

Confusion during learning is a complex state that can be a catalyst for deeper engagement and understanding if resolved effectively, but a significant barrier if left unaddressed (D'Mello et al., 2014; Lehman et al., 2013). Students who navigate confusion successfully may achieve greater learning gains (Arguel & Lane, 2015), while persistent, unresolved confusion often correlates with negative outcomes (Lee et al., 2011). Despite this understanding, research has focused on the measurable aspects of confusion, leaving the subjective, felt experience of confusion less explored. This emphasis may lead to operationalizations of confusion through assumptions, and potentially overlook ways in which students internalize and make sense of this state.

Confusion is often internal and not easily observable, making it difficult for educators to detect and support in real-time, and for researchers to study reliably (Conati, 2002). Furthermore, confusion is subjective, and the same learning material might lead to different levels of confusion across individuals (Pekrun & Stephens, 2012). Common measurement approaches, such as discrete self-report scales administered post-task or at intervals (e.g., Pekrun et al., 2017), typically capture intensity ratings but cannot capture the qualitative shifts or lived experiences of being confused. To this end, we believe metaphors can serve as powerful cognitive tools for studying the qualitative experience of confusion, thus, enabling individuals to express complex and abstract experiences in more concrete and relatable terms (Lakoff & Johnson, 1980; Müller et al., 2024; Wingert & Ko, 2024). To our knowledge, no formal efforts have explored understanding what confusion feels like from students' perspectives using metaphors.

In this paper, our work is centered around addressing the following research question: *What metaphors do students use to characterize and represent the different intensities of confusion?* Metaphors could reveal the idiosyncratic dimensions of the abstract nature of confusion and capture diverse aspects of the state which more standard research measures may overlook. In this study, we used an ethnographic approach to understand students' subjective experiences of confusion during learning. By conducting in-depth interviews of the instances during learning when students self-reported various levels of confusion, we invited students to use similes and metaphors (e.g., "Confusion feels/is like …") to describe their confusion experiences. This approach aimed to understand the meaning representing the subjective levels of self-reported confusion and enrich number values for confusion intensities.

Methods

We recruited 14 students via a combination of convenience sampling and recruitment flyers from a large public university in the United States. The participating students included 11 graduate students, two undergraduate students, and one researcher, from diverse academic disciplines including information sciences, physics, mechanical engineering, history, educational psychology, and statistics. All students indicated they had completed at least one college-level statistics course. The study was approved by our university's institutional review board before beginning data collection, and each student received a $15 gift card for their time in the 60-minute study.

Students first engaged in a learning activity where they watched a series of nine brief instructional videos on various statistics topics, including basic and conditional probability, Bayes' theorem, hypothesis testing, and binomial distributions, for a total of about 18 minutes. After the video watching task, students were asked detailed questions about their confusion experiences during the study, which involved questions encouraging students to describe their confusion intensities in terms of metaphors. Students were asked, "If you were to use a metaphor to describe what confusion during learning is like, what would you say? For example, an example might be 'being confused feels stuffy, like having a cold.'" After providing an initial metaphor, students were encouraged to expand their example through five different intensities of confusion, if possible. Interview audio files were subsequently transcribed into text, and metaphor-related student responses were identified and organized by theme. We created the themes by first compiling a list of all metaphors shared by the students, and then identifying patterns in the nature of the metaphors.

Findings

The students' metaphors revealed three prominent themes characterizing experiences of confusion during the video learning task: "Lack of Familiarity", "Cognitive Overstimulation", and "Effort Against Impending Failure". Ten out of the fourteen study students provided descriptive metaphors for how they experienced confusion, and four of the students had difficulty creating metaphors and were not able to provide any metaphors for their confusion, perhaps due to the abstract nature of the task. Below, we share the three themes and one representative metaphor from the interview transcripts.

Five students described confusion as occurring within the theme of "Lack of Familiarity", as something that stems from a sense of unfamiliarity with the material or context. For example, *Student 2* compared confusion to different levels of knowing and interacting with people and elaborated the metaphor for three confusion intensities:

> "Three [confusion intensity out of five] is like meeting my friends. People I know well enough and feel comfortable with. Even though I don't fully understand these topics, I've seen and heard them so many times that they don't scare me. Bayes theorem and probability mass functions are like my friends. But level four is like meeting and talking with strangers I don't know if I like or people I don't talk to often. They make me feel a bit scared or hesitant. Level five is not even knowing whether I'm even supposed to be talking to this person."

Another theme that emerged among five students was the sensation of being overwhelmed by the complexity or volume of information, or "Cognitive Overstimulation". *Student 7* gave an expanded metaphor for confusion comparing it to different conditions for driving.

> "One would be like driving on a straight road, empty highway. No cars on the road. It's very easy. You don't even think about the fact that you're driving. Level two is a little bit of traffic, and level three is like there's traffic and you're driving in a city that you have never been to. So you grip the wheel harder. Then level four is like driving in a storm so it's stressful and you're really gripping the wheel. Then level five, which would be like driving in a storm at night, and you don't know where you are. You can't see where you're going. It's just too much."

Three students used metaphors which described confusion within the theme of "Effort Against Impending Failure", a state which required significant effort despite a bleak outlook. *Student 6* used the metaphor of trying to outrun a car, mentioning:

> "It's like sprinting as fast as you can, but the car keeps getting farther away. No matter how hard you try, you can't catch up. You can be on a bike or something faster, but it is not possible. But you're tethered to the car, so you can't not run."

Discussion

By inviting students to articulate their confusion through metaphors, we were able to prompt their personal interpretations of how it feels to be confused. Current self-report tools and Likert-type items which use a form of stepped scales may not be able to represent the qualitative, non-linear experiences of what it feels like to be confused. Thus, it may be worthwhile to consider integrating approaches that account for transitions in the experience (e.g., journaling, trace data, multimodal methods), to better account for the diversity of individual perspectives and experiences around confusion.

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