DNP student perspectives of an asynchronous statistics course

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Disclosures

The presenters have nothing to disclose.

Background

Attitudes towards math/statistics among nurses vary, with trends towards *fear and loathing*[1-4]

Background

Constructs proposed as contributing to performance in challenging academic environments:

- **Growth mindset**[5]
- **Task value**[6]
- **Stereotype threat**[7-8]
- **Intergroup relationships/Sense of belonging**[9]
- **In-group inoculation**[10]
- …Any many more!

Background

Growth mindset: One seeks out learning experiences, is resilient to educational obstacles, and uses feedback as a source of improvement[5]

- Proposed as a means of approaching challenging content in health sciences education[11-12]
- Evidence suggests a course instructor may be able to encourage a growth mindset via pedagogy[13] and instructor talk[14].

Aim

The aim of this study is to use focus groups with doctorate of nursing practice (DNP) students who have completed a required statistics course to a) explore the extent to which DNP students espouse a growth mindset with respect to statistics b) and identify course-related factors that served as supports or barriers to a growth mindset.

Methods: Design

Exploratory study using focus groups

IRB approval obtained

Methods: Context

- Vanderbilt University School of Nursing Doctorate of Nursing Practice (DNP) program
- N8014 Statistics for the Health Sciences
- Required course; 2nd semester of 5-6 semester program
- Course redesigned by DNP (1st author) and statistician (3rd author)
- Course enrollment = 51
- Blended format – 1 in-person session, remainder of content asynchronous
- 4 quizzes and 2 projects

Methods: Recruitment and format

Recruitment via email using the class list

Format:

- Two 60-minute focus group sessions
- Dual moderator[15]
- Participants begin by reflecting and writing responses to interview prompts, then discuss answers in small group of 2-4 participants, then invited to participate in group discussion.

Methods: Main prompts

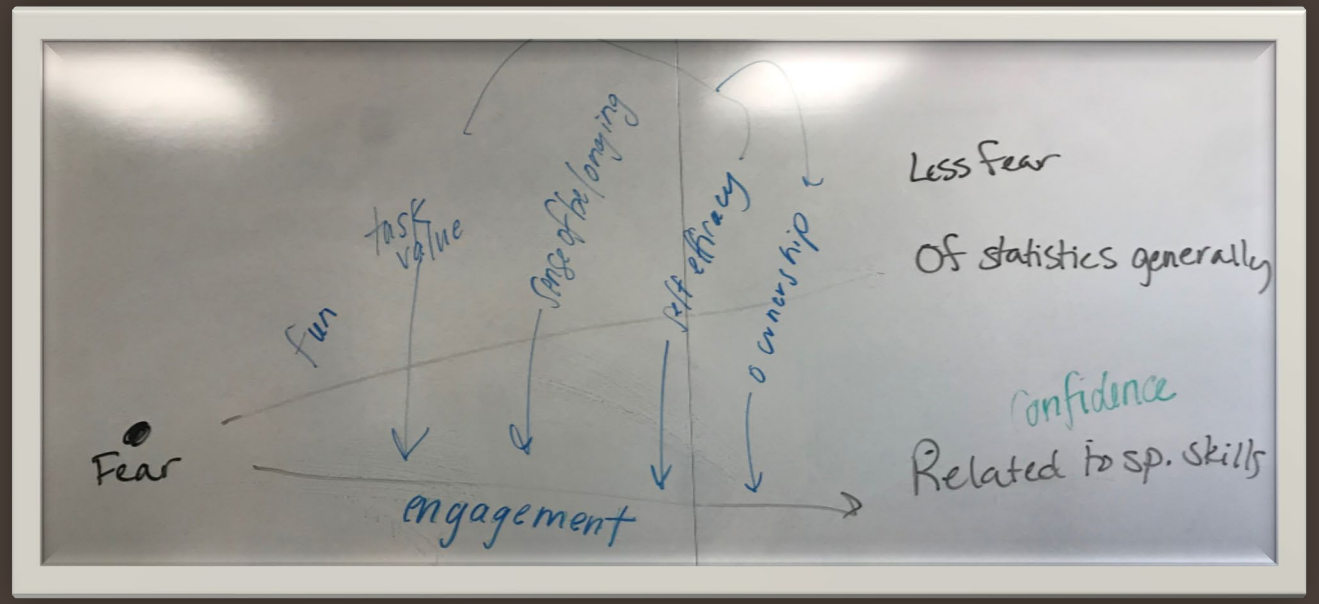
- Have your attitudes towards statistics changed over the course of the semester? If so, how?
- Do you agree with the statement, "To be honest, people have a certain ability to understand and use math, and they can't really do much to change it." Why or why not?
- What aspects of the class helped build your confidence?
- How did you deal with challenges when you encountered them in this class?
- What additional class elements could help you be more confident in your ability to learn and use statistics in the future?

