CIFellows 2020-2021

Computing Innovation Fellows

Subgoals' Learning Now, and Then!

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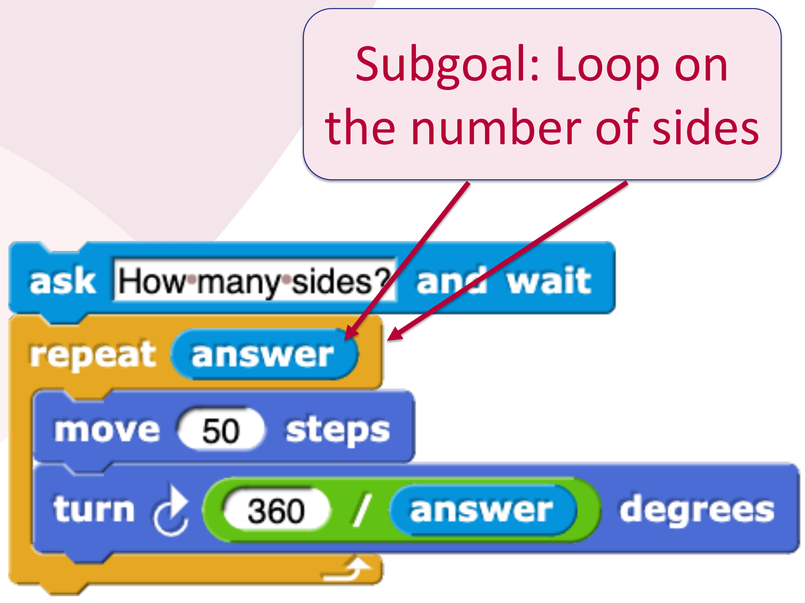
What is Subgoal Learning?

- A strategy used predominantly in STEM fields that helps students deconstruct problem-solving procedures into smaller structural parts [1].
- Subgoals can be constructed by instructors, or students [1, 2], or detected automatically from prior solutions [3].

Subgoal Example



Why Subgoal Learning is Important?

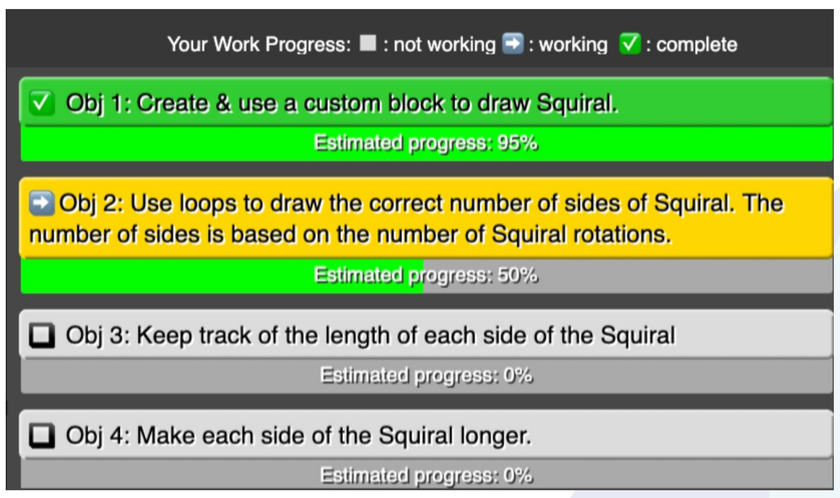
- Decreases students' cognitive load.
- Increases students' ability to transfer learning across contexts.
- Increases students' performance, and persistence to complete tasks.

Expert-authored Subgoals Vs. Automated Subgoals

Expert-authored subgoals: Several studies showed that students learn best when they generate their own subgoals more than when they are given predefined subgoals [1, 2].

Automated subgoals: Prior work used data-driven methods to generate subgoals with immediate formative feedback on each. Studies found that it improved students' performance, task completion rate, and intentions to persist in CS [3].

Checkout demo here:
https://go.ncsu.edu/aif2021



Future Directions

- Examine students' strategies of problem decomposition into subgoals across domains.
- Explore the impact of subgoal learning when complemented with other effective instructional techniques (e.g. self-explanation prompts).
- Develop tool to assist in problem decomposition.
- Explore the impact of such tool on performance of underrepresented groups.

References

1. Margulieux, L. E., & Catrambone, R. (2017). Using learners' self-explanations of subgoals to guide initial problem solving in app inventor. In Proceedings of the 2017 ACM Conference on International Computing Education Research (pp. 21-29).
2. Margulieux, L. E., Morrison, B. B., & Decker, A. (2020). Reducing withdrawal and failure rates in introductory programming with subgoal labeled worked examples. International Journal of STEM Education, 7, 1-16.
3. Marwan, S., Gao, G., Fisk, S., Price, T. W., & Barnes, T. (2020). Adaptive immediate feedback can improve novice programming engagement and intention to persist in computer science. In Proceedings of the 2020 ACM conference on international computing education research (pp. 194-203).

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