Develop Expertise in Students
by Creating Cognitive Apprenticeships for Students

Learning in a discipline involves more than acquisition of content knowledge. Development of expertise requires students to develop skills in reasoning and strategies for solving disciplinary problems or applying disciplinary models to real-world applications. Fields with tradition of teaching through apprenticeships include trades and crafts dominated by skills and tasks that students can easily observe (e.g., building a cabinet, tailoring a piece of clothing). Academic disciplines present challenges because disciplinary strategies for reasoning and problem solving are cognitive strategies and are not readily observable. Nevertheless, students must acquire these skills to develop advanced skills in the discipline.

Collins, Brown, and Holum (1991) propose that instructors must find strategies to make their expert thinking and problem-solving skills explicit to create effective cognitive apprenticeships in academic disciplines. They propose the following components for an effective cognitive apprenticeship:

- Domain knowledge: the subject matter content usually addressed in textbooks and lectures
- Heuristic strategies: techniques used to accomplish common tasks in the discipline
- Control strategies: approaches experts use to guide their problem-solving processes
- Learning strategies: knowledge about how to learn new concepts, procedures and strategies

We have many strategies for transmitting domain knowledge (lectures, textbooks, etc.), but the remaining three components must be addressed in other ways. Colling, Brown, and Holum (1991) suggest the following strategies:

- Model a task so that students can observe all of the component steps — completing a heuristic strategy, thinking aloud to demonstrate how you guide your problem solving
- Coach students and provide feedback on their actions while they perform a task or solve a problem
- Scaffold tasks by breaking a complex task into simpler components that build on one another
- Encourage students to verbalize their thought processes while solving problems so you can observe and offer feedback to correct sub-optimal strategies
- Ask students to reflect on their performance and compare their strategies and outcomes to others
- Explore new problems; solving the same problems over and over encourages a plug-and-chug mentality that does not generalize well to the new problems students encounter

Pay attention to the sequence of learning activities to build skill.

- Begin with a conceptual model for the larger task. This model creates a road map that enables students to identify how component skills contribute to larger goals.
- Initial tasks should be relatively simple; later tasks should add complexity as students become more skilled. Create a series of assignments or projects that provide repeated practice with initial skills; later tasks include additional skills without becoming overwhelmingly complex, the final project should require the full set of skills.
- Introduce variations in how students apply skills to new tasks and assignments that add complexity. Students must then make decisions about when and how to apply a strategy they've practiced and increases the likelihood that students will apply strategies to new situations appropriately.

Resources:

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator, 15 (3)*, 6-11, 38-46.

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