Invited Workshop

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MOVING BEYOND "BREAKING ICE" TO "BUILDING BONDS" IN ENGINEERING CLASSROOMS: AN EVALUATION FRAMEWORK FOR TEAM BUILDING ACTIVITIES

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ABSTRACT

Engineering curricula frequently require students to engage in group work and interact with practitioners. To facilitate team building and cohesion, engineering instructors often propose and facilitate "icebreakers" or team-building activities. However, not all activities are designed with inclusivity as the focus and could inadvertently lead to reinforcing biases or students feeling excluded.

This workshop introduced the participants to a framework developed using evidence-based approaches to team building, with a focus on Diversity, Equity and Inclusion. Participants evaluated an existing activity based on the framework, proposed modifications to refine the framework, and were provided an opportunity to sue it in identifying areas for improvement in one of their own activities.

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1 BACKGROUND AND RATIONALE

1.1 Fostering Diversity, Equity and Inclusion with ice breakers and team-building activities

Creating a positive and inclusive learning environment is essential to promoting Diversity, Equity, and Inclusion (DEI) in engineering education, where collaborative work is fundamental. Engineering students often work on team-based projects that require collective problem-solving, while interdisciplinary teams are increasingly promoted to tackle complex real-world problems (Seidel & Godfrey, 2005; Van den Beemt et al., 2020). These group assignments not only enhance technical skills but also provide opportunities to develop project management and interpersonal skills (Mercier et al., 2023). However, without an inclusive learning environment, some team members may feel marginalised, undermining their learning experiences and potential outcomes (Haller et al., 2000).

Icebreakers and team-building activities (termed “bond building activities” in this proposal) present a valuable opportunity to foster a more inclusive environment within student teams. Icebreakers are short activities designed to help participants get to know each other, break down barriers and feel more open to one another before starting an event (Chlup & Collins, 2010). Meanwhile, team-building activities are structured exercises aimed at promoting four key components: interpersonal relations, problem-solving, role clarification and shared goal-setting among participants (Klein et al., 2009).

Nevertheless, not all icebreakers and team-building activities are inherently inclusive. Their design and facilitation must be intentional, considering the diverse needs, backgrounds, and experiences of the participants. For instance, activities that unintentionally reinforce biases or pressure participants to disclose personal information can alienate some individuals (Lou et al., 2021). However, when designed thoughtfully, these activities can play a significant role in fostering DEI in engineering classrooms and group work. They ensure all students feel, seen, heard, and valued, while also helping to strengthen bonds between team members and enhance the overall learning experience.

1.2 Evaluating bond-building activities

The fostering of DEI within bond building activities requires effort and deliberate action so that they are most effective (Harris et al., 2025). Additionally, it has been suggested that “structured interactions” can, for example, contribute effectively to retaining minoritised students such as students of colour (Rasco, Day & Denton, 2023). Despite this, evaluations of bond building activities typically report DEI outcomes as secondary effects (Klein et al., 2009) and as such the activities are not facilitated with DEI at the forefront. Furthermore, evaluations are usually applied after the activity is implemented rather than at the design stage (such as in Sasan, Tugbong & Alistre, 2023) and so there is little support for practitioners aiming to create inclusive and equitable activities.

To supplement the lack of evaluation tools for practitioners to implement meaningful DEI-fostering activities, the authors have developed a framework that concerns the following five dimensions: purpose of the activity, feasibility of implementation,

dynamics and interactions between participants, engagement of participants in the activity, and development of engineering identity. These dimensions were adapted from the four components of team-building activities listed by Klein et al. (2009) which were derived from a wide base of literature. Icebreakers and team-building activities typically take place in group settings, but the framework was also designed to be applied to different bond building scenarios. This was based on some of the authors' experiences of using these types of activities to also strengthen teacher-student relationships and student-mentor relationships.

This paper reports on feedback gathered during the workshop to ensure that the framework is useful and useable; that it facilitates the creation or improvement of activities that can be used to foster DEI in engineering classrooms.

2 WORKSHOP OBJECTIVES

2.1 Target audience

The framework has been constructed to assess the efficacy of activities which are supplementary to the course (not part of the core learning activities). It was aimed at STEM educators who currently use activities that they consider to be bond building activities to foster DEI in learning spaces. This may include in student coursework groups, between staff and students, or in other relationships that students will build as part of their degree courses.

2.2 Expected learning outcomes

Following this workshop, attendees will be able to:

1. Evaluate an existing icebreaker or team-building activity using a provided evidence-based framework.
2. Use evidence from their practice to increase the relevance and effectiveness of the framework (practice-based evidence).
3. Transfer the refined framework to their own activities to identify areas for improvement.

3 WORKSHOP DESIGN

3.1 Time plan

The workshop was organised in five steps, as shown in Table 1.

Table 1. The schedule of the workshop

Run time	Activity	Notes
5 min	1. Introduction (Goal setting & creating cohesion)	Plenary - brief introduction to: • The workshop and its aims • The main dimensions of the framework, to facilitate appropriately engagement with the next activity.
10 min	2. Team-building activity	Small groups (4 - 5 participants):

	(Active engagement & creating cohesion)	Participants engage in a common team-building activity in small groups.
8 min	3. Evaluation of activity using the framework (Active learning & evidence-based practice)	Small groups (same group as above): Participants evaluate the activity using the framework (one dimension per group) and propose modifications for that dimension (or missing dimensions).
22 min	4. Discussion of activity evaluation results (Active engagement & practice-based evidence)	Plenary: Participants share their evaluation of the existing activity using the framework, and their proposed modifications of the framework. They are guided to identify and refine modifications to ensure that they are grounded in evidence.
8 min	5. Conclusions and next steps (Active engagement & transfer to practice)	Individual: Participants use the modified framework to evaluate one of their own activities and identify areas for improvement.

