Evaluating the Use of “I don’t know” Statements in Expert Thinking

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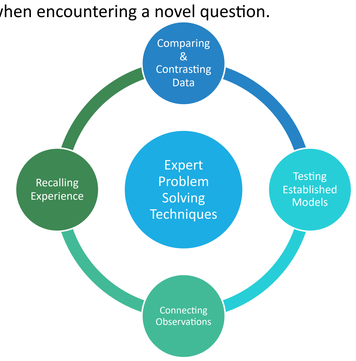
Abstract

Expert chemists often employ complex problem-solving strategies. These non-linear pathways may enable a chemist to progress through uncertainty when encountering a novel question.



In this study, expert chemists thought their way through a novel bonding question. During their responses, participants used “I don’t know” (IDK) statements as tools to continue working on the interview question in the face of uncertainty. Their IDK statements seemed to serve varying purposes. The overall effect of the use of IDK statements was to “unstick” the participant from an idea. We hope that this study contributes to normalizing the use of IDK statements in classroom settings. If positioning as “not knowing” enables experts to explore and grow in their learning, then that method of inquiry should be encouraged for students (Watkins).

Methods

Participants engaged in a semi-structured, recorded Zoom interview where they were asked to think-aloud through a novel chemical bonding question. At the start of the interview, all participants were told that there was no single, “correct” answer to the question(s) they would hear, that we were only interested in their thoughts, and that we hoped to learn how they chose to go about answering the question(s). The interview followed the basic, loose format shown below. Follow-up, precising questions were added, where necessary, to keep the conversation flowing. Data from this study was analyzed in a fashion consistent with Grounded Theory (Saldaña). The phrase “I don’t know” emerged as a focal point given its prominence across the fourteen interviews.

Question 1

- **Aim:** Welcome the participant; solicit a molecular structure from the given atoms
- Example: Image a compound made of one atom of fluorine, boron, and oxygen; how would you chemically describe it?

Follow-Up Questions

- Assess the comfortability of the participant with their molecule
- Observe the uncertainty levels of the participant

Question 2

- **Aim:** Interrogate the stability of the molecular structure drawn
- Example: Will this molecule be stable? Why may it not exist at STP?

Results

Expert chemists use IDK statements in a variety of ways to accomplish different goals. Selected examples of such uses are detailed below.

Contextualizing: Participants used an IDK statement to indicate their expertise in a particular subdiscipline of chemistry.

> “It all depends on bond energies. I would have to look it all up. You know, one of the things is you got to know what you don't know, and I know that **I don't know** much about boron chemistry, so you know I would be… I would be digging on the bond energies and how reactive it is and I’m sure papers have been written about this—boron complexes.”

Searching: A participant used an IDK statement as a complex tool to search for more information.

Marker for Concurrent Searching:

“And then, you know, just thinking about like how to, how to, you know, if there's a ring there, like plopping a fluorine sort of one bond away from the oxygen, **I don't know** how to… That, without having any real reasoning whatsoever, that doesn't feel right to me.”

The IDK statement was spoken slowly as if to suggest that thinking was occurring in the same moment.

Seed for Future Searching:

“I **don't know** if it'd be linear. Like, so like, it's a boron, like the borate, other borate esters that we saw, like those like to be little, you know, pyramids like so it's like you know, in terms of how, how their bonds are, are distributed around the center, the center boron atom.”

The IDK statement was spoken quickly while drawing and made the space for the participant to want to explore.

Reflecting: Participants used IDK statements to pause and take stock of their own thinking or to make an assessment of what they would like to contribute to the conversation.

> “It'd be helpful if I remembered actually how to determine formal charge—which I don't feel like—I mean, I can look up, if you need me to, but **I really don't know** if it'll be super helpful, for me.”

Shielding (Epistemic Distancing): Participants used IDK statements to distance themselves from an idea that they had mentioned.

