

## Learning from Mistakes

Children are constantly protected from failure, as though it's a horrible thing. This robs them of their best learning experiences. Our students come to university fearful of making mistakes, sharing the larger society's "error blindness" (Schultz): we think the way to do well is life is to never be wrong, and if we get something wrong, it means there's something wrong with us. We stop entertaining the possibility that we could be wrong, and assume our understanding perfectly reflects reality. This attachment to our own rightness keeps us from doing things correctly (because we look only for confirmation of our correctness) and makes us treat others horribly. Making mistakes is fundamental to who we are, and is one of the best ways to learn.

An active learning approach values experiential learning, in which students apply new concepts to projects, assignments and problem-solving, then evaluate the results and learn from errors. Making mistakes, depending on how we react to them, teaches us lessons, keep us from going in the wrong direction, and is part of striving for success (Hillson). It's fear of making mistakes, not the mistakes themselves, that is corrosive—we feel embarrassed and stupid. Giving in to this fear makes us avoid learning opportunities, keeps us from taking risks, and makes us seek safety rather than thinking or acting creatively or innovatively. One job of university instructors is to provide a safe place in which to make mistakes without feeling embarrassed, where students can trust that they will not be made to feel stupid. The ideal place to make mistakes and learn is in class, doing application activities, in the presence of an expert who can coach when mistakes are made. Such learning is far lower stakes than learning all the theory in the class and then figuring out the application in a real life work environment, where mistakes can have serious consequences.

"If we foster an environment in our classrooms in which failing is a natural and necessary component in making progress, then we allow our students to release their own genius and share their authentic ideas — even if (or especially when) those ideas aren't quite polished or perfectly formed" (Burger).

With active learning activities, such as question and answer, discussion, peer instruction, and project-based group work, instructors often fear that not all the course content will be covered. However, contrary to what one might expect, instructors have found they covered more content even though more of what they taught was skills embedded in blocks of content and less direct teaching of the content itself (Brockbank, 222).

## Practical Tips for Fostering an Attitude of Learning from Mistakes

- Taking a risk and being willing to fail is an essential part of learning anything meaningful. Perhaps instructors can model this attitude by outlining examples from their own experience of learning from mistakes.

- When a student gives an incorrect answer in Q & A or class discussion, the instructor needs to point out in a face-saving way that it is incorrect, and solicit answers that build on insight into what was wrong with it as a way of getting to the correct answer. Students must listen actively and react, and the student who was incorrect must be made to realize she or he has contributed something worthwhile to moving class understanding forward.
- Instructors can also refer back to previous student mistakes to show how valuable they were in refining our understanding.
- One idea that has been tried is a Quality of Failure mark, in the 5-10% range. The rating scale used ranges from 0, meaning "I never failed" or "I learned nothing from failing" to 10, meaning "I created and understood in profound, new ways from my failed attempts." Part of the self-assessment is to write a 1-page reflective paper on how they have grown from productive failure. Students assign themselves a mark and the instructor reviews it. After returning marks, students are asked to share their mistakes, which they eagerly do in order to provide valuable learning moments (Burger).
- UNB Engineering Assistant Dean and Senior Instructor Frank Collins uses graduated testing in his first year classes. He has five tests consisting of problem sets of increasing length and mark value. (Test #1 – 5 min (2% value) Test #2 – 10 min (4% value) Test #3 – 20 min (8% value) Test #4 – 30 min (16% value) Test #5 – 50 min (25% value)). The incentive is to try early and often, which means you make mistakes early and maybe lose some unrecoverable marks (the consequences of failure that students are too much protected from but give them a stake in the activity), but they are a small amount. Or, students can start later when the marks stakes are higher--their choice.
- An interesting and counterintuitive bit of instructional video research shows that unless common misconceptions are addressed in the videos (so students can realize their conceptions are incorrect) then students will not learn. Students will not pay close attention, thinking that the video is presenting what they already know, and not only do they not learn, they become more confident in their mistaken understanding (Veritasium).
- And here is an interesting research finding about labs: lab experience is only worthwhile if students generate their own data. Otherwise, the data is just a set of meaningless numbers. Once they get data, students can analyze it to see if it's what they expected and, if not, analyze why not, which is the level of engagement with the content necessary to lead to deeper understanding of the topic (Keller).

Some students may resist more active learning methods. They may have become comfortable depending on instructors telling them what they need to know and do, and may resist having to figure this out for themselves even to the small degree required for these types of learning activities. Overcoming this resistance requires the instructor to build trust in the method and convincing through practice the value of mistakes in the learning process.

## Fixed Intelligence vs. Growth Mindset

Fear of making mistakes, or falling apart emotionally when mistakes are made, may well be the result of a faulty view of intelligence as being a fixed and unchangeable trait. Students who have been told they have high intelligence and think it is a fixed trait are less likely to take risks on challenging work, since a possible outcome may be a lower mark that may knock them off their “high IQ pedestal” and make them feel bad about themselves. Or when faced with failure, they are unlikely to try again or try harder or do things differently, because they think, “I guess I’m just not good at that,” so they give up. However, it turns out that effort and persistence can significantly increase students’ performance on intellectual tasks, and that intelligence is not so “fixed” after all (Dweck, 63ff). People who see intelligence as something that grows with effort and taking on challenges are far less hindered by the rigid thinking and sense of helplessness and frustration that besets those with a fixed intelligence mindset. They don’t take “I’m not good at this” as an answer. Making students aware of this distinction can be life changing for them. In the References list below, see the Popova online article that summarizes the main points of Carol Dweck’s book, as a resource for students and instructors alike.

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