

First-year engineering students' metacognitive strategies demonstrated through weekly reflection over the span of one semester

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Background

- Metacognition is important in developing learning strategies
- Sole emphasis on technical concepts in engineering courses leads to a lack of reflection and lack of development of learning strategies¹
- Having students reflecting on their work and current learning strategies can help them develop metacognitive strategies and become self-directed learners
- Tracking metacognitive strategies over time will help identify whether consistent reflection aids development of learning strategies

Purpose

Examine changes in first-year engineering students' metacognitive strategies, as demonstrated through responses to weekly reflection prompts, over the span of a semester.

Research Question

How do first-year engineering students' metacognitive strategies change over the course of a semester when reflecting on their learning via weekly reflection prompts?

Methods

- Participants:** First-year engineering students in three sections of a large required course; N = 1521, n = 344
- Data Collection:**
 - Students' self-ratings regarding their mastery of course learning objectives (LO's)
 - Students' responses to open-ended weekly reflection prompts concerning their successes and difficulties in mastering course LO's
- Qualitative Coding Analysis:** Coding of metacognitive strategies demonstrated in written reflective responses to open-ended prompts

Open-ended Reflection Prompts

- Considering the evidence of proficiency for the LO's:
- what is going particularly well for you? Be specific.
 - what is particularly difficult for you? Be specific.

Metacognitive Regulation Dimensions Coding Scheme^{2,3,4}

Planning	Preparing for continued learning/improvement or future tasks: awareness/need (Low), action OR goal (Medium), action AND goal (High)
Monitoring	Reflecting on understanding of course content: understanding w/out reference to topic/LO (Low); experience with a topic/LO (Medium); understanding/experience with specific details of a topic/LO (High)
Evaluating	Assessment of performance using an external indicator to confirm understanding: problem/success w/out further explanation (Low); solution/action using feedback/answer key (Medium); change in thinking/understanding supported by solution/feedback (High)

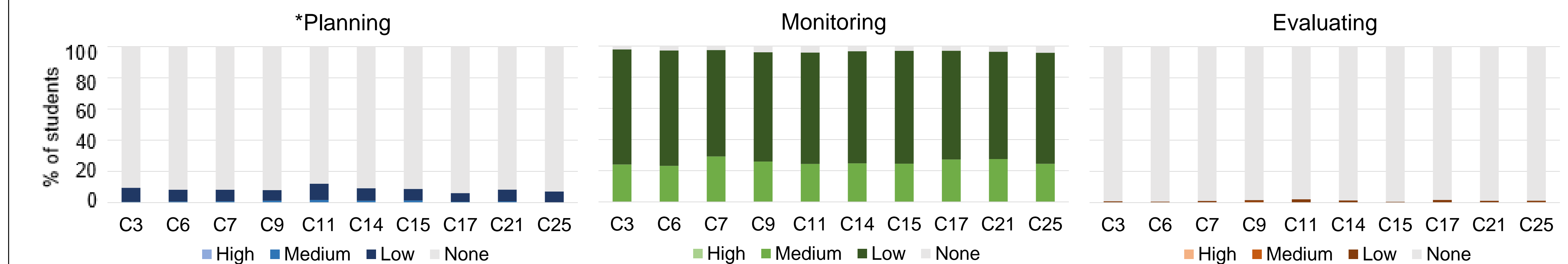
References

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Acknowledgement

Thank you to the University of Nebraska-Lincoln UCARE program for funding this research project.

Results



* Plans for improvement were considered in a multiple-select list item of learning strategies types (e.g., office hours) in a different part of the reflection (possible explanation for low levels of planning in written reflections)

Discussion

- Overall, highest level of reflection reached was low
- Majority monitoring strategies used, little to no planning and evaluating
- Improvement in metacognitive strategies not seen across semester
- Students focused on understanding of overall topics but struggled to reflect on specific details of topics or LO's

Conclusion

- Students need more guidance on how to improve learning strategies through reflection
- Students who are new to reflection need prompts that specifically guide them to engage in different metacognitive strategies
- Coding scheme could serve as a guide for students to identify different levels of reflection and strive for higher levels in their reflections
- Instructors could use coding scheme as a rubric to provide feedback on students' reflections to help improve learning strategies and reach higher levels of metacognitive strategies