TRAINING TEACHING ASSISTANTS AS COACHES: A SUSTAINABLE APPROACH

Alexandros Dimopoulos, Eric Wilson, Kush Bubbar, and Peter Wild

Faculty of Engineering, University of Victoria

Corresponding Author: adimopou@uvic.ca

Abstract—More is being asked of graduate teaching assistants (GTAs) as engineering education places an increased emphasis on teamwork and design. GTAs directly influence undergraduate learning. How they approach their role can determine if that influence is positive or negative. Exerting a positive influence requires GTAs to encourage positive group dynamics, foster self-directed learning, and support individual and team innovation. In other words, the role of a GTA is closer to that of a coach than to a teacher or a mentor. Unfortunately, most GTAs lack experience and skill in coaching and facilitation. To help shift our GTAs' perspectives and help them to think, act, and view themselves as coaches, we have developed a coaching and facilitation training workshop. We have now offered this workshop for a second year. The second offering includes a number of important updates which were driven by three motivations: 1) improved educational effectiveness, 2) sustainability, and 3) dissemination. Important changes include a new activity to introduce the use of open-ended questioning and a workbook which supports the workshop activities and acts as a reference source which participants can consult after the workshop. We have also created a facilitators' guide so that the workshop may be delivered by facilitators other than the authors. All workshop materials have been released under a Creative Commons license to facilitate dissemination.

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

1. INTRODUCTION

For a number of years, an engineering education which overemphasizes an engineering science approach has been considered inadequate. This style of education, which teaches students to apply scientific principles to technological problems, has been in use since the 1950s and produces graduates which have difficulty adapting to the professional environment. In response, there has been a serious effort in recent years to support the development of teamwork and design competencies in students [1]. At the University of Victoria (UVic), these skills are targeted

through a series of engineering design courses which use a project-based learning (PBL) model. Many of the other, more traditional engineering courses also require students to work in teams and exercise varying degrees of engineering design judgement in order to tackle laboratory exercises and course-long projects. All of these courses rely on graduate teaching assistants (GTAs) to help guide students through an open-ended decision-making process. To successfully facilitate student teams, GTAs need to encourage positive group dynamics, individual and team innovation, and problem solving [2]. In other words, they need to work like coaches.

Though some GTAs possess a coach-like mindset and can be effective by following their instincts, this is far from universal. This is not surprising considering that our GTAs are not required to receive any formal instructional training and that didactic style teaching still dominates engineering education in North America [3]. Didactic teaching relies almost exclusively on lecturing and has limited student interaction. Without having been taught other methods of instruction, many GTAs will model what they have already been exposed to [4]: didactic teaching.

To improve student experiences in engineering design we created a workshop with the aim of training GTAs to think and act like coaches [5]. We hope that participants are awakened to new ways of thinking about their role as GTAs and how they relate to their students.

An education professional who is an International Coaching Federation (ICF) Professional Certified Coach (PCC) [6] was heavily involved in the development and facilitation of the workshop's first edition. Unfortunately, this expert was not able to facilitate the workshop for a second year. This forced us to consider our workshop's sustainability. Many of the authors are graduate students who will be involved with this workshop for a limited time. Soon enough, no one who has been involved in the creation of this workshop will be available to facilitate it. To sustain it into the future, our workshop will need new facilitators. Could non-expert coaches successfully deliver a workshop on coaching? We believe the answer is yes, with the following caveats: 1) the facilitators should have

a coach-like mindset, and 2) the workshop is a broad introduction to coaching.

We have modified our original workshop by incorporating changes based on our observations from last year's offering, and to make it deliverable by non-expert coaches. These changes include: a more structured presentation, introduction of a reference workbook for participants, and introduction of a scaffold exercise. This new version of the workshop has been presented to GTAs both at UVic and at the University of British Columbia (UBC).

We believe that our workshop can be run by anyone who is responsible for training GTAs, including experienced GTAs. To support this, we have created a workshop facilitators' guide and released all workshop materials under a Creative Commons license (available at <https://www.oac.uvic.ca/etacoach>). We hope that our workshop will help future GTAs at UVic and at other universities.

The rest of this paper begins with an overview of coaching concepts, both generally and in the context of teaching engineering design (section 2). It then describes the content of the workshop (section 3), efforts to make the workshop future-proof and widely available (section 4), results of participant surveys and facilitator observations (section 5), some suggestions for future work (section 6), and conclusions (section 7).

2. COACHING CONCEPTS

The International Coach Federation defines coaching as "Partnering with clients in a thought-provoking and creative process that inspires them to maximize their personal and professional potential" [7]. Coaches encourage others to improve their performance and enhance their quality of life. They seek to elicit solutions and strategies from the client, and don't aim to act as a mentor or a teacher. The coach understands that the client is naturally creative and resourceful and seeks to encourage the client to recognize these attributes in themselves, and work to enhance these innate abilities [8]. In other words, the coach encourages responsibility, self-directed learning, and accountability in their clients [9]. Another way to consider this is that a coach works more like a partner than a leader. Coaching is a natural fit for GTAs since their role is primarily supportive: they help students to understand and set project goals, to manage their work, to apply their knowledge, and to work together in teams. Our goal is not to train coaches, but rather to encourage GTAs to become more coach-like. To do so, participants need to be able to understand coaching in the context of supporting engineering students performing design work. To this end, our workshop focuses on five key concepts: the learning continuum, group dynamics, mindsets, the creative process, and

inspiration. The first four of these were present in the first edition of the workshop, inspiration is a new addition.