Methods: Analysis

- Student written responses were collected, and field notes from the sessions were transcribed
- Written and transcribed data were independently coded using the scissor-and-sort technique[15]
- Analyzed to identify content themes
- Investigators collaboratively determined final themes and supporting quotes

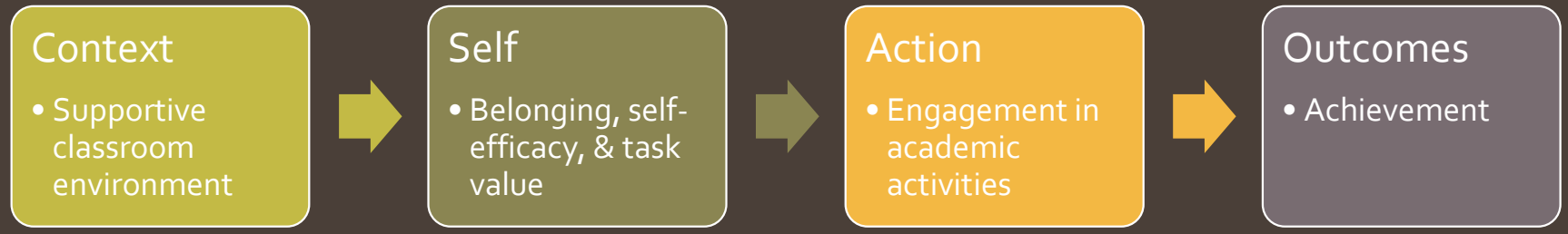
Results

- N = 17 students (33.3%) participated in 2 focus group sessions
- Although the prompts aimed to elicit content related to growth mindset, most responses revealed the importance of other elements in the course instead.

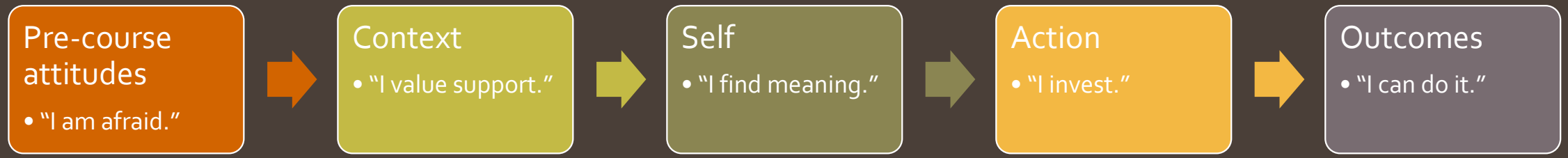


Results

Zumbrunn, S., McKinn, C., Buhs E., & Hawley, L.R. (2014.) Support, belonging, motivation, and engagement in the college classroom: A mixed methods study. *Instructional Science, 42*, 661-684.



Themes from our participants:



Theme 0: Pre-course attitudes

- *"I am afraid."*

- "Fear," "hesitation," "intimidated," "afraid," "scary topic"
- "I felt like complete understanding of statistics was for 'the others'"
- "We definitely felt that some people were 'math people,' others weren't."

