Making similar representations with different reasoning helped students learn through relation and abstraction

Analyzing the functions of multiple external representations of electric potential

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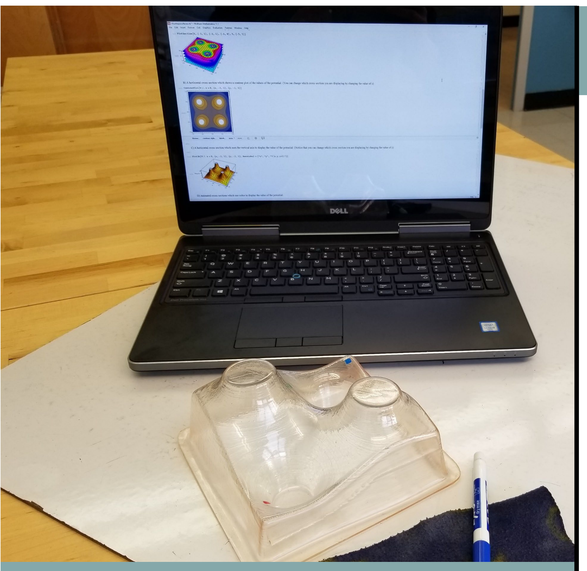


Research Question

What facets of this group's use of the multiple external representations are captured by the Functions framework?

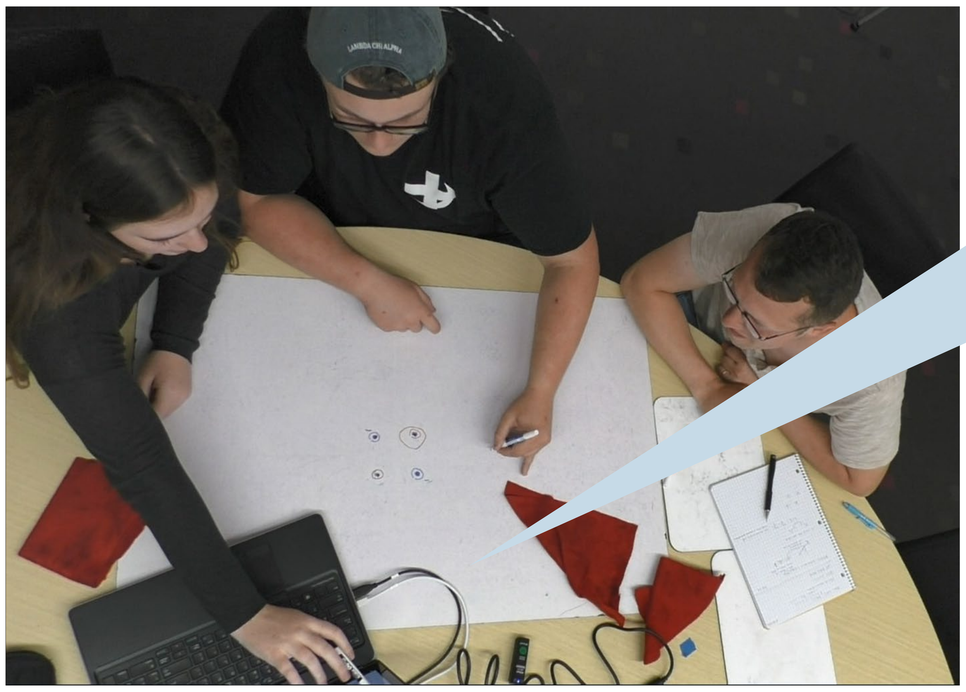
Complementary
- Processes
- Information

Construct deeper understanding through
- Abstraction
- Relation
- Extension

Constrain interpretation by
- Familiarity
- Inherent properties

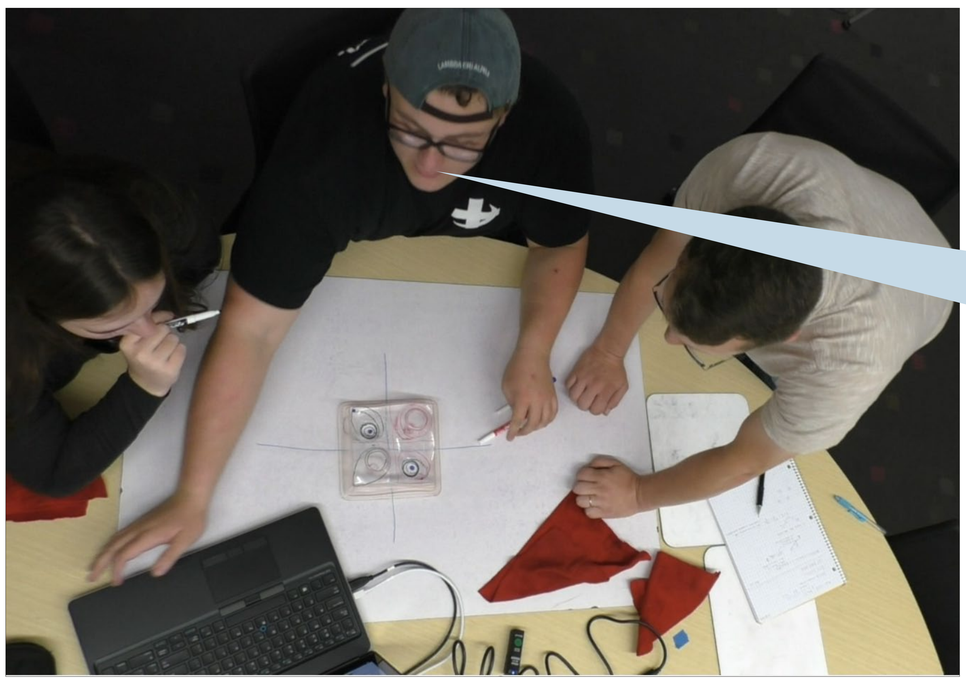
S. Ainsworth, The functions of multiple representations, Computers & Education 33, 131 (1999).

Students were prompted to work with their group to draw the equipotential curves in the plane of a quadrupole.



Sage: "Yeah, I was right! [Points to computer screen.] On the asymptotes it's zero because along those lines, there's equal push/pull."
Olive: "Right. And then, yeah, so it is actually spaced farther out that way and closer this way. So it's the opposite of what you [Forest] drew."

Forest: "When we get the [plastic graph], let's draw some rings on them."
Olive: "Oh! Cool."
Forest: "We can look at the projection."



Forest: "Can we snag one? We're trying to decide whether or not we think it'll be fatter this way or fatter on the back end"

Forest: "I'm just trying. . . I like our picture. I want to know what these do farther out. . . Is there a way?. . . Let's do this."

Forest: "I also appreciate that we can successfully use technology to not have to think about stuff. I like that. [Olive and Sage nod]"

Conclusions

The students sought to relate all three representations. Each representation recruited different reasoning processes while being produced. We see a need to consider this generation of representations when discussing how multiple external representations connect to student reasoning.

Paradigms @ OSU

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