TRAINING TEACHING ASSISTANTS AS COACHES

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Abstract – *The role of graduate teaching assistants (GTAs) is becoming more demanding as engineering education places an increased emphasis on teamwork and design. For undergraduate students to excel, GTAs must help them form well-functioning teams and encourage them to operate as self-directed learners. In other words, GTAs should operate more as coaches rather than teachers. Many GTAs, unfortunately, lack the basic competencies of to perform as a coach. In this work, we present a 3-hour workshop designed to address this skills gap. The role of a coach and basic theoretical concepts, as well as a simple tool to elicit self-reflection in students are presented through a series of experiential exercises and discussions. The exercises also give participants an opportunity to practice these newly acquired skills while developing confidence in identifying scenarios where the tool may be applied. This workshop has been executed once with a group of 10 graduate engineering students at the University of Victoria. Survey results have been encouraging, we believe that the participants successfully acquired basic coaching competencies and applied them to their interactions with undergraduate students.*

Keywords: coaching, teaching assistants, graduate students, skills workshop

1 INTRODUCTION

Traditionally, engineering education has emphasized the acquisition of engineering science knowledge. In recent years, there has been a concerted effort to strike a balance between knowledge acquisition and skills development, with teamwork and design competencies being viewed as particularly valuable by the engineering industry community [1]. These skills are specifically targeted at the University of Victoria (UVic) through a series of design courses which use a problem based learning (PBL) approach. The design courses comprise only a minority of the course offerings at UVic, most are taught using the more traditional engineering science model [1]. Many of these have a laboratory component, some of which are organized as course-long projects, and others as independent self-contained exercises; all require students to exercise teamwork with varying degrees of

engineering design judgement. All courses depend heavily upon graduate teaching assistants (GTAs) who are increasingly called upon to coach undergraduate students as they progress through an open-ended decision making process. Success in facilitating students through these exercises depends in large part on a GTA's ability to effectively coach student teams, namely, encourage positive group dynamics, individual and team innovation, and problem solving [2].

While GTAs generally have a good command of engineering theory and are comfortable sharing their knowledge, many have deficiencies in the competencies required to effectively teach engineering design, including team coaching abilities. A one-week training program, the Design Engineering Mentorship Program (DEMP), with the aim of preparing GTAs to work in design courses was developed at UVic under the mandate of the NSERC Chair in Design Engineering [3].

GTAs working as lab instructors in other courses, as well as those working as tutorial instructors can also benefit from learning coaching skills. Instruction in coaching was made available to all engineering GTAs at UVic for the first time this year through the teaching assistant consultant (TAC) program, which employs experienced GTAs as peer mentors [4]. The workshop described in this paper was originally developed for DEMP and reused with little modification. This self-contained workshop focuses on developing general coaching skills which suits a general engineering GTA audience.

A description of our coaching workshop follows in section 2, including important theoretical concepts (2.1), a practical tool (2.2), and experiential activities used (2.3). Workshop results are presented in section 3, including information from participant surveys (3.1) and observations from the workshop facilitators (0). Recommendations for future improvements are discussed in section 4. Finally, conclusions are presented in section 5.

2 WORKSHOP DESCRIPTION

The workshop was designed with three goals in mind:

1. Introduce participants to some of the main concepts behind coaching (section 2.1).
2. Arm participants with a basic tool that they can easily use with their students (section 2.2).
3. Reinforce coaching theory through experiential activities employing the basic tool while gaining confidence in the process (section 2.3).

Our goal was for participants to be awakened to new ways of thinking about their role as GTAs and how they relate to their students.

2.1 Basic Coaching Theory

Central to coaching is the idea of “unlocking people’s potential to maximize their own performance” [5]. In other words, a coach practices andragogy as opposed to pedagogy; he or she fosters self-directed learning in students [6]. Those who are self-directed (or lifelong) learners are able to assess the demands of a task, evaluate their own knowledge and skills, plan their approach, monitor their progress, and adjust their strategies as needed [7]. In other words, self-directed learners are capable of making “good decisions” in an uncertain environment.

