Teaching Metacognition

This webpage is a summary, written by Carol Ormand, of Marsha Lovett's presentation at the 2008 Educause Learning Initiative conference. Dr. Lovett's slides and a podcast of her presentation can be accessed at https://net.educause.edu/ir/library/pdf/ELI08104.pdf

Teaching Metacognition Improves Learning

Metacognition is a critically important, yet often overlooked component of learning. Effective learning involves planning and goal-setting, monitoring one's progress, and adapting as needed. All of these activities are metacognitive in nature. By teaching students these skills - all of which can be learned - we can improve student learning. There are three critical steps to teaching metacognition:

1. Teaching students that their ability to learn is mutable
2. Teaching planning and goal-setting
3. Giving students ample opportunities to practice monitoring their learning and adapting as necessary

Self–Regulated Learning

Expert learners consider their learning goals, plan accordingly, and monitor their own learning as they carry out their plans. Novice learners, in contrast, don't have explicit learning goals, fail to plan, and often have only one learning strategy, which they apply without thinking about whether it's appropriate to the situation. Not surprisingly, novice learners are often disappointed in the results of their studying, while expert learners are generally satisfied with their results (and will make adjustments if not).

Expert learners engage in what we call Self-Regulated Learning. A Self-Regulated Learner begins with goal-setting and planning, taking into account his or her time constraints, strengths and weaknesses relevant to the learning task, and motivation for learning. Having set reasonable goals and planned his or her learning strategies, the Self-Regulated Learner then implements his or her plan, monitoring the results as he or she studies. If the chosen strategies are working well, he or she continues; if not, he or she makes adjustments and monitors the results until they are in line with his or her learning goals.

Expert Learners Can Be Made

Although early attempts to teach students metacognitive skills were unsuccessful, more recent studies demonstrate that metacognition can be taught and learned.

Step 1: Teach students that the ability to learn is not a fixed quantity

The key to a student's ability to become a self-regulated (i.e., metacognitive) learner is understanding that one's ability to learn is a skill that develops over time rather than a fixed trait, inherited at birth. Students who believe that the ability to learn can improve over time earn higher grades, even after controlling for prior achievement (Henderson and Dweck, 1990). These students set reasonable learning goals for themselves and have the self-efficacy to choose and use productive learning strategies. These strategies then result in learning gains. Moreover, students can be taught that their ability to learn can improve over time; those who learn this simple lesson show increased motivation to learn and improved grades (Aronson et al., 2002; Blackwell et al., 2007).
Step 2: Teach students how to set goals and plan to meet them

Many students don’t set explicit learning goals for themselves, or make plans to meet any goals they might have. Yet students who received as little as half an hour of training (in the form of one-to-one tutoring) on the process of self-regulated learning outperformed students who did not receive the training in several important ways. First and foremost, they learned more. In addition, they planned how they would spend their time in the learning task, spent more of their time in goal-oriented searching, and periodically reminded themselves of their current goal (Azevedo and Cromley, 2004).

Step 3: Give students opportunities to practice self-monitoring and adapting

Accurate self-monitoring is quite difficult. Many first-year college students, in particular, are over-confident. For example, first-year students at Carnegie Mellon University were asked what grades they anticipated earning in their science and math courses. While results varied somewhat by subject area, more than 90% of students in biology, chemistry, physics and calculus courses expected to earn A’s or B’s. These expectations were clearly not realistic and suggested some problems on the horizon for these students.

Teaching Self-Monitoring Strategies

Monitoring and adapting strategies can be taught as learning habits. A wrapper is one tool for teaching self-monitoring behavior. A wrapper is an activity that surrounds an existing assignment or activity and encourages metacognition. For example, wrappers can be used with lectures, homework assignments, or exams. Wrappers require just a few extra minutes of time, but can have a big impact. They are effective because they integrate metacognitive behavior where it is needed - when the student is in a learning situation where self-monitoring can be helpful. Students can also get immediate feedback on the accuracy of their perceptions, thus alleviating the problem of over-confidence. Finally, wrappers require minimal faculty time.

Example: lecture wrappers

Prior to beginning the day’s lecture, the instructor gives students some tips on active listening. In particular, students are encouraged to think about the key points of the lecture as they listen and take notes. At the end of the lecture, students write what they think the three most important ideas of the lecture were on an index card. After they hand those in, the instructor reveals the three most important ideas from the lecture. This immediate feedback allows students to monitor their active listening strategies. After three successive lecture wrappers (with successively less faculty support, from a mini-lecture on active listening to no advance warning), student responses increasingly matched the instructor's: 45% the first time, 68% the second time, and 75% the third (Lovett, 2008).

Example: homework wrappers

Before beginning a homework assignment, students answer a brief set of self-assessment questions focusing on skills they should be monitoring. Students complete the homework as usual, and then answer a follow-up set of self-assessment questions. For example, for a homework assignment about vector arithmetic, a student may be asked (beforehand) "How quickly and easily can you solve problems that involve vector subtraction?" and (afterward) "Now that you have completed this homework, how quickly and easily can you solve problems that involve vector subtraction?" Student reports from the homework wrappers ranged from noting that the practice exercises were helpful to them to commenting that they were probably overconfident before doing the homework problems.

Example: exam wrappers

When graded exams are returned (as soon as possible after the exam was given), students complete an exam reflection sheet. They describe their study strategies, analyze the mistakes they made, and plan
their study strategies for the next exam. These reflection sheets are returned to students before the next exam, so that they can make use of the ideas they had when the previous exam was still fresh in their minds. Students identified several new approaches they would use in future exam preparation.

Conclusions

- "Metacognitive skills and beliefs about learning have consequences for students' learning and performance.
- "Teaching metacognition - introducing these new skills and beliefs, and giving students practice at applying them - improves students' learning.
- "Low-cost interventions can have big payoffs."

References Cited


Adapted from “The Role of Metacognition in Teaching Geoscience” Carleton College,” (November 2, 2015) http://serc.carleton.edu/NAGTWorkshops/metacognition/teaching_metacognition.html