Reducing Anxiety in the Statistics Classroom

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Mini-Abstract

Psychology students who experience anxiety in a statistics course are at risk of poor performance in the class. This chapter provides a mindset presentation that helps deconstruct students' misperceptions and reframe their approach to learning statistics. Through this activity, students decrease their statistics anxiety and increase their ability to study and learn statistics.

Concept

This activity is designed to reduce mathematics/statistics anxiety in psychology students enrolled in introductory statistics classes. The activity is based on the use of cognitive interventions that are designed to restructure beliefs about ability, increase self-confidence, and create a growth mindset (Paunesku et al., 2015). Research has shown that anxiety about mathematics tends to distract students, thereby reducing their available working memory and hindering their learning and performance (Beilock, 2014). With the use of the activity described here, instructors can help students develop the belief that they are capable of learning statistics, which in turn should reduce their anxiety and improve their learning.

The activity involves presenting students with a series of techniques that will help them reduce their anxiety throughout their statistics course, and a list of empirically-based study strategies to help them be more successful in the course. Getting students to choose to use the techniques that are presented to them requires that they believe the techniques will, in fact, be helpful. To that end, the presentation first reviews fixed versus growth mindsets and the

relationship between anxiety and academic performance. The goal of the first two parts of the presentation is to help students understand that a growth mindset exists; that one's ability to do well in statistics is not a fixed inherited factor; and that anxiety is not just the result of poor performance, but also a cause. Anxiety and mindset have been shown to have a strong relationship (see Dai & Cromley, 2014), making a mindset intervention an ideal way to help reduce statistics anxiety. When students believe that they are capable of learning, they will be more likely to use the anxiety reduction and study strategies described at the end of the presentation. These techniques should allow them to reduce their anxiety and succeed in the course (see Blackwell, Trzesniewski & Dweck, 2007).

Materials Needed

On the first day of class, students complete 6 items related to implicit theories of intelligence and school performance (Wang & Ng, 2012)**,** the first 23 items of the Statistics Anxiety Rating Scale (STARS; Cruise, Cash, & Bolton, 1985), and an 18-item assessment of statistics knowledge (Smith, 2015; available from the author upon request). The activity takes the form of a visual presentation with the main points highlighted in a bulleted fashion (see "Instructions"). Free alternative measures can be accessed on the ARTIST website (https://apps3.cehd.umn.edu/artist/research_instruments.html) and include measures of statistics knowledge, attitudes towards statistics and a self-efficacy scale.

Instructions

After students complete the baseline assessment, the instructor should present the four topics below, in order. Students should be asked to take notes during the instructor's presentation, which takes approximately 30 minutes to complete (including the viewing of the video mentioned below).

- ***Myths about math.*** The instructor should address the myth that we are *not* born better at either math or reading/writing, and introduce the concept of mindset. Emphasis should be made on the power of our belief and that practice can improve performance regardless of our starting point or past experiences (see also Carnegie Foundation, 2016). For an example of the power of belief, see Tomasetto, Matteucci, Carugati, and Selleri's (2009) study that showed that students who identify as being better with language than math can do better on a math test than students who identify as being better at math than language.
- ***Brain plasticity and mindset.*** Plasticity refers to the changes in our brain that occur when we engage in learning something new. This happens more with a growth mindset than a fixed mindset. Biceno's (2012) video suggests that people with a growth mindset subscribe to the idea that they can learn through practice, while a fixed mindset reflects beliefs of innate, therefore fixed, intelligence. Research where brain scans have monitored individuals after completing a task showed that those with a growth mindset had increased brain activity associated with attention errors, which in turn led to increase accuracy. This type of brain activity was not present in those with a fixed mindset leading to less accuracy in that group due to the lack of the brain's attention on errors (Moser, Schroder, Heeter, Moran, & Lee, 2011).
- ***Attitudes and anxiety.*** The instructor should explain to students that their attitudes, including their beliefs about their abilities and past math experiences, can cause anxiety. This anxiety taxes their working memory, which detracts from their ability to focus on learning statistics (see Beilock, 2014).
- ***Evidence-based, concrete ways to manage anxiety and learn.*** This final section provides concrete strategies students can use to reduce or reappraise their anxiety and maximize their