Fostering self-directed learning is only part of the story. Coaches need to help teams to come together so that they can work efficiently. In 1965, Tuckman introduced a now well-known model of group dynamics [8]. In order to optimally perform a task, teams need to successfully traverse a sequence of stages:

1. **Forming:** The team members meet and begin to orient themselves to both one another and the task at hand. Leadership relationships begin to emerge, but members are still behaving independently.
2. **Storming:** Conflict and polarization arise out of disagreements and personality clashes, with a negative influence on task performance.
3. **Norming:** The team becomes cohesive as conflicts are overcome and personal, intimate opinions are shared. Team members begin to work towards shared goals.
4. **Performing:** Structural issues have been overcome and the team is both cohesive and flexible as it works to achieve its goals. The team is now performing optimally.

When left to its own devices, there is no guarantee that a team will successfully traverse each stage and transition into the next. The storming stage can be particularly difficult to navigate, with some teams never moving past it. By promoting mutual understanding and appreciation

for diverse perspectives, a coach is able to support positive movement through the stages [9].

Team members’ mindsets are at the heart of conflicts in the storming stage. The coach’s mindset will also determine his or her success in helping the team navigate all of Tuckman’s stages. The judger/learner model is a choice model, it describes two contrasting mindsets from which we can operate. The model frames our view of the world; it shapes our beliefs about limitations and possibilities. Awareness of it can help us make more effective choices and increase collaboration [10]. Table 1 summarizes the judger/learner model. Those with a judger mindset tend to be closed, negative, and punishing in their interactions; they are problem-focused. In contrast, those with a learner mindset are open, curious, encouraging, and positive; they are solution focused and seek to create win/win situations. A team with a learner mindset will have a better chance of successfully traversing the storming stage. By adopting a learner mindset when interacting with the team, a coach can deliberately model the desired behavior for the team members to emulate. This creates a positive team environment that fosters creativity, curiosity, innovation, and a commitment from the team to see the project through [11].

Table 1: Characteristics of judger and learner mindsets [12].

Judger Mindset	Learner Mindset
<ul style="list-style-type: none"> • Know it all attitude • Reactive, automatic • Judgmental • Problem focused • Inflexible, rigid • Avoids responsibility for own thoughts, feelings, actions • Blames & complains • Assumes scarce resources • Assumes limited possibilities • Feedback = rejection • Protective & defensive • Change is dangerous, must be resisted 	<ul style="list-style-type: none"> • Beginner attitude • Responsive, thoughtful • Researcher, reporter • Solution focused • Flexible, adaptive • Takes responsibility for own thoughts, feelings, actions • Avoids blaming & complaining • Assumes resources are plentiful • Assumes unlimited possibilities • Feedback = helpful • Curious & open • Change is constant, must be embraced and managed

Engineering design is a creative endeavor. Creativity is often incorrectly thought of as being an intrinsic ability rather than a learnable skill [13]. The creative process is understood to have two alternating phases: divergent thinking and convergent thinking. Divergent thinking serves to maximize the solution search space. It is an

unconstrained thinking mode that “attempts to diverge from facts to possibilities that can be created from them”. Convergent thinking is, unsurprisingly, the opposite process. It is the pruning away of inferior ideas until only the best solution remains [1][14]. Shifting between these two modes of thinking is difficult. The transition leads to feelings of impatience and frustration. It is uncomfortable and commonly referred to as the groan zone [15]. By understanding this process, a coach can encourage a team to think both divergently and convergently, and support the team through the groan zone, thus fostering a creative mindset.

2.2 A Basic Coaching Tool – Stem Sentences

Language is a coach’s most powerful tool. It can encourage a learner mindset, foster self-awareness, and stimulate creativity. This workshop teaches participants to use stem sentences. These are open-ended questions or statements which are designed to induce self-directed thought. Stem sentences are context sensitive and should not be used arbitrarily if they are to be effective. Thankfully, they are quite generic since the context is the behavior the coach is trying to elicit. This means that once a coach has created a catalogue of stem sentences, he or she will be able to easily use them in a wide variety of situations. Examples of stem sentences are listed in Table 2.

Table 2: Stem sentence examples.

Context	Stem sentence
Encouraging	May we hear from someone who hasn’t talked in a while?
Balancing participation	Would someone like to play devil’s advocate for a moment?
Finding like minds	Who else feels similarly?
Drawing people out	Tell me more.
Divergent thinking	If anything were possible, what would you create?
Convergent thinking	What works?

Participants were provided with a short inventory of stem sentences alongside a worksheet and encouraged to create their own. Two activities, described below in section 2.3, provided a contextualized opportunity to practice using stem sentences.

