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BEYOND THE BEAKER:
Scaffolding students to connect observations with the particle level in organic chemistry

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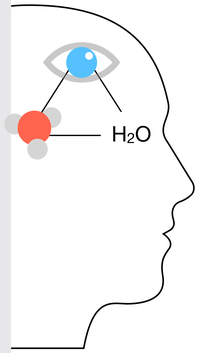
MOTIVATION



- Meaningful understanding of chemical processes requires
  1. constantly **shifting between the representational levels**: the macroscopic, the submicroscopic and the symbolic level[1]
  2. reasoning about **mechanistic features** (entities, properties, organization and activity) at each of these levels[2]

Research shows that students have **difficulties to discern and comprehend the meaning of the submicroscopic level** and its visualization[3], especially in the laboratory[4].

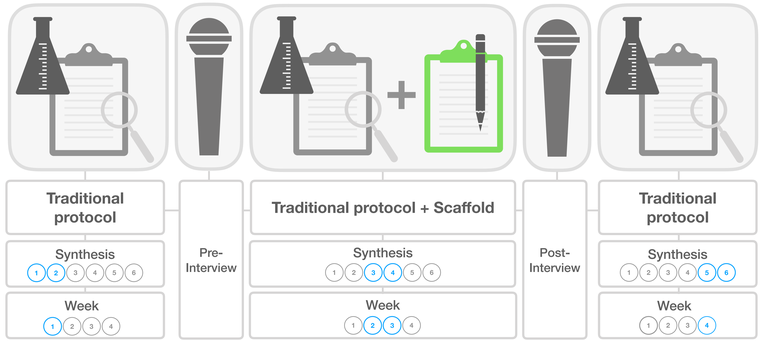
The expository lab fails to help students discerning the relationship between their observations and the corresponding explanations[5].

To what extend does an **instructional scaffold for the organic laboratory supports students in connecting the representational levels?**

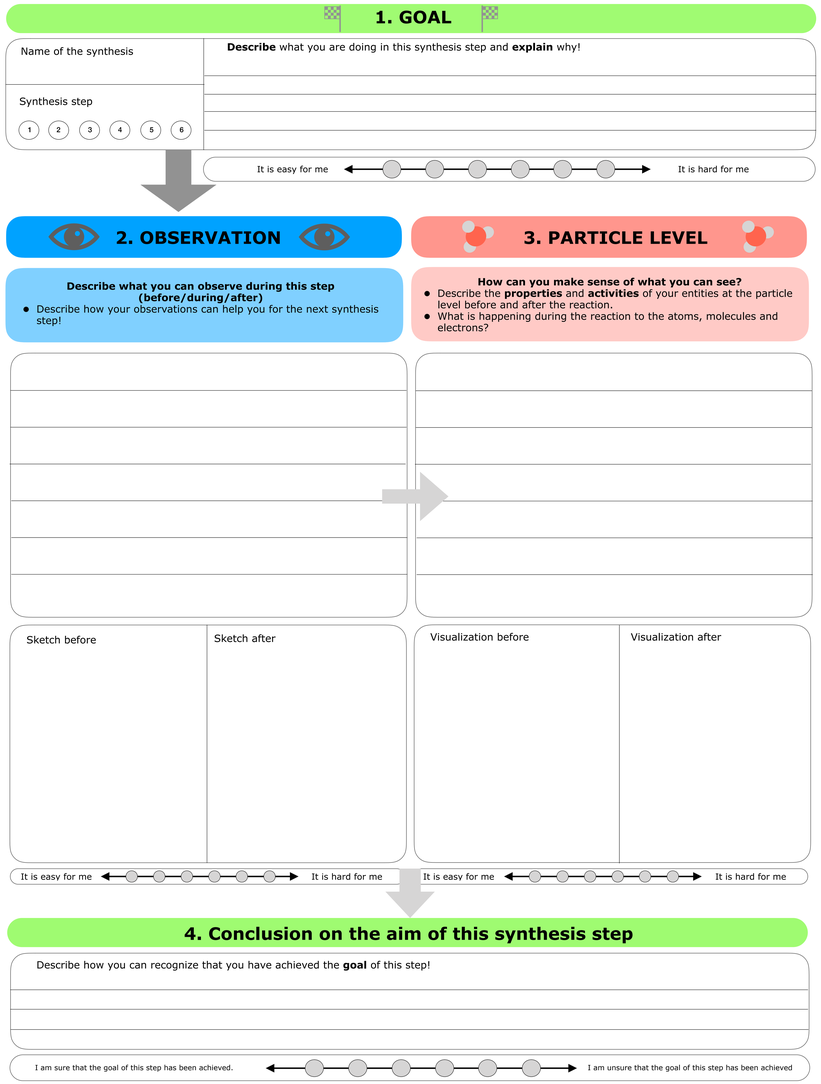
METHOD

Context and Participants

- Data was collected in an organic chemistry lab for student teachers in 2019.
- 22 undergraduate chemistry student teachers (15 female and 7 male)

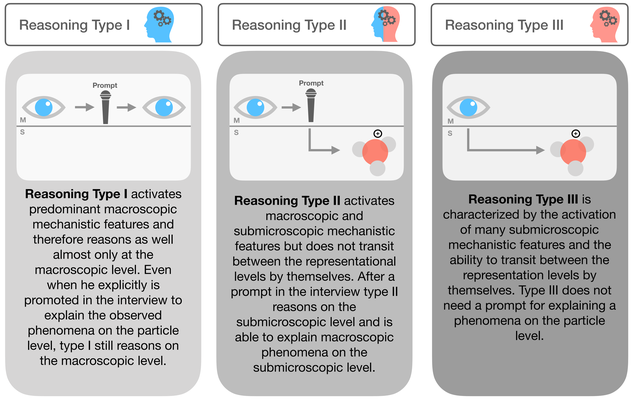


INSTRUCTIONAL SCAFFOLD



CONCLUSION

- Students can be characterized in their approach to make-sense of their organic synthesis on the representational levels, before and after working with the instructional scaffold
- There seems to be three dominant **Types**
- After working with the scaffold, we could observe that students change their approaches



- The here-reported scaffold seems to be a good compromise between expository and new approaches like inquiry-, or problem-based labs
- Students showed **gains in their understanding of the synthesis and its underlying explanation** especially on the submicroscopic level.

REFERENCES

1. Johnstone A. H., (1993), The Development of Chemistry Teaching: a changing response to changing demand, J. Chem. Educ., 70, 701–705.
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3. Gilbert J. K. and Treagust D. F., (2009), in Gilbert J. K. and Treagust D. F. (ed.), Multiple representations in chemical education, Dordrecht: Springer, vol. 4, pp. 333–350.
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5. Collison, C. G., Cody, J., & Stanford, C. (2012). An SN1–SN2 Lesson in an Organic Chemistry Lab Using a Studio-Based Approach. J. Chem. Educ., 89(6), 750-754.