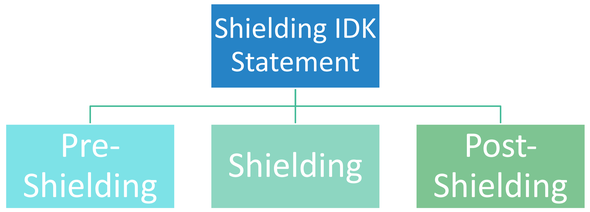
> “It may be tricky to find the right solvent that you could even isolate it in, or do you try to isolate it as its own thing? Or, do you try to see in the gas phase? **I don't know** it's…”

Factual: Participants used IDK statements to comment on their knowing or not knowing a particular, discrete piece of information.

> “But, I **don't know**. I’d have to look up the bond energies.”

Temporal Facets to Shielding

Epistemic distancing, as currently articulated, details the move of “saving face” after proposing an adventurous idea which the participant near simultaneously judges to be potentially incorrect or inapplicable (Conlin). Over the course of this work, expert chemists used IDK statements in strategic places: either before, in the middle of, or after proposing an answer to a stated or implied question.



Experts in this study preferentially utilized shielding or post-shielding IDK statements. This may indicate that experts are more willing to propose ideas and *then* weigh the importance or validity of that idea.

Participant Case Study

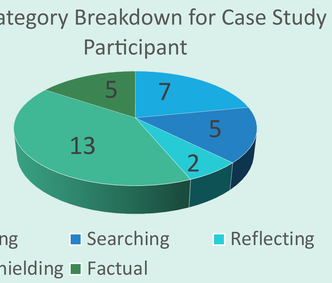
In this study, participants used an average of 13 IDK statements during the course of their reasoning through the interview questions. One participant used 36 consequential IDK statements to support his/her reasoning. Below are the distributions of IDK statements utilized by category.

> “Well, I know boron has some funky banana bond kind of things that I haven't thought about in 30 years, so I can't really tell you much about them. But, I do remember learning about them at one point in my education, and I, but I remember they’re called banana bonds; I **don't know**, did you learn about this in some class?”

The participant suggested a potentially valid line of reasoning to answer the odd bonding nature of boron; however, introducing “banana bonds” was immediately followed by an IDK statement (post-shielding) and a deflection question.

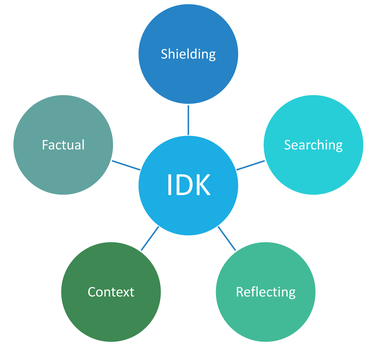
> “So, that's why I **don't know** if this [drawing] would work; I **don't know** if this would make some… will… would make the…. that would be allowed? I **don't know**, it might. I **don't know**.”

After drawing a structure, the participant used IDK statements to convey his/her comfortability with that structure and indicated that (s)he was not necessarily happy with that proposal. The cluster of IDK statements may suggest an increased level of discomfort with the suggestion that was provided. IDK statements were frequently appended to discussions based on the drawings provided by this participant.



Conclusions

In this study, expert chemists used IDK statements to reason their way through novel questions. Their avowals of ”not knowing” served as important moves for the participants as they made judgements and comments about their own knowledge and suggestions.



Experts demarcated the bounds of their knowledge and familiarity within the subdisciplines of chemistry as if to indicate a level of humility acquired with comfortability in the subject. Searching IDK statements provided experts with the space to reason and check their intuitions (Kahneman; Kahneman & Klein). As participants navigated the interview, they frequently commented on their prior contributions and took stock of what they might like to add to the discussion. Epistemic distancing, herein referred to as “shielding” may depict an intricate societal dynamic which favors the absoluteness of a “correct” idea over the importance of “not knowing” in the scientific fields. Future work should also be conducted to determine if there is a link between student and expert use of IDK statement assessments (Clement). Factual IDK statements may be important for experts to acknowledge what information they need to continue working, productively, through the problem in front of them. IDK statements may serve as a powerful epistemic move for scientists and students to “battle” a question in the face of uncertainty.

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