2.3 Workshop Structure

The workshop was presented in two 1.5 hour sessions over two consecutive days. Our reasoning was to offer more flexible scheduling in order to maximize GTA participation. This workshop structure had an added benefit, it afforded participants a chance to reflect on what

they learned in the first day and to prepare more deeply reasoned questions on the second day.

The workshop was very hands-on and needed three facilitators. Three experiential activities, described below, served to introduce aspects of coaching theory and to give opportunity for hands-on practice. The activities were interspersed with in-depth discussions led by Gaetz, a Professional Certified Coach (PCC) [16] with 15 years of experience.

2.3.1 Good Coach, Bad Coach. Activity 1 served as an introduction to the main themes of the workshop. It also served another important role: it accelerated the forming stage in the participants’ group dynamic. It was launched at the beginning of the workshop before any information was presented. This allowed participants to learn the importance of effective coaching through experience. Two stations, each with a short design challenge, were set up. The participants were split into two teams and given 10 minutes to complete each challenge. Each project came with a facilitator acting as a coach. The coaches behaved in a “good cop/bad cop” fashion, presenting radically contrasting styles of coaching. The first coach modeled a learner mindset (patient, encouraging, inclusive), while the second coach was impatient, authoritative, and overly critical to the point of belittling his team. The activity concluded with a reflection period where participants discussed how both facilitators influenced the quality of their design output. This served to emphasize how a coaching approach influences the dynamics of a team and ultimately the quality of the deliverable.

Activity 1 was followed by a presentation and discussion of coaching theory (section 2.1) and stem sentences were introduced. This concluded the first session. Participants were provided with a worksheet for developing their own stem sentences as homework. The second session began with a recap aimed at reinforcing theoretical aspects presented the previous day, as well as answering participants’ questions.

2.3.2 Interactive Coaching Demo. Activity 2 followed as an interactive coaching demo. Here Bubbar and Dimopoulos played the role of two students tasked with solving a design challenge. Gaetz as a meta-coach, facilitated the design challenge while soliciting guidance on how to coach these “students” from the participants. The “students” were intentionally difficult: they frequently clashed with each other, they were inattentive, and they ignored instructions. This gave participants many opportunities to identify sources of conflict, understand how to best use their stem sentences, and build confidence in their abilities to coach a student team.

2.3.3 GTAs as Coaches. Activity 3 concluded the workshop. Participants were tasked with coaching a team through a predefined design challenge without “training wheels”. Participants broke into groups of three or four. One group member played the role of the coach and the rest of the group played the role of a student team. After 10 minutes a new person rotated into the coach role and presented a new design challenge to the team. This was repeated until all group members had a chance to be the coach. The twist here was that the coach was presented with a suggested solution to the design challenge. The goal was to effectively support the team to develop a solution to the design challenge *without* pushing the suggested solution. This explicitly forced the coach to promote a self-directed learning mindset.

3 RESULTS

The workshop ran with 10 participants. This group size was appropriate as it allowed for intimate discussions with wide participation. We did not envision being able to effectively run the workshop with a group larger than 15. Attracting enough participants was a bit of a challenge and required some lobbying on the part of a design course instructor.

3.1 Survey Results

Our participants appeared to be enthusiastic and highly engaged throughout the workshop. However, anecdotal evidence is not enough to gauge the effectiveness of the workshop. In attempts to quantify the influence of the workshop on our participants, we delivered three short surveys to help us understand what our participants gained from the workshop: one immediately before the workshop, one immediately after the workshop, and a one six weeks later. All 10 participants completed the pre-workshop survey, 7 completed the post-workshop survey, and 5 completed the delayed survey.

From the pre-workshop survey, we learned that 60% of our participants were experienced GTAs having taught at least three lab or tutorial sections. 80% of the participants had never received any coaching instruction prior to the workshop.

We observed an interesting shift in self-reporting of participants’ comfort level of working with students. Most responses were initially near the midpoint between “completely at ease” and “extremely anxious”. While there was a shift towards “completely at ease”, there was also a new tail towards “extremely anxious”. Some of the less experienced participants may have initially underestimated the needed level of student-GTA interaction.

Comparison of the pre- and post-workshop surveys was encouraging:

- Initially, most participants considered themselves to have had little to no coaching experience. This shifted towards a higher level of experience after the workshop. Participants understood the role of a coach and were able to apply it to their past experiences.
- There was a clear indication that participants learned that a coach’s role is not to lead the team.
- Participants were initially uniformly unfamiliar with the term andragogy. All respondents understood it after the workshop.
- 90% of participants were initially unfamiliar with stem sentences. All respondents were able to correctly identify the proper use of stem sentences after the workshop.

