International Society of the Learning Sciences

Students' Epistemological and Positional Framing in Uncertain Situations during a Collaborative Design Activity

Navneet Kaur, Chandan Dasgupta
navneetkaur@iitb.ac.in, cdasgupta@iitb.ac.in
IDP in Educational Technology, IIT Bombay, Mumbai, India

Abstract: This study examines students' epistemological and positional framing when they collaboratively resolve uncertainties in a problem-solving process. We qualitatively analyzed three teams' discourse from the sixth standard classroom based on their behaviors in uncertain situations during design activity. We identified four types of students' epistemological framing and three types of positional framing in our data.

Introduction

Students experience uncertainties all the time in academic settings and there has been growing emphasis on ideas like problematizing content (Reiser, 2004) and engendering productive failure (Kapur & Bielaczyc, 2012) to help students meaningfully engage in and learn from uncertainties. However, how learning happens in a situation depends not only on teacher instruction and strategies but also on students' personal beliefs and understanding of the task they engage in and how they view their own and others' participation in that task (Greeno, 2009). We argue that it is crucial to understand learners' propensities in situations fraught with uncertainties for helping students productively grapple with uncertainties. This study explores this direction using 'Framing' as an analytical lens. The term "Framing" is used to describe an individual's interpretation and answer to the question - "What is it that is going on here?" (Goffman, 1974). Framing shapes how people experience situations, develop expectations, and make decisions (Hutchison & Hammer, 2010). For our analysis, we are particularly interested in two types of framing – students' epistemological and positional framing. Students' epistemological framing refers to their expectations and understanding about how to engage in the knowledge that they consider relevant for a task; in this case, the task of resolving uncertainty. Positional framing, on the other hand, refers to how students position themselves and others in their interaction (Greeno, 2009).We examined students' framing in the context of collaborative engineering design tasks since ill-structured nature of the design tasks makes them rich in providing students with opportunities to experience multiple types of uncertainties (Jordan & McDaniel, 2014).

Method

We conducted an engineering design activity in a sixth-grade classroom in a metropolitan city in India. In the study, we asked learners to design a balloon powered toy vehicle that travels straight and smooth for a larger distance. We randomly divided students in the class into groups consisting of either three or four participants to form twelve teams. For data collection purposes, we chose three teams based on the team's potential for providing rich data by virtue of active conversations between the members during the initial phase, where teams discussed problems among themselves. A materials kit was provided to the teams for constructing a prototype. Two primary researchers were present in the class as observers. The primary researchers were accompanied by three teaching assistants (TAs) from the same department. The primary role of the TAs was to handle the logistics related to audio and video data collection.

We analyzed video recordings using a coding scheme developed by Jordan et al. (2014) for identifying all the uncertainties that the team members experienced during the design activity . For each of the unique uncertainty identified in this step, we traced all the episodes where learners attempted to resolve them and then we transcribed these episodes. We then qualitatively analyzed students' discourse in each episode to identify their epistemological and positional framing. The unit of analysis is individual-in-group context (Hogan & Fisherkeller, 2005). We adapted the Interpretation Framework used by Shim et al. (2018) for our analysis. For sampling episodes to present in this study, we chose all the episodes related to the uncertainties regarding the issue of choosing an appropriate nozzle for the design. Students were given three different sized nozzles for building prototypes of their designs, and they had to choose one. This decision problem frequently triggered uncertainty for the team members in the problem-solving process.

Findings

In our data, we found different types of students' epistemological and positional framing. For example, there were instances when learners framed the uncertain situation as inquiry tasks where they engage in the exploration of

"what," "why," and "how" questions related to the uncertainty they experienced. For example, students try to resolve uncertainty by figuring out the relationship of the uncertainty to the task goals, finding out factors that cause or influence the uncertainty, and figuring out how they can intervene to alter those factors. In other uncertain situations, learners viewed these situations as a task to be completed or a decision to be made to move ahead and complete the activity assigned to them. In such epistemological framing, students are least bothered about making sense of the events that caused uncertainty; instead, they make quick random decisions to resolve the uncertainty. There were also situations where learners resist engaging in any form of knowledge building as they do not see any epistemic value in pursuing it. In these situations, learners do not share the uncertainty expressed by other team members in the first place. We call this type of epistemological framing "Framing uncertain situation as not worth pursuing." In this frame, learners either ignore the uncertainty or express their unwillingness to participate in the knowledge construction process through their actions. Learners also frame an uncertain situation as "resolvable by an authority figure" when they expect to construct knowledge to resolve uncertainty by receiving direct instruction from an authority figure. Instead of engaging in sensemaking activities, students desire an authority figure like a TA or a teacher to provide immediate solutions to resolve their uncertainty.

Regarding students' positional framing, one of the framings that we observed was where students positioned themselves and the other team member(s) in a "supervisor-assistant" kind of relationship. In this kind of positioning, "supervisor" is regarded as decision-making authority, and the assistant seeks the go-ahead from the "supervisor" for their work. Student positioning oneself as "supervisor" delegates work and direct instructions to those positioned as "assistant." For the cases in this category, we saw an implicit agreement of the roles students positioned for one another where team members positioned as "assistant" readily agreed to follow the "supervisor's" instructions. Students also often positioned themselves and other teammates as legitimate collaborators in the uncertainty resolution process. This kind of positioning is characterized by behaviors where students collaboratively solve uncertainty by seeking and considering each other's help, ideas, suggestions, and viewpoints. A few instances were where a participant treated other team members as unimportant or valueless to the team. Positioning a team member as an "insignificant member" is different from positioning the person as an "assistant." An assistant is regarded as a legitimate member of the team who has a specific role in the uncertainty resolution process. Positioning a person as an insignificant member indicates that the person is considered little to no value to the team's progress or success.

Conclusion

The finding also aligns with the previous studies, which show that students' framing is dynamic (Hutchison & Hammer, 2010; Shim & Kim, 2018). Students respond to various cues and accordingly keep shifting their framings. Expecting that students should always show productive framing like the "inquiry" frame might not be helpful. Instead, it would be beneficial to understand factors contributing to student framing and make efforts to orient them into the productive direction slowly. In future work, we expect to delve deeper into students' framing dynamics and have a nuanced understanding of moment-to-moment shifts in students' responses to uncertainties.

References

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience.* Harvard University Press.

Greeno, J. G. (2009). A theory bite on contextualizing, framing, and positioning: A companion to Son and Goldstone. *Cognition and Instruction*, *27*(3), 269–275.

Hogan, K., & Fisherkeller, J. (2005). Dialogue as data: Assessing students' scientific reasoning with interactive protocols. In *Assessing Science Understanding* (pp. 95–127). Elsevier.

Hutchison, P., & Hammer, D. (2010). Attending to student epistemological framing in a science classroom. *Science Education*, *94*(3), 506–524.

Jordan, M. E., & McDaniel, R. R. (2014). Managing Uncertainty During Collaborative Problem Solving in Elementary School Teams: The Role of Peer Influence in Robotics Engineering Activity. *Journal of the Learning Sciences*, *23*(4), 490–536. https://doi.org/10.1080/10508406.2014.896254

Kapur, M., & Bielaczyc, K. (2012). Designing for productive failure. *Journal of the Learning Sciences*, *21*(1), 45–83.

Reiser, B. J. (2004). Scaffolding complex learning: The mechanisms of structuring and problematizing student work. *The Journal of the Learning Sciences*, *13*(3), 273–304.

Shim, S., & Kim, H. (2018). Framing negotiation: Dynamics of epistemological and positional framing in small groups during scientific modeling. *Science Education*, *102*(1), 128–152.