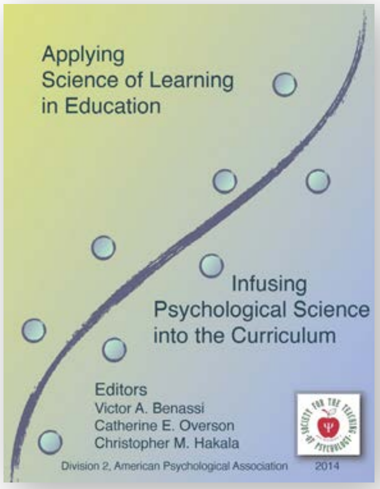

How Accuracy in Students' Self Perceptions Relates to Success in Learning

Joyce Ehrlinger and E. Ashley Shain
Washington State University

Most teachers are all too familiar with the challenge of helping students who remain baffled about why they are not doing well in class. "But I studied so hard!" students might say. "I don't understand how I could have gotten such a low test score!" The frequency of such concerns among students highlights the difficulty that students face when trying to understand whether they have truly mastered learning a topic, when they prepared themselves well for exams, and when their learning might fall short.

Effective learning requires metacognition — the process of reflecting upon which learning concepts one has already mastered, what still needs to be learned, and how to best approach the task of learning. Within educational contexts, metacognitive perceptions are defined as students' beliefs about their learning process, including the degree to which they have mastered learning tasks. Students' metacognitive perceptions reflect the degree to which they believe that they understand lesson material and have mastered learning different concepts or tasks. In this chapter, we review research suggesting that students' metacognitive perceptions are often error-prone. We discuss factors that introduce error into students' perceptions and offer concrete suggestions designed to help encourage greater accuracy in students' perceptions and, in turn, to facilitate student learning.

Accuracy of Metacognitive Perceptions

To the degree that students hold accurate metacognitive perceptions during learning, they can make wise decisions about how best to allocate their time studying and which strategies to use in order to learn course material. However, it can be very challenging for students to have true insight into the quality of their understanding and learning. Laboratory-based research suggests that there are some learning tasks about which students make quite accurate predictions about their level of learning and about the degree to which they will perform well on tests of their knowledge (e.g., King, Zechmeister, & Shaughnessy, 1980; Leonesio & Nelson, 1990; Nelson & Dunlosky, 1991). However, for many learning tasks, students' metacognitive perceptions tend to be error-prone. The degree to which students' perceptions are accurate depends on the topic being studied and the students' level of ability, as well as a number of other factors. On average, however, research suggests that students' metacognitive perceptions tend to be plagued by error across a variety of academic subjects (for review, see Dunning, 2005). Often students are wildly inaccurate about a host of abilities and personal qualities (e.g., Fischhoff, Slovic, & Lichtenstein, 1977). In the classroom, many students tend to hold overly positive impressions of their current level of knowledge (e.g., Ehrlinger & Dunning, 2003), the quality of their performance on academic tests (e.g., Ehrlinger, Johnson, Banner, Dunning, & Kruger, 2008), and the speed with which they can master and complete future academic tasks (e.g., Buehler, Griffin, & Ross, 1994).

One might wonder whether there is any reason to be concerned about overconfidence in students. After all, confidence is often considered a positive trait. Indeed, research suggests that students who are confident about their ability to succeed in school tend to perform better on academic tests than those with less confidence (e.g., Zimmerman, Bandura, & Martinez-Pons, 1992). That said, negative consequences also stem from being too confident in the classroom. Students who are overconfident about their ability to succeed in college end up feeling more disconnected and disillusioned than those with more modest expectations (Robins & Pals, 2001). Overconfidence can also leave students with mistaken impressions that they are fully prepared for tests and no longer need to study (Metcalfe & Finn, 2008; Metcalfe & Kornell, 2005). People who have relatively accurate perceptions regarding their progress in learning tend to use more effective study habits and perform better on tests than do those with more error-prone views of their knowledge (Thiede, Anderson, & Therriault, 2003).

Overconfidence can be particularly troubling when it exists in those who are truly performing poorly in the classroom. Top students do often hold overly positive views of their learning but this seems far less troubling than overconfidence among those with failing test scores. Tragically, it tends to be the poor students, however, who demonstrate the most overconfidence (Dunning, Johnson, Ehrlinger, Kruger, 2003; Ehrlinger et al., 2008). Consider, for example, one study in which college students who had just completed a test in their psychology course were then asked to estimate how well they had performed. Overconfidence was common in students' performance estimates. However, those students scoring in the bottom quartile were, by far, the most overconfident students in the class. The actual performance of these students averaged in the 12^{th} percentile in the class. However, these students estimated that they had performed in the 61st percentile on average (Ehrlinger et al., 2008). They were vastly overconfident about the quality of their test performance. This seems almost unfair. Certainly poor students have the most room for improvement and, thus, the greatest need for understanding when improvement is necessary. However, these students lack knowledge necessary to know when they have offered answers that are incorrect. Thus, bottom performers in the class struggle both with their poor grades and with particularly error-prone, overconfident metacognitive perceptions about their progress in learning.