Theme 0: Pre-course attitudes

- Course elements that addressed the theme:
  - Normalization via class survey
- Instructor elements that addressed the theme:
  - Acknowledgement of student fear
  - Encouragement of questions *("No question was too dumb, weird, or silly.")*

Class survey

Please choose the answer that most closely describes how you feel about each item.

		strongly agree	agree	agree somewhat	neutral	disagree somewhat	disagree	strongly disagree
1.	I am happier in a math class than in any other class.	○	○	○	○	○	○	○
2.	I have a lot of self-confidence when it comes to mathematics.	○	○	○	○	○	○	○
3.	Statistics should be a required part of my professional training.	○	○	○	○	○	○	○
4.	I am scared by statistics.	○	○	○	○	○	○	○
5.	I will like statistics.	○	○	○	○	○	○	○
6.	I can learn statistics.	○	○	○	○	○	○	○
7.	I plan to work hard in my statistics course.	○	○	○	○	○	○	○

Theme 1: Context

- *"I value support."*

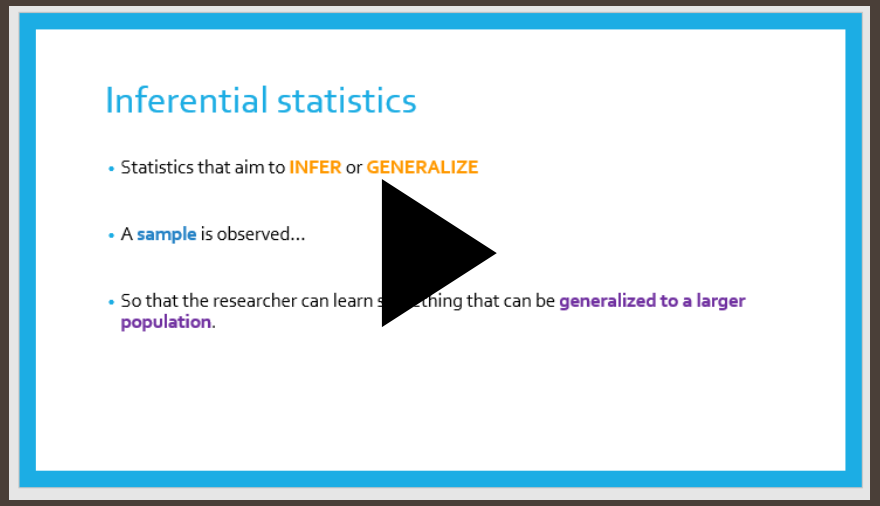
- "Ability is based on the environment and structure offered/available."
- "[Success] is really subjective to the teacher/methods used to teach."
- "[Success] depends on a supportive teacher that can change their explanations to suit the learning styles of the students."
- "It's all about your teacher. Students may have been taught in ways that were not conducive to understanding based on their learning style."

Theme 1: Context

- Course factors:
  - **Direct encouragement** (*"Hearing 'you can do this'," "Consistent check-in emails with encouraging words," "Constructive feedback"*)
  - **Shorter videos with transcripts** (*"Presentation appealed to multiple learning preferences"*)
  - **Module atlas** (*"A clear roadmap with structured guidance was meaningful," "step by step instructions"*)
  - **Affirmation activities**
  - **"Office hours"** synchronous sessions
- Instructor factors:
  - **Supportive & responsive** (*"She would always respond quickly and helpfully," "Faculty that is approachable and realistic," "Infinitely accessible, patient, helpful, and accepting."*)

Module Lectures

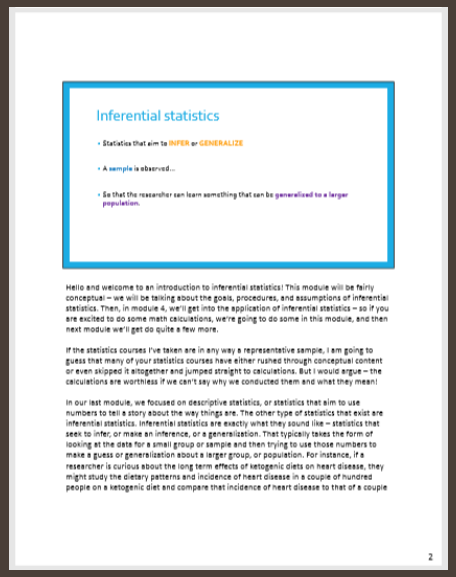
WATCH….



