Everyday Belonging: Communal Goals As A Route to Bolstering Student's STEM Motivation

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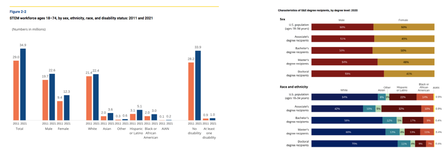
Introduction

- Previous research has shown that minority individuals leave STEM fields at a higher rate than in other fields (NCSES, 2023). Fostering a sense of belonging is a key factor in increasing student persistence in STEM (and retention among college students more broadly, Walton et al., 2023).

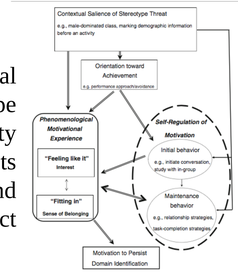


Communal and agentic goals in STEM

- Diekman et al. (2011) demonstrated that women are more validated by communal goals and that STEM careers are viewed as less communal (vs. other careers). Results showed that congruency between goal endorsement and perceived goal affordances interact to predict desire towards a career in STEM.
- Further, Allen et al. (2021) demonstrated (at a single time point) that women's communal perceptions significantly predicted belonging and science research motivation, which in turn predicted future science motivation.

Navigating Stereotype Threat Experiences

- Thoman et al. (2013) proposed the Motivational Experiences Model to understand how stereotype threat (ST) affects multiple motivational and identity pathways in science students. The model suggests that self-regulatory processes ("feeling like it" and "fitting in") during task engagement impact motivational outcomes.



Tracking Fluctuations in Belonging and Intrinsic Motivation

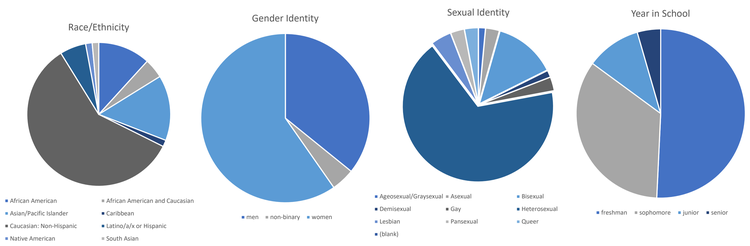
- Runyan et al. (2013) introduced LifeData to collect real-time psychological data. Overall, students reported being more aware of how they spent their time while using the app and responded at a high rate (thus making it a possible tool for our student-centered research).

Goal of the Proposed Study

We aim to understand what impacts undergraduate STEM students' sense of social-belonging, in a naturalistic setting. The proposed intervention leverages communal goals to foster belonging and intrinsic interest to enhance STEM motivation.

Participants

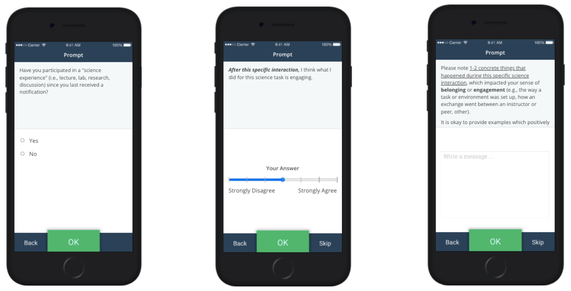
- **Anticipated Participants:** 160 undergraduate students enrolled in introductory science courses at Drake University
- **Pilot Study**: 68 undergraduate students enrolled in introductory science courses at Drake University
  - Mean age = 19.45 years (*SD* = 2.10)



LifeData App: Measuring Fluctuations

Figure 1.

Participant view of LifeData survey questions.



Method

- **Procedure Overview:** (1) Opening Qualtrics survey, (2) LifeData daily notifications and self-reporting lasting two weeks, excluding weekends, (3) Closing survey (see below)
- **Inclusion Criteria**: Must be a STEM major or minor, enrolled in psychology or neuroscience course, own/daily use of smart phone
- **Compensation:** Participants earned partial course credit and were entered in drawing to win a $25 gift card (based on 70% daily survey completion)

Phase 1: Background Information (Qualtrics)

- **Domain Identification in Science (Smith & White, 2001)**
  - Ex: how much do you enjoy science related activities, how important is it to you to be good at science
  - (1) as *not at all, (5) as very much*
- **Close Friends and Social Support Questionnaire (Yeager et al., 2016)**
  - Ex: "Thinking back on this past academic year, I feel that I have made some close friends at Drake University"
- **Communal and Agentic Goal Endorsement (Pohlmann, 2001)**
  - (1) as *not at all, (7) as extremely*
  - Agentic Ex: power, focus on self, recognition
  - Communal Ex: helping others, working with people, attending to others' needs
- **Demographics-** gender, race/ethnicity, age, socioeconomic status, first-generation student