Although overconfidence creates troubling roadblocks to learning, the opposite issue — underconfidence — comes with its own costs in the classroom. Perhaps the most noteworthy cases in which underconfidence impedes learning are in the fields of science, technology, engineering, and math (STEM). A wealth of research suggests that women in general and, in particular, women who are Black, Hispanic, or American Indian are vastly underrepresented in STEM fields (e.g., NSB, 2006; NSF, 2009). For example, women account for less than 20% of undergraduate computer science and engineering degrees and less than 25% of the doctoral degrees awarded in these fields (NSF, 2009). Multiple factors combine to create and perpetuate the lack of diversity in STEM fields. However, underconfidence is among the factors that dissuade women and underrepresented minorities from participating in these fields. Women and underrepresented minority students tend to report lower confidence in their abilities for STEM subjects compared to white men (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999; Ehrlinger & Dunning, 2003). This lack of confidence then leads these students to perceive that they are performing poorly in their classes and, ultimately, to avoid future opportunities related to STEM. For example, Ehrlinger and Dunning (2003) demonstrated that a tendency for women to hold less confidence in their scientific ability, compared to men, led women to be less confident about their performance on a science test. This difference in confidence emerged even though men and women performed equally well on the test! Further, women's comparative lack of confidence led them to show less interest in a future science opportunity than men in the study (see also Ehrlinger, 2008; Goodman et al., 2002). Thus, even talented students can end up withdrawing from important fields because they lack the confidence necessary to understand how much they could accomplish.

How Metacognitive Monitoring Relates to Learning

One important reason that students might hold overly positive or, in the case of STEM fields sometimes negative, metacognitive perceptions is that they do not always strive to hold accurate views of their progress in the classroom. Students differ in the degree to which they actively engage in metacognitive monitoring, or monitoring whether and how well they have mastered learning tasks. Individuals who engage in metacognitive monitoring are more likely to discover gaps in their understanding than are those who do not monitor. Metacognitive monitoring allows students to identify which concepts they have mastered, which they want to work on more, and which concepts might be so difficult that it isn't worth the time and effort necessary to truly learn them (Metcalfe & Kornell, 2005; Kornell & Metcalfe, 2006). Past research suggests that students can draw upon this metacognitive monitoring information when deciding whether and when to engage in learning tasks (Ehrlinger & Dunning, 2003), how to focus their study time (e.g., Kornell & Bjork, 2007; Metcalfe & Kornell, 2005), and which strategies to use (e.g, Kornell & Metcalfe, 2006; Thiede & Dunlosky, 1999).

Metacognitive monitoring has important benefits for student learning. Those who engage in monitoring perform better on measures of learning than those less likely to monitor. Students who do not monitor are likely able to maintain confidence in their skill level even when it is not merited. By engaging in metacognitive monitoring, students take an active role in the process of learning (Chen, 2002; Schraw & Dennison, 1994; Vrugt & Oort, 2008; Yukselturk & Bulut, 2007). In addition, study strategies that entail metacognitive monitoring are particularly effective in advancing learning. For example, quizzing oneself on course material (Roediger & Karpicke, 2006; see Pyc, Agarwal, & Roediger, this volume, for a review) and summarizing key points from text passages (Thiede, Anderson, & Therriault, 2003) lead to improvements in learning. Further, students who are encouraged to monitor their understanding and knowledge show better student outcomes than those who are not. Students who received instruction in metacognitive monitoring (i.e., were asked to make confidence judgments) engaged more fully in the classroom, remembered more course material, and performed better on subject-matter tests than control participants (Georghiades, 2000). In addition, students required to make judgments of learning in conjunction with readings in their physics class demonstrated significantly higher text comprehension than control participants (Koch, 2001). It is worth noting, however, that the degree to which metacognitive monitoring leads to improvements in student learning depends heavily on the degree to which students are able to accurately evaluate their level of knowledge and understanding (Dunlosky, Hertzog, Kennedy, & Theide, 2005). To the degree that students are able to accurately identify what they have not fully mastered, they can effectively direct their efforts toward improving mastery (e.g., Kornell & Bjork, 2007; Metcalfe & Finn, 2008; Thiede et al., 2003) and perform better on tests (Dunlosky & Rawson, In Press).