Videos

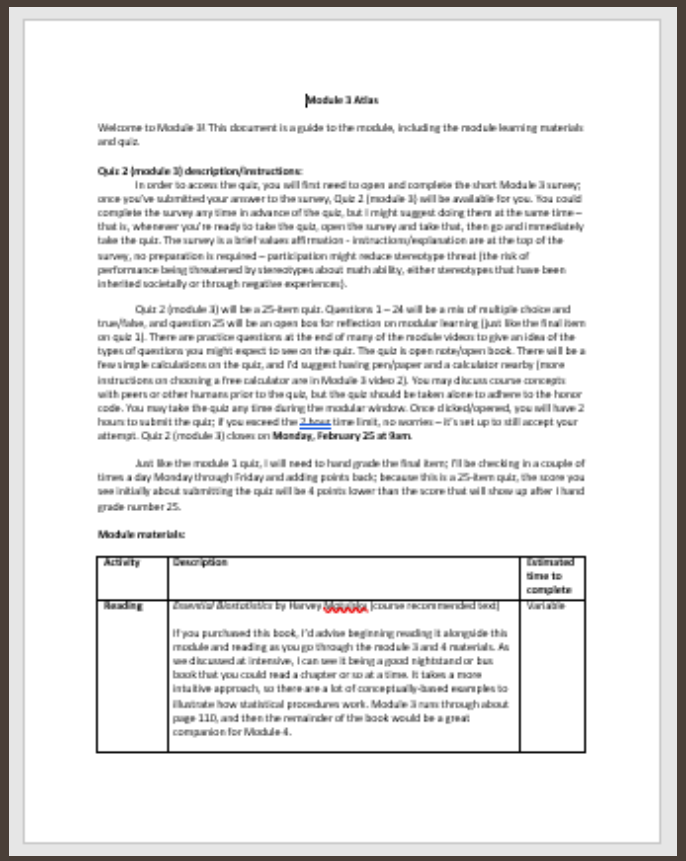
AND/OR…

READ



Transcripts

Module Atlas



Module 3 Atlas

Welcome to Module 3! This document is a guide to the module, including the module learning materials and quiz.

Quiz 2 (module 3) description/instructions:

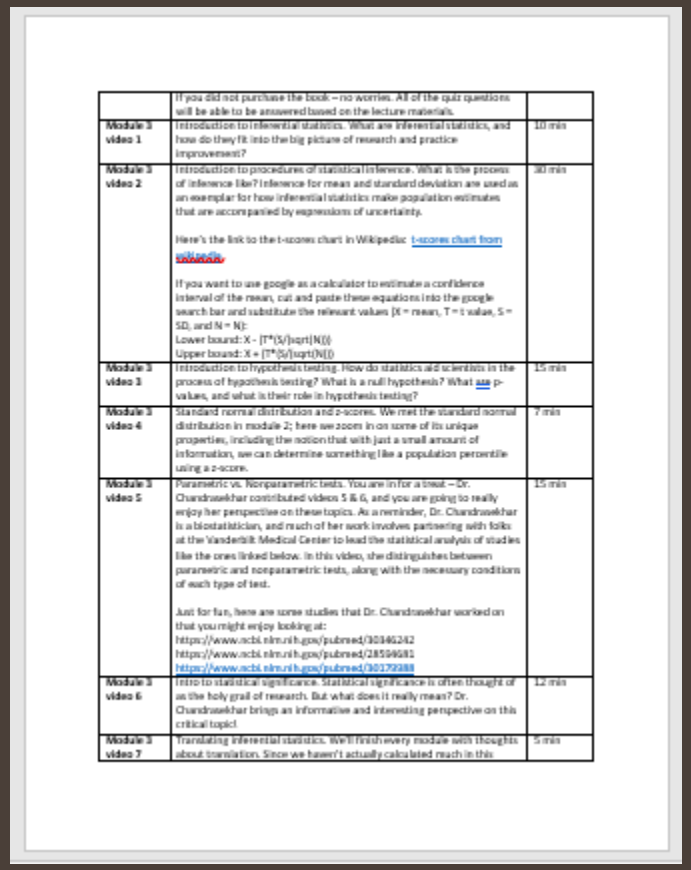
In order to access the quiz, you will first need to open and complete the short Module 3 survey; once you've submitted your answer to the survey, Quiz 2 (module 3) will be available for you. You could complete the survey any time in advance of the quiz, but I might suggest doing them at the same time – that is, whenever you're ready to take the quiz, open the survey and take that, then go and immediately take the quiz. The survey is a brief values affirmation - instructions/explanation are at the top of the survey, no preparation is required – participation might reduce stereotype threat (the risk of performance being threatened by stereotypes about math ability, either stereotypes that have been inherited societally or through negative experiences).