Phase 2: Daily Fluctuations in Belonging & Interest (LifeData)

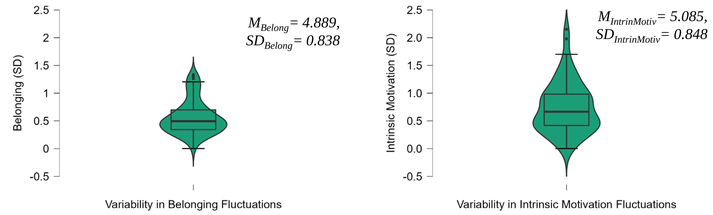
- **Daily Science Experience-** (1) as strongly disagree, (7) as strongly agree
  - **Belonging (4 items):** part of a larger science community, living as my authentic self, fit into a "larger science community"
  - **Intrinsic Motivation (3 items)-** science task is engaging, what I learned from this science task is valuable, I enjoy my work with this science task
- **Open-Ended Report-** 1-2 specific things which impacted belonging/ engagement in a positive/negative way
- **Self-Reported Science Experience Format**
  - Added in Wave 2
  - Ex: Lecture, Lab, Study group

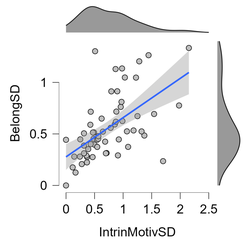
Phase 3: Motivation Outcomes & Individual Differences

- **Subjective Science Attitude Change Measure (Deemer et al., 2014)**
  - Ex: made me feel relaxed about learning science, stimulated my enthusiasm for science (10 items)
  - (1) *not at all* to (7) *a great deal*
- **Future Science Motivation (Smith, Sansone, & White, 2007)**
  - Ex: Volunteer in a science research lab, work in a science career (4 items)
  - (1) *not at all* to (7) *Very willing*
- **Attitudes Toward Technology (Rosen et al., 2013)**
  - Ex: get anxious when internet is unavailable, with technology anything is possible
  - (5) as *Strongly agree,* (1) as *Strongly Disagree*
- **Goal Affordances (Diekman et al., 2012)**
  - Ex: Science fulfills goals such as power, a career that uses science fulfills goals such as working with people, helping others, and serving the community (18 items)
  - (1) as not at all, (7) as extremely
- **Study Feedback-** Reflection on LifeData app; Suggestions for future participants

Data from Pilot Study

(1) To what extent are belonging and intrinsic motivation fluctuating?





r = 0.574
95% CI: [0.374, 0.722]

(2) Do these fluctuations predict meaningful STEM outcomes?

Results of parallel regression analyses suggested that *both* belonging and intrinsic motivation fluctuations positively predicted future STEM motivation, after controlling for mean levels:

- **Belonging :** b = 0.726, SE = *0.340* (p = .038*)*
- **Intrinsic Motivation***:* b = 0.630, SE = 0.294 (p = .037*)*

Conclusion and Implications

- Taken together, results of our feasibility study demonstrate that belonging and intrinsic motivation both fluctuate over the course of 10 days, suggesting that we have adequately captured within-person variability.
  - **Importantly, such intraindividual fluctuations also predicted future STEM motivation (with stronger effects for belonging).**
  - Given the high correlation between belonging and intrinsic interest fluctuations, we suggest that both are key processes in the self-regulation of motivation.

What is the Best Route to Increase Belonging in STEM?

- Different research teams (and theoretical frameworks) point to different points of intervention:
  - Walton et al. (2023) provides evidence of a social norms, role model and 'saying is believing" *individual level* intervention, increasing undergraduate student retention and persistence across academic fields.
  - Ayala et al. (2021) argues for *cultural change* to increase belonging in STEM, utilizing information from science lab team self-reports to transform organizations in ways which create and maintain a culture of belonging for underrepresented individuals.
- Our research provides a novel methodology to capture momentary changes in belonging and interest regulation (e.g., Thoman et al, 2013), thus allowing for future tests of social-belonging interventions.

Future Directions for Intervention Research

- Leveraging Goal Congruity Theory (Diekman et al., 2011), we aim to develop an intervention which increases belonging and intrinsic motivation, leading to long-term positive motivational and identity outcomes.
  - Identifying those with "low stability" (vs. "high stability") belonging experiences may help identify STEM students who would benefit most from a social-belonging intervention, bridging existing research with belonging uncertainty.

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