Recommendations for Educators

We have described research suggesting that students who develop accurate metacognitive perceptions and who monitor their metacognition reap benefits in terms of success in learning. What, then, can teachers do to encourage accurate metacognition and metacognitive monitoring among their students? There are at least two broad strategies that educators can utilize in order to encourage improved metacognition in the classroom. First, we will discuss how teachers can encourage students to utilize learning strategies that have been demonstrated to help them gain more accurate perceptions of their learning and, in turn, to perform better on tests. Finally, we will discuss the ways in which teachers can encourage positive mindsets that minimize the degree to which students feel threatened by difficulty in the classroom and, as such, are more open to understanding how they can improve their success in learning.

Encouraging metacognitive monitoring through study strategies

We began this chapter by referencing the challenges that teachers face in trying to help students who fail to understand why they have performed poorly. As mentioned earlier, these students serve as salient reminders that they do not always hold accurate perceptions of their learning. Further conversation with these frustrated students also tends to reveal other ways in which they lack insight in the classroom. Often, they fail to understand the best strategies for improving their level of learning. It is especially important that students learn more effective strategies so that they can better direct their own learning and have more accurate insight into their learning processes.

Students do not always have good insight into what specific strategies they need to use to improve their learning (e.g., Pyc & Dunlosky, 2010), so it is important for educators to explicitly encourage these strategies or use them when appropriate as part of a classroom setting. For example, students may feel like cramming all of their studying into a long session just before the test is an effective strategy for learning information. Indeed, this type of cramming before an exam can leave students feeling very confident of their knowledge (Baddeley & Longman, 1978; Bjork, 1999; Simon & Bjork, 2001). However, actual sustained learning is much more likely to result from spacing out one's study (Bahrick, 1979; Schmidt & Bjork, 1992; see Carpenter, this volume, for a review). Students are particularly likely to mass their study together into single study sessions when working on difficult material (e.g., Pyc & Dunlosky, 2010). However, spacing out one's study over time can hold particularly strong benefits for learning difficult concepts (Cuddy & Jacoby, 1982).

Another common learning strategy that can impede accurate metacognition is the use of flashcards to learn or study new material. Students who use flashcards may become overconfident that they have learned association because they have immediate access to an answer (Koriat & Bjork, 2006). This overconfidence may lead students to neglect practice on items they do not understand well. A more helpful strategy that gives students better insight into their own learning is for students to quiz themselves on the study material, which has been show to encourage long-term learning of material (e.g., Roediger & Karpicke, 2006). When students self-quiz, they are required to think of questions to ask of themselves (i.e., judge what is important about the topic), and if used properly, this strategy will help students simulate the testing environment by answering their own questions without immediate access to answers to the questions. Other effective learning strategies include summarizing main points of a text (Thiede, Anderson, & Therriault, 2003), and asking students to make judgments of how well they understood reading or textbook passages for their classes (Koch, 2001). To summarize a text, students need a basic understanding of what the text means and how the main points in the text relate to one another; this process helps provide students with feedback on what they have learned or not learned according to how well they can write about the text. Further, making judgments of understanding for a text overtly asks students to think about what they need to read over again or spend more time understanding. Overall, more effective learning strategies help give students more feedback and insight into how they learn and how they learn well. For students, having better insight into their own learning is associated with improved long-term retention of material and improved performance in college (Chen, 2002; Schraw & Dennison, 1994; Vrugt & Oort, 2008; Yukselturk & Bulut, 2007). Teaching these strategies to students and reinforcing them through classroom use (e.g., asking students to reflect on how well they understood various parts of a class reading) will give them the tools to gain better insight into their own learning.

Encouraging metacognitive monitoring through motivation

We know that metacognitive monitoring helps students to see the "big picture" of their learning habits and current knowledge, which then can provide an opportunity for students to improve learning habits and increase knowledge when appropriate. Given the opportunity to gain knowledge and improve the learning experience, why do some students not engage in metacognitive monitoring? Even when students are taught effective study strategies for learning, they might not be willing to expend the extra effort inherent in some of the most effective learning strategies. Students are especially vulnerable to ineffective habits when facing difficult material. Even though spacing study out over time instead of massing it together creates "desirable difficulties" that promote sustained learning of material (e.g., Schmidt & Bjork, 1992; Bjork, 1994; see Clark & Bjork, this volume, for a review), students often choose to mass study rather than space it over time (Pyc & Dunlosky, 2010). When students separate study sessions, they must come back to the material and reevaluate what they remember and need to study harder since the last study session. Students who do not space practice may have a hard time realizing how much they have left to learn, contributing to overconfidence in their learning.

