

## **Studies on teaming experience through embedding psychological safety, motivational driver, and cognitive diversity into pedagogy**

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Mirna Mattjik is a Teaching Associate Professor in the Engineering, Design, and Society Division, Cornerstone Design@Mines Program. Mirna is also faculty in the McBride Honors Program, and faculty affiliate for Entrepreneurship and Innovation. Mirna's formal education is in industrial technology, international political economy, project management and leadership. Her active research agenda is about improving teaching and learning for engineers and applied scientists, targeting transformative learning. Interests include but not limited to: student-centered teaching and learning, pedagogy in design, honors pedagogy and scholarship, diversity and inclusion in higher education, ethics in engineering education and reflective practices. In the classroom, Mirna strives to encourage students' intrinsic motivation to learn through modeling authenticity in teaching and learning.

Recent scholarships: Nickoloff Scholar in Entrepreneurship and Innovation, Daniels Fund Scholar in Engineering Ethics

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### **Dr. Megan Sanders, Colorado School of Mines**

Megan Sanders is the Senior Assessment Associate at the Trefny Innovative Instruction Center at the Colorado School of Mines. Before joining Mines, Megan worked at the Eberly Center for Teaching Excellence and Instructional Innovation at Carnegie Mellon University, where her role focused on supporting instructors in conducting research about student outcomes in their courses. Megan's disciplinary background is in educational psychology. She earned her PhD from the Ohio State University, and her research focused on the idea of relevance in higher education—how we define it, how students perceive it, and how to measure it—an interest that continues to inform her work.

### **Dr. Amy Hermundstad Nave, Colorado School of Mines**

Amy Hermundstad Nave is a Faculty Developer in the Trefny Innovative Instruction Center at the Colorado School of Mines. She earned a BS in Mechanical Engineering from Colorado State University before going on to earn her PhD in Engineering Education and MEng in Mechanical Engineering from Virginia Tech. Her research has focused on conceptual understanding in core engineering courses, opportunities to support engineering students' professional development, and efforts to support underrepresented students in engineering. Her current work in faculty development focuses on supporting faculty members in incorporating research-based practices into their own classrooms.

### **Ms. Wieke Gur, ICQ Global Asia**

Wieke is an Intercultural & People Skill Coach, born in Indonesia and is now based in Perth, Australia. She is a Global DISC master trainer and coach, CEO of ICQ Global Asia. Wieke has worked with many global training companies in the US and Europe, facilitating their intercultural program for their global clients since 2015.

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# Work in Progress: Studies on teaming experience through embedding psychological safety, motivational driver, and cognitive diversity into pedagogy

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## Abstract

During a series of classroom-based studies, the authors from Colorado School of Mines used two tools to measure students' motivation and the team's psychological safety in the cornerstone first-year design and problem-solving course at Colorado School of Mines. Intervention through implementation of Psych Safe modules was initially done along with a modified version of the Basic Psychological Needs Scale<sup>1</sup> to measure motivation (Fall 2019). The recent classroom-based study in the Spring 2021 semester utilized an industry tool formerly owned by fable+ and administered by ICQ Global Australia. The author from Pertamina University used the same tool in the senior year capstone course, not only for student teams but also for the instructors. Outcome from the application of this tool was further discussed formally with students, facilitated by our industry partners. From this trial it was observed that most of the teams fall into the Fear/Anxiety zone<sup>2</sup>. Also, teams who possess similar behavior and communication style with their instructors tend to perform better. In both cases, the effect of the pandemic lingers resulting in reduced focus and level of engagement. Potential future studies will be conducted independently by each institution, which may consist of: (1) authentic learning and assessment to encourage interaction between students beyond what is guided by the instructor; and/or (2) a qualitative study to compare focus groups between first year students and senior year students in cornerstone and capstone design respectively, for current insights on their experience in teaming without intervention. The assumption is improvement in employability skills<sup>3</sup> such as teaming and collaboration give a better chance for equity in impact. Through this poster presentation we are seeking feedback on both potential studies.