Quiz 2 (module 3) will be a 25-item quiz. Questions 1 – 24 will be a mix of multiple choice and true/false, and question 25 will be an open box for reflection on modular learning (just like the final item on quiz 1). There are practice questions at the end of many of the module videos to give an idea of the types of questions you might expect to see on the quiz. The quiz is open note/open book. There will be a few simple calculations on the quiz, and I'd suggest having pen/paper and a calculator nearby (more instructions on choosing a free calculator are in Module 3 video 2). You may discuss course concepts with peers or other humans prior to the quiz, but the quiz should be taken alone to adhere to the honor code. You may take the quiz any time during the modular window. Once clicked/opened, you will have 2 hours to submit the quiz; if you exceed the 2 hour time limit, no worries – it's set up to still accept your attempt. Quiz 2 (module 3) closes on **Monday, February 25 at 9am**.

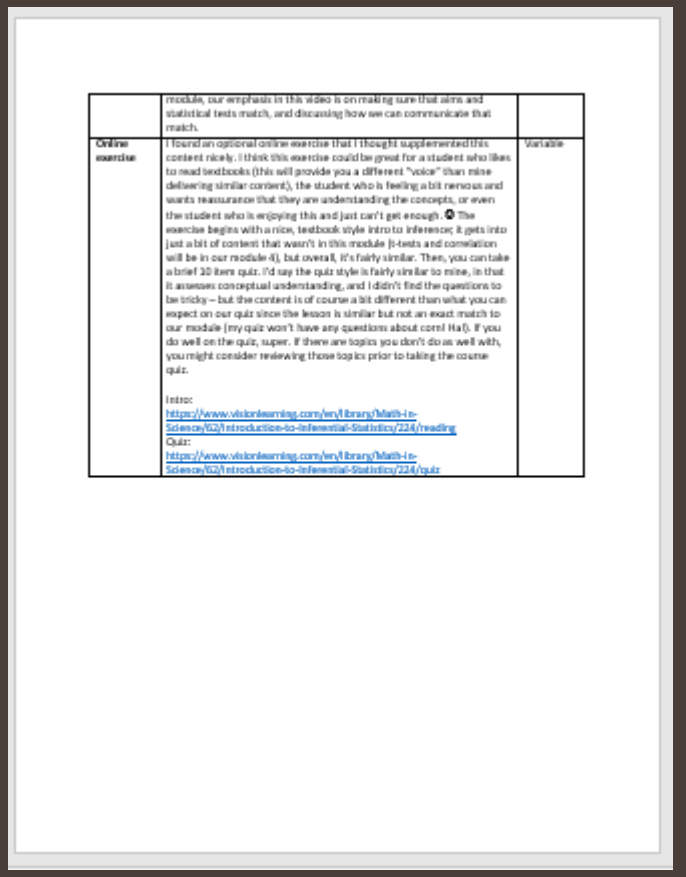
Just like the module 1 quiz, I will need to hand grade the final item; I'll be checking in a couple of times a day Monday through Friday and adding points back; because this is a 25-item quiz, the score you see initially about submitting the quiz will be 4 points lower than the score that will show up after I hand grade number 25.