One strategy that teachers can use to help students use effective learning strategies is to foster mastery goals in the classroom. Students who hold mastery goals focus mainly on trying to learn new material, while students holding performance goals tend to focus on appearing intelligent and avoiding failure (e.g., Elliot & Harackiewicz, 1996; Elliot & McGregor, 2001). Educators can help students by creating a "culture of learning" in the classroom, which would entail encouraging students to adopt mastery goals by focusing on acquiring new knowledge and skills, even when doing so may mean that students look unintelligent or failing sometimes. Students who hold mastery goals tend to process material more deeply (Elliot, McGregor, & Gable, 1999), seek out help more often when appropriate (Linnenbrink, 2005) and ultimately have greater learning success than students holding performance goals (Elliot & McGregor, 1999; Robbins et al., 2004).

Similarly, teachers can encourage learning by teaching students an incremental view of intelligence. An incremental view of intelligence is characterized by the belief that intelligence is malleable and can be developed. In contrast, one might hold an entity view of intelligence, which is characterized by the belief that intelligence is fixed (for review, see Dweck, 1999). Students' theories of intelligence influence the goals that students adopt (Dweck & Leggett, 1988; Elliot & McGregor, 2001). For example, a view of intelligence as malleable encourages students to adopt learning goals over performance goals (Blackwell et al., 2007; Robins & Pals, 2002). In contrast, an entity view also predicts a tendency to make helpless attributions when facing difficulty on learning tasks (Blackwell et al., 2007; Hong et al., 1999; Nussbaum & Dweck, 2008; Robins & Pals, 2002). Students with an incremental theory, in comparison, make more beneficial attributions in the face of difficulty and report more positive beliefs about effort (Blackwell et al., 2007). These differences in attributions and perceptions of effort carry over to help students perform well on learning tasks. For example, Blackwell, Trzesniewski, and Dweck (2007) found that holding an incremental view of intelligence in the 6th grade predicted higher grades in students' math classes two years later. Other research has shown benefits of teaching students an incremental view of intelligence for math grades (Aronson et al., 2002) and standardized test scores (Good, Aronson, & Inzlicht, 2003). Collectively, this research provides intriguing evidence that teaching students an incremental view of intelligence can improve student achievement.

Research suggests that an incremental theory of intelligence is also associated with more effective study practices (e.g., Cury, Da Fonseca, Zahn, & Elliot, 2008; Kovach, Fleming, & Wilgosh, 2001) and more accurate metacognitive perceptions (Ehrlinger & Dweck, 2013). For example, Blackwell, Trzesniewski, and Dweck (2007) found that students with an incremental theory of intelligence reported a greater willingness to engage in positive study strategies than entity theorist students (e.g., willingness to "work harder in this class from now on" and "spend more time studying for tests"). In addition, incremental theorists engaged in reading strategies that aid comprehension more often than did entity theorists (Law, 2009) and were more likely to report using positive learning strategies (Braten & Olaussen, 1998; Stipek & Gralinski, 1996), including elaborating and organizing concepts when studying (Lachman and Andreoletti, 2006; Ommundsen, Haugen & Lund, 2005; Smith, 2005). Past research has also found that high endorsement of performance goals correlates with lower self-reported use of self-regulated learning strategies (Bartels & Magun-Jackson, 2009; Vrugt & Oot, 2008). Ehrlinger and Ward (2012) found that high school students with stronger incremental beliefs more often reported using deep learning strategies than students with stronger entity views, as measured by responses to questions like "I reviewed material by trying to see how new material related to things I knew" and "When I studied I put important ideas into my own words." We found that stronger incremental views also predicted greater reported use of metacognitive monitoring, as measured by agreement with questions like "I asked myself questions to make sure I knew the material I had been studying" and "I thought about what I already knew and what I still had to learn." Further, students with an incremental view offered less overconfident, more accurate self-assessments than those with a stronger entity view. These findings suggest that incremental theorists might choose self-regulated strategies and show greater metacognitive accuracy more often than do entity theorists.

Conclusion

Many students' metacognitive perceptions are error-prone. In particular, those students who are the poorest performers in the class are often the most overconfident. By encouraging students to monitor their level of understanding and progress in learning, teachers can encourage more accurate self-perceptions among their students. Teachers can accomplish this important goal through several strategies outlined in this chapter. By encouraging effective study strategies that increase students' metacognitive insight, teachers can improve both the accuracy in students' metacognitive perceptions and students' success in learning. Similarly, by fostering a culture of learning in the classroom in which intelligence is viewed as a malleable quality and students are encouraged to pursue mastery-oriented learning goals, students are likely to be more open to facing difficulty in the classroom. We view these strategies as important tools that teachers can use to help their students reach their true potential.

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