The post-workshop survey also asked respondents to comment on changes in their views on how coaches support students, and what they felt to be the most important lesson from the workshop. The responses were positive and those who chose to elaborate their responses clearly understood that the coach plays a supportive role using stem sentences as a tool to elicit self-directed thought.

Half of the respondents to the delayed survey (6 weeks after the workshop) reported using stem sentences with students in their courses. They also reported that stem sentences helped them promote self-directed learning in their students.

The delayed survey also asked respondents to comment on how the workshop influenced their views on being a GTA. Among the positive answers were mentions of holding a learner mindset and the importance of fostering engagement. One response was interesting, the author mentioned noticing the difference between western and eastern education.

The vast majority of our GTAs are international graduate students from countries such as Iran, China, and India where education is teacher-centric rather than student-centric as in Canada [17]. Many of these GTAs may not fully appreciate this difference in education style. This might account in part for the low rate of interest in the workshop when it was initially advertised.

3.2 Facilitator Observations

We were generally pleased with the workshop, it unfolded almost as anticipated. The only real difficulty came in activity 3 (GTAs as coaches), but it was easily corrected.

Activity 1 was quite unobtrusive, due the extreme contrast in coaching behavior, and participants quickly clued in to what was going on. It was effective nonetheless. From the

debrief discussion, we learned that we had induced strong enough emotions so as to influence participants' attitudes towards the task and each other. The judge coach made participants feel stressed and anxious, while the learner coach made them feel relaxed and cooperative.

Activity 2 was very effective in demonstrating the selection and use of stem sentences. All participants took part, some more actively than others. Ensuring that all participants are drawn into the exercise is important to its success and is highly dependent on the skills of the meta-coach.

Activity 3 had a blind spot. The teams all worked so well together that it was clear after the first iteration that the coach had little, if anything to do. The group suffered from a self-selection bias, as participants were all interested in coaching and understood the importance of cooperation. To remedy this, a facilitator joined each group and acted as a difficult team member in order to inject group conflict. The style of disruption was varied so as to give each new coach a different experience.

A question raised during the workshop revealed a theoretical aspect which had been overlooked when planning the workshop. What is the difference between a teacher, a coach, and a mentor? Answering this insightful question really helps to clarify the role of a coach. Briefly, a teacher imparts new knowledge, a mentor shares personal experiences, and a coach fosters autonomy. Addressing this distinction earlier in the workshop would help participants to more quickly understand a coach's role.

A number of participants had difficulty understanding the use of stem sentences when the concept was introduced on the first day. Further discussion on the second day helped somewhat. Activity 2 really cemented the concept of stem sentences and their use. Breaking for the day after stem sentences were introduced but before they could be demonstrated was sub-optimal.

4 RECOMMENDATIONS FOR IMPROVEMENT

We believe that engineering undergraduate students at UVic would benefit if more of their GTAs understood the importance of fostering a self-directed learning environment, and were able to do so with confidence. Reaching out to GTAs and convincing them of the value of coach training has proven difficult. As discussed above, this may be due at least in part to the background and educational experiences of our international GTAs. Emphasizing the importance of self-directed learning to all new GTAs and linking it to this workshop during a mandatory orientation could boost interest in coaching.

The workshop can be improved in a few ways.

Highlighting the differences between a teacher, a mentor, and a coach is illuminating and should be discussed early in the workshop.

Immediately following the introduction of stem sentences with Activity 2 would help participants to more quickly appreciate the concept.

Activity 3 should be updated. Team conflict is central to this exercise and it did not naturally arise among participants. Facilitators or some other outside actors should join each group and play-act as difficult people.

5 CONCLUSIONS

We have presented a 3-hour workshop designed to train GTAs to act as coaches in the context of undergraduate engineering courses. We have given an account of the first offering of this workshop generally available to all engineering GTAs at UVic. Survey results indicate that participating GTAs acquired knowledge of and skills in coaching which they have subsequently used in their interactions with undergraduate students. Some easily-implemented improvements to the workshop were also given.

Acknowledgments

The authors appreciate the financial support from Natural Sciences and Engineering Research Council (NSERC) of Canada Design Chair for funding this publication.

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