3.2 Interactivity

This workshop has been explicitly designed to allow for multiple levels of engagement.

a) Plenary: Participants have multiple opportunities to contribute to discussions in a large group setting, both with other participants and with the workshop organisers (e.g. during activities 1 & 4).
b) Small group: Participants have the opportunity to engage in small groups during an interactive activity (activity 2), and in discussions (activity 3).
c) Individual: to ensure that the workshop is relevant to each individual participant, they will also have the opportunity to individually work on transferring the framework to their own practice (activity 5).

4 WORKSHOP RESULTS

The workshop had 27 attendees split between five groups. The authors gathered feedback from the groups who were focused on each of the following dimensions of the framework: 1) Purpose of the activity, 2) Dynamics and interactions between participants (inter-personal), 3) Engagement of participants (intra-personal), 4) Development of engineering identity, and 5) Feasibility of implementation.

4.1 Feedback on the activity

The ice-breaking activity selected for the workshop was “Two Truths and a Lie”. which groups evaluated using the framework. They found that while it was apt for “breaking ice” it was rather limited in its ability to “build bonds” and trust.

Attendees in every group expressed that the psychological safety of participants is essential (Edmondson and Bransby, 2023) but might not be adequately supported by

this activity. Specifically, they thought that participants may feel pressured to share personal details beyond their comfort level, or because they may be uncomfortable with lying. Multiple groups expressed a necessity for clear facilitation with explicit boundaries related to what participants are encouraged to share (such as telling them their truths and lie should only regard their professional life). Without boundaries participants can be "lulled into sharing something that is personal" so skilled facilitation is required in case sensitive information is shared.

4.2 Feedback on the framework

Primarily, attendees across different groups noted that the dimensions of the framework are linked. This made it challenging to comment on a single dimension in isolation as they were not aware of whether their proposals already existed under another dimension. As a result, some additions were made for multiple dimensions: for example, to emphasise an activity's intended and perceived purpose in relation to both dimensions 1 (to demonstrate that an activity has been designed intentionally) and 3 (to demonstrate that an activity has value for participants). It was also suggested to combine dimensions 2 and 3 as some participants commented that inter- and intra- personal considerations were very closely linked; this suggestion was accepted by many attendees in the whole room discussion.

Another core discussion point was the importance of the framework being explicit in ensuring that participants are equitably engaged, such as by allowing for the activity to have flexible approaches in order to be accessible.

4.3 Optimized evaluation framework

The framework was adapted using these suggestions and is presented in Table 2.

Table 2. Optimized Evaluation Framework for Team Building Activities

Dimension	Definition	Evaluation Prompts
1. Purpose of the activity	The reason for which the activity is done.	*Are the aims:* • Made explicit and relevant to participants? • Aligned with participants' motivations and interests? *What does this activity:* • Aim to achieve (e.g. building trust, clarifying roles, problem-solving)? • Do to support DEI in the teams and more widely in engineering? • Do to inadvertently exclude or stereotype some groups?
2. Engagement and interactions of participants	Engagement: The extent to which participants contribute behaviourally, cognitively, and emotionally in an activity to foster	*Will all participants:* • Have meaningful opportunities to contribute? • Feel their contributions are valued and respected? • Have opportunities for participants to take ownership or leadership within the activity? *How does the activity:*

	belonging and respect across diverse backgrounds. Interactions: The quality of social interactions that are fostered among members within the activity, where everyone (students and staff) experiences psychological safety and respect.	• Ensure accessibility and meaningful participation across diverse abilities, backgrounds, and identities? • Promote trust and understanding between participants? • Mitigate possible risks to participants being put in uncomfortable or marginalising situations (such as forced disclosures, gendered roles)? • Facilitate equitable contributions from all members? • Enable staff to mediate interactions between student participants to ensure psychological safety and respect? • Foster emotional and social investment (confidence, trust, sense of belonging)?
3. Development of **engineering identity**	The extent to which an activity fosters students' self-perception, confidence, recognition, and sense of belonging as engineers.	*How does the activity:* • Relate to engineering? • Provide opportunities for participants to integrate their personal identity within an engineering application? • Enable participants to build confidence? • Provide recognition for different contributions in engineering (not just technical)? • Help underrepresented groups feel they belong in engineering?
5. Feasibility of implementation	The practicality of running the activity inclusively using resources that are available.	*What consideration is there for:* • Designing the activity for accessibility (e.g. cost, group size, staffing?) • Additional adaptations that can be made and what additional resources are required? • Abilities and mental or physical requirements will students need to complete the activity? • The resources (time, space and materials) required and their availability as intended? • Other feasibility planning to consider diverse student needs?

5 CONCLUSION AND FUTURE WORK

There was convergence in improvements for the activity and framework. Given the feedback, it is evident that the various dimensions of the framework are interlinked, and it is important to have an overview of the full framework rather than a piecemeal view of each dimension.

The framework is large and comprehensive, and as such could not be fully evaluated within this workshop but still requires testing and development to ensure that it covers a broad range of DEI considerations and suggestions for implementation. Because of this, a suitable approach for developing the framework further may be co-design and continuous improvement with engineering educators.

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