Module materials:

Activity	Description	Estimated time to complete
Reading	*Essential Biostatistics* by Harvey Motulsky (course recommended text) If you purchased this book, I'd advise beginning reading it alongside this module and reading as you go through the module 3 and 4 materials. As we discussed at intensive, I can see it being a good nightstand or bus book that you could read a chapter or so at a time. It takes a more intuitive approach, so there are a lot of conceptually-based examples to illustrate how statistical procedures work. Module 3 runs through about page 110, and then the remainder of the book would be a great companion for Module 4.	Variable



	If you did not purchase the book – no worries. All of the quiz questions will be able to be answered based on the lecture materials.	
Module 3 video 1	Introduction to inferential statistics. What are inferential statistics, and how do they fit into the big picture of research and practice improvement?	10 min
Module 3 video 2	Introduction to procedures of statistical inference. What is the process of inference like? Inference for mean and standard deviation are used as an exemplar for how inferential statistics make population estimates that are accompanied by expressions of uncertainty. Here's the link to the t-scores chart in Wikipedia: t-scores chart from wikipedia If you want to use google as a calculator to estimate a confidence interval of the mean, cut and paste these equations into the google search bar and substitute the relevant values (X = mean, T = t value, S = SD, and N = N): Lower bound: X - (T*(S/)sqrt(N)) Upper bound: X + (T*(S/)sqrt(N))	30 min
Module 3 video 3	Introduction to hypothesis testing. How do statistics aid scientists in the process of hypothesis testing? What is a null hypothesis? What are p-values, and what is their role in hypothesis testing?	15 min
Module 3 video 4	Standard normal distribution and z-scores. We met the standard normal distribution in module 2; here we zoom in on some of its unique properties, including the notion that with just a small amount of information, we can determine something like a population percentile using a z-score.	7 min
Module 3 video 5	Parametric vs. Nonparametric tests. You are in for a treat – Dr. Chandrasekhar contributed videos 5 & 6, and you are going to really enjoy her perspective on these topics. As a reminder, Dr. Chandrasekhar is a biostatistician, and much of her work involves partnering with folks at the Vanderbilt Medical Center to lead the statistical analysis of studies like the ones linked below. In this video, she distinguishes between parametric and nonparametric tests, along with the necessary conditions of each type of test. Just for fun, here are some studies that Dr. Chandrasekhar worked on that you might enjoy looking at: https://www.ncbi.nlm.nih.gov/pubmed/30146242 https://www.ncbi.nlm.nih.gov/pubmed/28599681 https://www.ncbi.nlm.nih.gov/pubmed/30179388	15 min
Module 3 video 6	Intro to statistical significance. Statistical significance is often thought of as the holy grail of research. But what does it really mean? Dr. Chandrasekhar brings an informative and interesting perspective on this critical topic!	12 min
Module 3 video 7	Translating inferential statistics. We'll finish every module with thoughts about translation. Since we haven't actually calculated much in this	5 min



	module, our emphasis in this video is on making sure that aims and statistical tests match, and discussing how we can communicate that match.	
Online exercise	I found an optional online exercise that I thought supplemented this content nicely. I think this exercise could be great for a student who likes to read textbooks (this will provide you a different "voice" than mine delivering similar content), the student who is feeling a bit nervous and wants reassurance that they are understanding the concepts, or even the student who is enjoying this and just can't get enough. ☺ The exercise begins with a nice, textbook style intro to inference; it gets into just a bit of content that wasn't in this module (t-tests and correlation will be in our module 4), but overall, it's fairly similar. Then, you can take a brief 10 item quiz. I'd say the quiz style is fairly similar to mine, in that it assesses conceptual understanding, and I didn't find the questions to be tricky – but the content is of course a bit different than what you can expect on our quiz since the lesson is similar but not an exact match to our module (my quiz won't have any questions about corr! Ha!). If you do well on the quiz, super. If there are topics you don't do as well with, you might consider reviewing those topics prior to taking the course quiz. Intro: https://www.visionlearning.com/en/library/Math-in-Science/62/Introduction-to-Inferential-Statistics/224/reading Quiz: https://www.visionlearning.com/en/library/Math-in-Science/62/Introduction-to-Inferential-Statistics/224/quiz	Variable

Affirmation activities pre-quiz

Welcome to the quiz 3 survey. While you must add some text in the box below to proceed, participating in this activity is OPTIONAL. You can type “n/a” in the box below and hit submit if you’d prefer not to participate, and that will enable you to open the module 3 quiz. The instructors in the course will not be reviewing responses to this question, so please feel free to use, or not use, the activity in whatever way suits your needs.