efforts when studying (see Appendix 1.1). Knowledge of these strategies is important for empowering students to enhance their skills rather than feeling they are fixed with no way to change. In this section, the instructor describes two techniques for avoiding negative consequences of anxiety: a self-regulation model for reducing anxiety and an anxiety reappraisal technique. Both can be use by students on their own throughout the course. Both techniques includes students' awareness of their feelings prior to beginning their statistics class. While completing their course work, students should take measures to help reduce or reappraise their anxiety (e.g., take a break, stretch, use deep breathing), and they should reflect afterwards on what did and did not work for them. They should acknowledge and commend themselves for any progress they make. The presentation should include attention to the problems with instructionalism and the need for active learning (see Mueller & Oppenheimer, 2014 for an example). Effective modes of learning include using what you know before you start, connecting different topics, being an active learner, considering your environment, and pacing your work. Sawyer (2006) provides more information in this area.

Assessment

To determine if anxiety has been reduced and knowledge increased, students complete pre/post assessment using the three instruments listed in the Materials section. Two instruments measure the main outcomes: anxiety toward statistics (STARS) and knowledge of statistics (RMSA). Given that the theoretical basis for the activity incorporates theories of intelligence, the third instrument measures students' beliefs of implicit intelligence to determine the extent to which the presentation was effective in restructuring their beliefs. Again, all instruments should be distributed pre and post in counterbalanced packets.

Student names or identification numbers should be recorded on each packet to allow for pre/post comparisons, but students should be ensured that the materials are confidential. The second assessment should be given during the last week of the course and follow the same procedure as the first assessment. When comparing pre and post scores, past studies that have used techniques similar to the one described here have seen large effect sizes (*d*s >.60) for both anxiety and beliefs about intelligence (Blackwell et al., 2007).

Discussion

This activity provides a general framework for reducing anxiety in one presentation. Some instructors present students with this type of material throughout the duration of a course (Venkatesan, 2009). Others utilize other different activities to reduce anxiety such as showing documentaries (Hekimoglu & Kittrell, 2010), or have students write about how they feel prior to an exam, an activity that by itself has shown to reduce anxiety in educational settings (Beilock, 2014). However these are not necessary to be used in the activity described here, but instructors may wish to use these techniques to supplement the activity described here. This activity focuses solely on student efforts, however instructors can benefit from reviewing techniques for incorporating productive feedback (Yeager et al., 2013) to help support students' continued growth mindsets.

Caution should be exercised when working with students who may have especially high levels of anxiety. It is possible that class discussions about anxiety could trigger or heighten fears to an unhealthy level in some students. Instructors should be aware of this possibility and provide appropriate assistance, such as directing students who show significant signs of distress to the institution's counseling center.

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Appendix 1.1

Evidence-Based, Concrete Ways to Manage Anxiety and Learn

- ***Use evidence-based study techniques.*** No one is going to open up your head and drop the knowledge into it. You have to work for it, and your effort, not natural talent, is what helps you learn by building neural networks in your brain. Try the following:
    - Be an active learner by writing things down, drawing ideas, diagramming them, and even saying them out loud.
    - Use what you know before you start studying to help you connect the new material to other topics.
    - Use the tools, people, and environment you are in to help you apply content.
    - Pace and space! Consider how an athlete trains. They do not just practice the night before the game. They practice playing the game every day.
- ***Manage your anxiety***. It is common for people to experience some degree of nervousness when they are faced with trying to accomplish a new task. You may not be able to stop anxiety from coming, but you can stop it from managing you. Self-regulation is key!
    - ***Before you start your work***, think about how you feel. Are you about to do something you feel is going to be hard? If yes, then you know to be on the lookout for anxiety. Be aware that the physiological arousal caused by anxiety can actually aid performance.

- ***While you are working,*** if you begin to feel anxious, remind yourself that you are capable of learning. Take a time-out if you need it; take a walk; joke with a friend. Then reconsider what it is you are trying to do and try to identify the parts you are not understanding. Remember, arousal from anxiety does not have to be a bad thing, but can help you in performing better.
- ***Reflect***. How do you feel when you are done? What were the strategies that helped you get the work done? Congratulate yourself. Even if the work is not perfect or complete, it is more than what you had when you started. Good for you!