Title:
Is failure learning and part of success?

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Topic: Failure has a key role in learning

Summary:
Failure is often a part of success. Educators must be willing to risk failure to experience true success. When educators think about failure, we think about things in a negative way. Educators normally think failure is pain, regret, and a myriad of negative emotions. It cuts deep, it hurts, but its positive impact is necessary for future success. When we fail, we learn and we grow. Those that persevere understand that failure is a necessary part of success. Society celebrates the end goal, the "success", rather than the journey of trials and tribulations one experiences to reach the goal. As one female scientist noted, "Failure gives you experiences which might make you want to reconsider, alter things, change strategies with a possibly better outcome than initially intended before failure" (Science, Female, Doctorate; Simpson & Maltese 2017). Educators should welcome failure and teach students to learn from it.

Background
A research study was initiated to investigate the role failure plays in the development of professionals in STEM. Specifically, the research addressed the following: 1) What role, if any, has failure played in STEM professionals' development as an individual in their respective field? 2) What differences, if any, exist between female and male participants or among those from different disciplines – science, technology, engineering and mathematics – or from highest degree earned?

Research Design

To collect data for this study, we recruited professionals in STEM from across the United States. We conducted semi-structured life-history interviews with 99 professionals. The main interview question this study focused on was, “What role did failure play in your development as an individual in your field?” The sample of professionals was a near-equal split between women and men. Most of the participants were in the fields of technology and engineering, with fewer in science and math. Forty-four percent of participants held Bachelor’s degrees and 55% held graduate degrees. Ninety two percent of the participants identified as White or Asian.

Findings

The study highlighted personal stories and experiences that detailed numerous failures along participants’ paths to success. Failure was a necessary and imperative part of the learning process that produced growth for the professionals in STEM. For example, “after experiencing academic failures in post-secondary courses, some participants continued on their path in STEM with more drive to succeed than before” (Simpson & Maltese, 2017, p. 232). [1]

“Participants who spoke of academic failures were not necessarily failing as receiving a grade of F, but more than likely not meeting their personal expectations of what it means to be proficient or advanced in a particular course or content specific area” (Simpson & Maltese, 2017). Failure yields experience, knowledge, confidence, resilience, grit, growth, and ultimately success through a journey of learning and discovery. Traumatic responses to failure, such as quitting, are few. Based on the study, 17% of participants stated that their experiences with failure changed their goals for their future. The inability to overcome failure is attributed mostly to the fears adult educators project on to their young students. Most students tend to experience failure, feel a sense of frustration, and pick up and try again. Based on reports from professionals - if we want students to engage with science, or STEM more broadly, then we need to lead them through experiences with failure. Failure does not devastate students; it is essential to their learning and growth.

So, what?

Educators need to embrace that failure is not a dead end, but rather an obstacle to overcome on a journey to reach a goal. Failure should carry positive connotations in education. Educators must discuss and embrace failure as a teachable moment to build resilience and perseverance in students.

Failure is not a step backward. Failure does not indicate weakness or inability in ourselves or our students, but can be a critical stepping stone to success. We never learn to move out of our

[1] Calfa, 2013

comfort zone if we don't overcome our fear of failure. As teachers, we need to embrace and discuss failures. Engineers, scientists, and professionals in STEM note that failure is an important part of their current profession. Without failures, they would not have developed critical thinking and problem-solving skills. Building from failures propels students forward, and only a small number will abandon their pursuits. On the contrary, society believes that failures will devastate most and only a few will persevere. As one participant noted "…failure is inseparable from learning. Not only do I think you can't learn without failure, but failure is also a fantastic way to go about learning." (Mathematics, Male, Master's). Educators need to model failure in their classrooms. For example, if an educators is in a Makerspace and does not succeed during the initial trial, it is important to show the students the frustration you experience. Demonstrate the thinking process and troubleshooting steps you take to move forward. Educators should accept a range of answers and use these to discuss variability and other relevant concepts, instead of having one correct answer. When teachers design lessons and assessments they often try to avoid challenges and areas students might struggle, possibly because of desire to produce high assessment scores. Through struggle, students build problem-solving and critical thinking skills that are imperative for work and life beyond the academic setting. Failure takes time to work through. Some STEM professionals argued that it's not failure, but the analysis of why failure occurred and ways to move forward that are most important.

To be sure, failure does not always lead to positive outcomes. One male scientist stated, "Failure is certainly not a positive thing in a work environment. Being willing to accept the risk of failure is necessary, but hardly implies that failure itself is positive." Persistence through failure is positive, but educators must instill determination in their students to overcome failures or setbacks. Students build determination by working hard toward challenges, maintaining effort and interest over time despite numerous failures, adversity, and plateaus in progress. As stated by a male technologist (Doctorate), "I think that confidence alone can be eroded quickly when there are multiple setbacks. Persistence is the willingness to keep trying while walking in the midst of setbacks." Without resolve, failure will not lead to growth and success. It also seems necessary for society to normalize the use of the term failure in classroom settings to reduce the angst students possess. Most STEM professionals agreed that the only true failure is when you stop trying or give up

Source:

Calfa , Jimena. "FAIL." *Risks, Failures and Learning*, ASQ, Influential Voices, 15 Feb. 2013, www.onquality.info/2013/02/risks-failures-and-learning.html/.

Simpson, A., & Maltese, A. (2017). "Failure Is a Major Component of Learning Anything": The Role of Failure in the Development of STEM Professionals. *Journal of Science Education and Technology*, *26*(2), 223-237.

ADDITIONAL RESOURCES:

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