Patterns of student reasoning in solving structures from organic spectra
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Problem solving in the context of organic spectroscopy is highly dependent on students’ abilities to accurately interpret expert-like external representations (ER). Building on Schönborn and Anderson’s model of interpreting biochemistry ERs, we revised their 3-Phase Single Interview Technique (3P-SIT) to examine the nature of student reasoning while solving structures of organic compounds. In efforts to examine patterns of student reasoning, we utilized Carlson and Bloom’s framework in the phases of problem solving.

**Methods**
- Students were enrolled in the second semester sequence of organic chemistry at two different universities (N=20)
- Students were prompted to solve the structures of two compounds from 1H NMR spectra, with our primary focus on Phase 2B
- Transcribed interviews were coded in Nuvo for:
  - Resources
  - Reasoning
  - Monitoring
- Videos were coded for instances when participants:
  - Sketched parts of structure
  - Sketched complete structures
  - Consulted the provided chemical shift table
- Interviews were conducted in a laboratory environment with a combination of structured and open-ended questions.

**Preliminary Results**

- Students in the class with procedural based instruction (University A), exhibit similar monitoring styles, yet their structural pathways are different (shown below left).
- Students in the class with emphasis on theory and no procedural instruction (University B), exhibit less similarity in monitoring styles, yet 60% of those students began both Phases 2A and 2B with the same steps.

**Discussion and Future Directions**
- Students receiving procedural problem solving instruction utilize the methods they are taught.
- Students not receiving procedural problem solving instruction still develop their own problem-solving processes.
- Although monitoring progressions can be similar, their generated structural pathways typically differ.
- Further examination of monitoring patterns may provide evidence of other reasoning strategies, e.g. trial and error.
- Connecting monitoring to the specific language used in the transcripts may elucidate what steps in monitoring lead from one structure to the next and the reasoning behind these actions.

**References**

**For more information**
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