Geoscience Success Lessons: Creating a Psychologically Wise Intervention for Geoscience Students to Change Their Working Hypotheses on Learning

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Abstract

The geoscience discipline struggles to attract and retain majors, and women are underrepresented in geoscience careers. Research indicates that this struggle is, in part, due to negative attitudes toward math/science. But many students misunderstand the learning process and fail to consider the role of affect in learning. Changing students' working hypotheses about learning to include affective components can improve their geoscience engagement. Psychologically wise interventions could effectively change these hypotheses, but it is a daunting task to develop interventions that align with the ideas of psychological wisdom. This presentation describes the process, challenges, and implications of creating psychologically wise interventions for geoscience.

Introduction

- Careers in geoscience are increasing in demand and with high salaries (AGI, 2014), but the discipline struggles to attract majors (McConnell & van der Hoeven Kraft, 2011).
- Women are underrepresented in the discipline despite above average grades (Wolfe & Riggs, 2017).
- This could be due to negative attitudes toward math/science (Jameson & Sexton, 2016) that influence their beliefs about learning.
- Students' working hypotheses about learning influence their decisions, behaviors, and choices.
  --Students' working hypotheses about learning can be inaccurate, which leads to ineffective strategies (Claxton, 2013).
  --Changing working hypotheses about learning to incorporate affective factors from a self-regulatory perspective can lead to increased learning, interest, and attraction to the field.
- To change working hypotheses, we should use **psychologically wise interventions.** These interventions aim to impact ubiquitous societal problems and are characterized by five principles:

Principle 1. Alter students' specific meaning and promote change in their thoughts, attitudes, and behaviors

Principle 2. Align with an understanding that students' meaning operates within complex systems

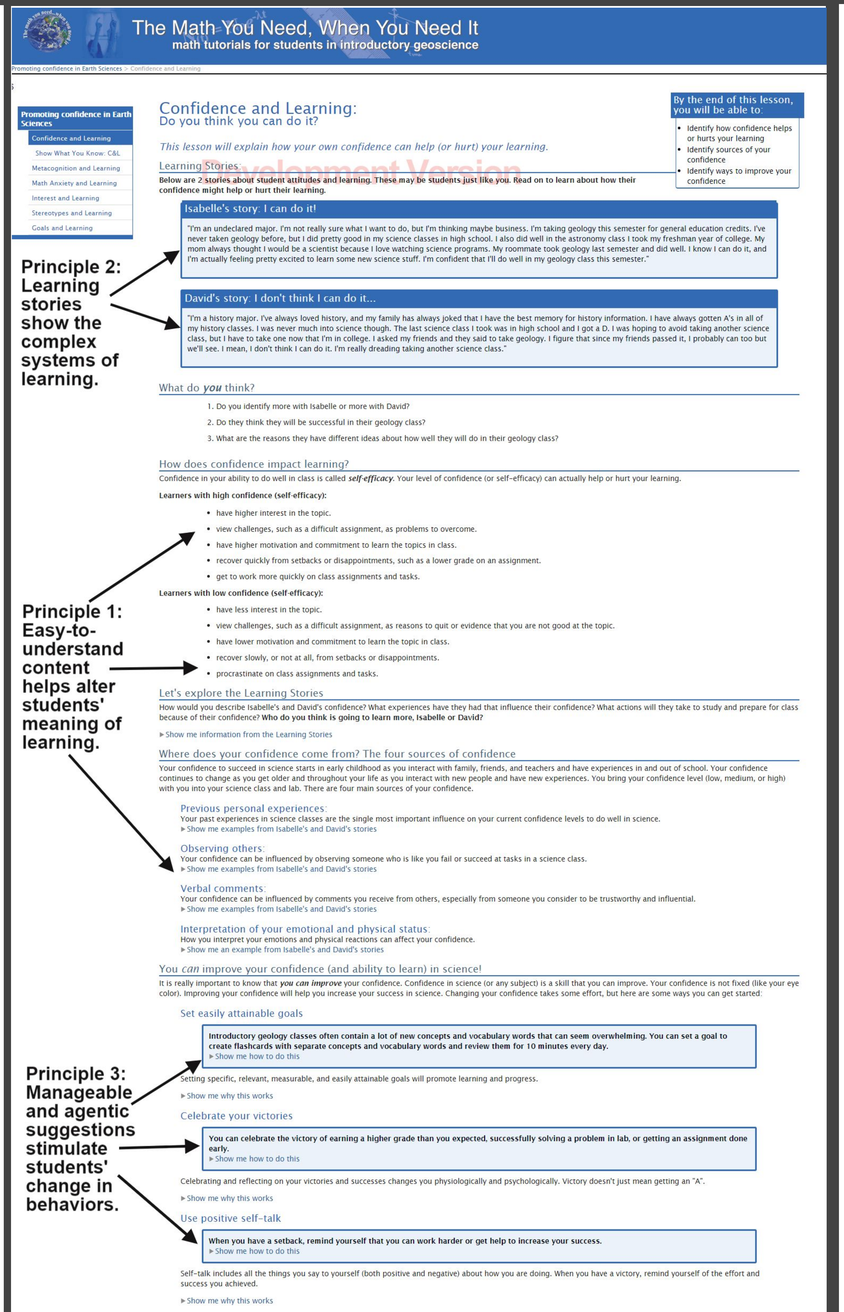
Principle 3. Stimulate students to change their behaviors

Principle 4. Are methodologically rigorous

Principle 5. Are ethically sound

Walton & Wilson (2018)

- **The five principles guided the creation of our psychologically wise interventions to change geoscience students' working hypotheses about learning to include self-regulatory affective components.**



- Principle 4: Methodologically rigorous: developed and reviewed by experts, sought and incorporated user (instructor & student) feedback, developed with empirically-based best practices, pre- and post-intervention assessments and mixed methods evaluation process
- Principle 5: Ethically sound: confidential data collection, beneficence at forefront of all decisions, advisory board and external evaluator

Challenges & Successes

Challenges
1. Simplifying psychological jargon for non-psychology students (e.g., self-efficacy)
2. Selecting the most relevant and utilitarian processes to include in the interventions.
3. Determining the best method of intervention implementation
4. Challenging to gain engagement from geoscience faculty and students as the material "was not directly related with lab content…"

Successes
1. Developed six online and in-lab interventions that broadly introduce self-regulatory processes in layman's terminology.
2. Selected: self-efficacy, interest, goal-setting, math anxiety, metacognition, and stereotype threat.
3. Intervention aligned with best practices in flipped teaching techniques and based in pedagogical content knowledge.
4. Did gain engagement from geoscience faculty and students because the interventions: • "...are applicable to things outside geology…" • "...gave me a bit more confidence when it comes to doing math in other subjects." • "...I love what you guys are doing...I have seen no other class do this...you are trying to get students to see how they can apply this to different life situations…" • "....you're making sure students realize this is bigger than just a class. This is something you can do for your entire life."

Lessons Learned

- The existing intervention literature focuses on actions that faculty can take to develop students' affective domain, while a dearth exists in student agency in affection domain.
- Our psychologically wise interventions aimed to provide students with agency to change their working hypotheses of learning to incorporate affect.
- Science faculty may need training to learn how to implement psychologically wise interventions.
- Psychologically wise interventions are challenging to create but worth the effort.

Contact Information and References

For further questions or for the complete reference list please contact Molly M. Jameson (molly.jameson@unco.edu).

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