Agreeing to Disagree: Challenges with Ambiguity in Visual Evidence

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Abstract: Students in CSCL environments can exhibit sophisticated argumentation skills. However, the challenges of using visual evidence are rarely addressed by current technological scaffolds. In light of the issues demonstrated in a dispute between two students over the meaning of a graph, we recommend that CSCL systems not only capture the outcomes of argumentation, but also the processes, whether of agreement or dissent. These would provide valuable learning objects, as well as insights into students' learning.

Background and Objectives

Learner-paced CSCL activities can allow students to pursue ideas through extended debate – opportunities for which are rare in traditional classroom instruction (Radinsky, Oliva, & Alamar, 2010). Technology-based scaffolds can furthermore enhance the benefits of learning through argumentation (e.g., Chin & Osborne, 2010) by supporting the interpretation and use of evidence in important discursive patterns, such as challenging, justifying, explaining, and understanding various perspectives of these processes. However, existing scaffolds rarely account for the unique challenges of using visual evidence in argumentation. Here, we offer an empirical illustration of the challenges posed by visual evidence, and recommend design features for CSCL environments that would support its use in students' argumentation.

Data Sources and Methods of Analysis

Our participants are Ted and Keiran (pseudonyms), one of 55 pairs of students in a California middle school who completed Global Climate Change (GCC). In GCC, a 5-day long computer-based module developed in the Web-based Inquiry Science Environment (WISE). In GCC, students are guided in their explorations of graphs and simulations to investigate the interaction of solar radiation with the earth's surface and atmosphere, and the impacts of human activity on levels of greenhouse gases. We focus on a dispute between Ted and Keiran that occurred on the first day of GCC, in which they attempt to resolve conflicting interpretations of a graph of global temperature change (Figure 1). Their case was selected because it illustrates the variety of argumentative strategies students can exhibit in CSCL systems. We qualitatively describe some unique challenges of using visual evidence in argumentation, and conclude by discussing implications for the design of CSCL environments that would support productive discourse with visual evidence.

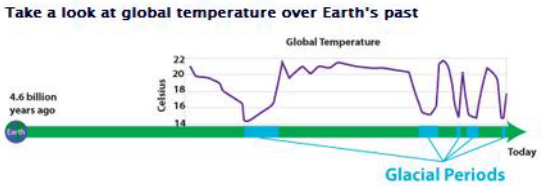

Figure 1. The Graph under Dispute by Ted and Keiran.

Findings

Perceptions are strongly influenced by prior expectations. Although the issue of subjectivity is true of any mode, there is an inherent vagueness of visual as opposed to numeric evidence (e.g., consider how 7 is indisputably greater than 2, but the visual salience of shape and line is subjective) that makes perception alone especially influenced by individual prior knowledge and expectations. For instance, Ted correctly recognized the rising and falling curve as an indication of fluctuating global temperatures: Sometimes it was hotter, and sometimes cooler than today. Meanwhile, Keiran attended exclusively to the pattern of increasingly narrow blue bars along the x-axis. These, he maintained, denoted briefer ice ages toward the present, and thus confirmed an assertion he had filtered from the previous activities in the unit, that "global warming made it warmer." It was a catchphrase he had earlier repeated, which now influenced the relative salience of the graphic elements before him.

Subjective interpretations are difficult to refute. Both Ted and Keiran skillfully provided evidence to justify their claims: Keiran directed Ted to notice the pattern of blue bars as consistent with increasingly shorter ice ages, as they had learned in the previous activities; and Ted broke down for Keiran the manners by which

different locations on the temperature curve corresponded to different temperature fluctuations. Yet, neither could find definitive fault in the logic of the others' interpretation. With no definitive way to interpret the graph, the students could only emphasize those components they personally deemed most salient. When Ted suggested Keiran mistakenly overlooked the temperature curve, Keiran objected, saying he did in fact consider it, but consciously disregarded it. "The thing that supported my answer was this," he said, and indicated the green x-axis. Such is the subjectivity of visual evidence that making explicit links between evidence and claims was alone not persuasive enough to shake either Ted or Keiran's commitments to their individual perceptions.

Criteria for evaluating visual evidence are not apparent. Failing to make Ted's perceptions align with his own, Keiran sought evidence beyond the graph as justification for his claims. In one instance, he argued that if the temperature curve were as important as Ted believed, the curriculum designer would have featured it accompanied by an explanation in the previous introductory screen. However, as the activity sequence was designed, only the green axis is presented with such an introduction. "That's the only important thing," Keiran consequently asserted. "That's why they only put this." In another instance, Keiran extrapolated a pattern from the temperature curve to support his claim that global temperatures were increasing. "It was super hot here," he said, and indicated a high point on the curve, "So I think it's going to be even hotter here," and he moved the cursor beyond the very end of the curve. That Keiran inappropriately resorted to making such inferences from evidence that was not available highlights the general lack of clear criteria upon which students can draw to effectively evaluate visual evidence.

Conclusions and Implications

Many CSCL environments assume eventual consensus between partners. Yet, supporting meaningful engagement in science means not only attending to the products of students' investigations – their consensus explanations – but also to the argumentative processes of their construction (Berland & Reiser. 2009). Indeed, in striving to reach consensus over conflicting views, students are stimulated to challenge one another's ideas and to make sense of alternative perspectives. By articulating connections between evidence and their claims, they can come to recognize where their knowledge lacks, and to build shared understanding of the phenomena investigated. However, such processes are rarely captured and objectified in CSCL systems. Moreover, with fewer criteria for evaluating visual as opposed to numeric data, it can be difficult for partners to successfully argue for and refute conflicting interpretations. As a result, students can be left struggling to effectively use visual evidence in argumentation. And with only one field in which to type what is meant to be a mutually agreed upon response, one of the partners will eventually feel the need to relent. "Just do it your way. I don't care if we got it right," Kieran told Ted. "But write 'I'," he insisted, seeking to distinguish Ted's response from his own.

To address these issues, CSCL systems might maintain a tangible record of key events and relations made between components of students' arguments, but with particular attention to the challenges of interpreting and using visual evidence. Thus, systems might prompt students to not only be explicit about the evidence they select from a given artifact as the basis of their claims (e.g., a fluctuating curve or a pattern of colored bars); but to also identify and articulate the prior knowledge and expectations attributed to their selections. Doing so may encourage greater awareness in students of the influences on their perceptions, and can also facilitate critical evaluation of visual evidence. Moreover, it would provide an artifact with which teachers and researchers can understand and assess students' use of and learning with visual evidence.

References

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