## Background

- Psychological Safety in teams is notably a major factor for the team's success however there is also a variable factor of motivation. Studies at Colorado School of Mines (Mines) dated from Fall 2019, though capturing both psych safe and motivation is proven to be difficult with using a modified version of the Basic Psychological Needs Scale (BNS) as tool. Though Psych Safe modules were created as attempt for intervention, results from the modified BNS was more telling about motivation rather than measures of psychological safety.
- ICQ Global Australia, a people development company, has been using a certain tool for industry practice in measuring team productivity. They wanted to know if the tool (originally owned by fable+) is also suitable in a higher education setting. Hence, they worked with a couple universities across the globe, namely Mines in the US and Pertamina University in Indonesia.
- Most recently at Mines in Spring 2021 a trial run was done with one section of a first-year design engineering course, where the intervention modules were loosely associated. In Pertamina University the trial run was done the semester before (Fall 2020), in a senior capstone class. In addition, the tool was implemented for the instructors who taught the class, too.

## Citations

- [1] "Self-Determination Theory," Center for Self Determination Theory, [Online]. Available: <http://selfdeterminationtheory.org/>
- [2] "Psychological Safety and the Critical Role of Leadership Development", McKinsey & Company, [Online]. Available: <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/psychological-safety-and-the-critical-role-of-leadership-development>
- [3] "Employability Skills Framework", Career and Technical Education, [Online]. Available: <https://cte.ed.gov/initiatives/employability-skills-framework>

## Methods & Partial Results

Fall 2019 at Mines: To examine changes in students' motivation within their teams across the course, we administered a version of the Basic Psychological Needs Scale that we modified to focus on students' perceptions within their teams (measuring Autonomy, Relatedness and Competence). The survey was administered first in week 3, at the beginning of the semester, after students had just started working in their teams but before engaging in the Psych Safe modules. Of the 25 students enrolled in the course, 24 completed the pre-test survey. The post-test survey was administered again after students had completed all three Psych Safe modules, in week 7 of the course, and 22 students participated. Finally, the survey was administered during the 15th week of the semester, and 7 students participated in this delayed post-test.

Spring 2021 at Mines: While still implementing two of the three Psych Safe modules, the class was introduced to the fable+ survey tool by ICQ Global Australia. Background information was provided before the survey was launched in an hour lecture by the company. General post-survey results were presented but not discussed individually.



Graphical representation of teams' performance on their level of psychological safety in comparison to their motivational driver. Left: explanation by fable+ Right: results from Mines (Spring 2021)

## Findings

- At the start, current Psych Safe modules target more of the autonomy and competence rather than relatedness. Autonomy is a dimension that was heavily emphasized, though it is more of a mindset objective that is relatively harder to attribute compared to competence, which directly relates to skill-based learning objectives. For example, proof of being a good team member is more tangible (competence dimension) compared to the ability to own and justify decisions in a team (autonomy dimension). Also, confidence in contributing ideas without judgment in a team—which is also indicative of competence, is psychological safety at its core.
- Since the pandemic, irrespective of the Psych Safe modules, the authors from Mines decided to be more intentional on finding an evidence-based tool that can measure both psychological safety and motivation combined.
- The pandemic had an effect on the ability for students to overall focus on academics, let alone thrive in a team setting. Mindset objectives takes precedence over skill-based learning objectives to alleviate this matter, for instance managing cognitive diversity and how important it is for team productivity.

## Gaps , Opportunities & Future Research

- Explore the potential objective measures to capture the 'team dynamics' between students – as part of team and individual performance assessment.
- Measure and visualize the level of awareness of class instructor on cognitive diversity and psychological safety and how this impact the learning dynamics
- Explore how to leverage the diversity and create psychological safety not only within the students but also within the class instructors and between students and the class instructors through syllabus design?
- A well-aware and committed class instructor is one of the keys for embedding psychological safety effectively in the class. A robust, effective and practical learning methodology on this topic for instructor is required.
- Measuring team dynamics is crucial to embed psychological safety in higher education learning process. The current approach is still using conventional approach.
- Tryout on a newly developed scanning tool, researched and developed by ICQ Global Australia.
- More concretely, these are possible (but not limited to) approaches for the research:  
(1) authentic learning and assessment to encourage interaction between students beyond what is guided by the instructor;  
(2) a qualitative study to compare focus groups between first year students and senior year students in cornerstone and capstone design respectively, for current insights on their experience in teaming without intervention.

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