If you choose to participate, this is an activity known as a “values affirmation.” It is an evidence-based technique to attenuate stereotype threat. Authors Cohen, Garcia, Apfel, and Master plus others at Stanford conducted landmark research about this technique using a longitudinal design, and they’ve found it to have a positive effect on academic performance, specifically in African American school-age children. They invite students to reflect on things or values that are important to them (e.g., family, art, etc) and why these things are important to them. Completing this affirmation has a surprisingly positive effect on academic performance that persists over time. To explain the surprising effect, the authors posit, “A feedback loop, with psychological threat and poor performance reinforcing one another, can create worsening performance over time…When such recursive cycles are interrupted early, baseline outcomes and the long-term performance trajectories following from them can be changed.”

We invite you to use the box below to reflect on values or parts of life that are important to you. Why do those things matter to you? After completing this exercise (or entering any text in the box), you may proceed to quiz 3.

Theme 2: Self

- *"I find meaning."*

- "We appreciated the more relevant approach to the topic—not emphasis on calculating the stats themselves, but being able to use them."
- "See it as applicable, not just a checkbox to complete."
- "Goal was attainable."
- "We have the ability to apply our knowledge to our work environments."
- "Before, I skimmed or skipped the methods/analysis portions of studies; now, I find meaning and importance there."
- "I see the value of statistics for 'non-scientists'."

Theme 2: Self

- Course elements:
  - Effective use of examples in lecture
  - Assignments using real data
  - Assignments that approximate nurse leader activities
- Instructor elements:
  - Meaningful, constructive feedback about progress
  - Positive, accepting responses to emails

RESULTS: FEAR OF STATISTICS

- Mean score decreased from 5.3 (SD1.5) to 4.2 (SD 1.8)

Theme 3: Action

- *"I invest."*

- "Personal effort increased with the understanding that the goal was attainable."
- "I feel ownership of the information and confident in my ability to access resources for what's less clear."
- "If we slowed down and re-read/re-watched material, the answers were there."
- "We emailed (and she was quick to respond)."
- "Individual investment and motivation to understand and use math contributes heavily to the outcomes."
- "Some find math easy, others have to work harder, but they can learn it if they are willing to work at it."

Theme 3: Action

- Course elements:
  - Materials that can be re-watched/read on demand
- Instructor elements:
  - Responsive to questions

Theme 4: Outcomes

- *"I can do it."*

- "My confidence in statistics and interpreting research writing has improved."
- "Yes, it gave us more confidence in our abilities to comprehend research and be able to articulate what we need to do for our project objectively - beyond just collecting data."
- "Talking about statistics and articulating findings—gave me confidence that you could be heard at the table, even with a previously scary topic."
- "We went from fearful and intimidated to more confident, and we have the ability to apply our knowledge to our work environments."
- "An overall feeling of 'I can do it'."

Discussion

- Overall, participants found the course to be effective and useful for their professional development.
- Surprisingly, students did not have as much to say about growth mindset – perhaps because some may have possessed a growth mindset prior to the course, so the course may not have been as necessary or influential for growth mindset development.
- Instead, the students discussed course and instructor elements that affected their growth in the subject.

Discussion

- Similarity to Zumbrunn et al.
  - **Limitation:** Our prompts were designed to assess a different set of constructs, specifically growth mindset.
  - **Strength:** The similarity emerged despite our prompts

Discussion

- **Suggestions for educational practice:**
  - Consider the use of nurses to teach stats to nurses to enhance task value/meaning.
  - Consider infusing course and instructor elements that students reported were effective.

- **Suggestions for future research:**
  - Devise quantitative methods to evaluate domains and relationships in nursing students learning statistics.

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