The way we learn can be thought of as a continuum which ranges from pedagogy, or teacher-directed, to andragogy, or self-directed. Those who operate as 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 [4]. In other words, self-directed learners are capable of making "good decisions" in an uncertain environment, as is constantly encountered in design.

Although being a self-directed learner is a good start, it is no guarantee of success, particularly in team scenarios. What happens when individuals have to work together to perform a task? How do they go from being a collection of individuals to being a productive team? In 1965, Tuckman proposed that teams must pass through four stages before become productive [10]:

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.

Successfully passing through each stage is not guaranteed. The storming stage is particularly challenging and some teams never get past it. In large part, this evolutionary process is about learning to communicate effectively. A coach is able to encourage positive movement through these stages by promoting mutual understanding and appreciation for diverse perspectives [11]. The coach can also encourage the team to focus on the "bigger picture" of the project at hand. When the team is unified by a common cause, the mindsets of the individuals in the team will shift toward the benefit of the collective, rather than on personal gain.

Team member mindsets are at the heart of conflict during the storming stage. The coach's mindset will also impact his or her effectiveness in facilitating a positive transition through Tuckman's stages. A mindset is a set of attitudes that determine our interpretation of and response to a situation. Mindsets are not fixed, we can choose to adopt different ones. Thus awareness of

mindsets can help us make more effective choices and increase collaboration [12]. In our workshop, we employ a model of contrasting mindsets called *judger/learner*. Those with a *judger* mindset tend to be closed, negative, and problem focused. In contrast, individuals with a *learner* mindset are open, curious, positive, and encouraging; they are solution focused and are open to possibility. The coach can approach team dynamics with the *learner* mindset to create a positive, open environment. Coming from the *learner* mindset, the coach can provide a standard which the rest of the team can emulate in their interactions. This type of environment will foster creativity, curiosity, innovation and commitment from team members [13].

The ultimate goal of engineering design is innovation: the creation of non-obvious solutions. It is a creative endeavor. Creativity is a learnable skill, not an innate gift [14]. The creative process comprises of two phases: divergent thinking (or ideation), and convergent thinking. Divergent thinking is unconstrained, it “attempts to diverge from facts to possibilities that can be created from them”. Convergent thinking is the converse. It is the pruning away of inferior ideas until only the best solution remains [1], [15]. Shifting between these two thinking modes is difficult. The transition leads to feelings of impatience and frustration as a team realigns itself. It is uncomfortable and commonly referred to as the *groan zone* [16]. By understanding this process, a coach can encourage a team to think both divergently and convergently, and support the team through the *groan zone*.

Encouraging motivation and inspiration is at the heart of the role of a coach, and that of an effective leader. A powerful way to motivate positive change in individuals and teams is to encourage them to identify a strategic vision, or a “greater purpose” their work is serving. This can help give team members a purposeful direction and align them with a common goal [17] thus enhancing communication, participation, and commitment [18]. Inspiration transforms perceptions of capabilities and expands possibilities [19]. Individuals who feel inspired report [20]:

- Openness to new experiences
- Greater absorption in their tasks
- Stronger drive to master their work
- Greater sense of intrinsic motivation
- Greater sense of creativity and higher self-ratings of creativity over time

An inspired team is not only more likely to work more effectively, but more *creatively*. An important and often overlooked trigger for inspiration is exposure to inspiring managers and role models. This is one of the reasons a coach’s own mindset and approach with a team can

profoundly affect its ability to achieve its goals. The coach can set-up the optimal circumstances for inspiration by encouraging members of the team to adopt a *learner* mindset, expand their view of possibility, hold them to a higher-purpose, and help them to manage conflict as it arises.

3. WORKSHOP STRUCTURE

The previous edition of the workshop was split over two days. Participants had required more review than anticipated on the 2nd day, causing some activities to be rushed. To save time, we decided to offer the updated workshop in a single 3-hour session. There were three facilitators, all of whom are graduate students with experience as GTAs. As mentioned in section 1, this is an important difference from the previous offering of the workshop where an experienced coach played an important facilitator role. Though this expert was no longer available, two of the facilitators returned from last year.

The basic structure of the workshop remains unchanged, it still revolves around three experiential activities, which are described below. The activities were interspersed with a presentation and discussions.

Many GTAs are English as additional language (EAL) and in the past a number of participants had some trouble fully engaging in the group discussions. To make the workshop more accessible, we have revamped our presentation slides to be more structured and detailed, we also provided each participant with a workbook. The workbook served as an aid for the experiential activities and as a reference which participants could use at their convenience after the workshop.

3.1. Activities

Two of the activities from the first edition were judged to be very effective and were reused. The third activity, which involved having participants coach each other, was replaced with a new activity designed to teach effective questioning (section 3.1.2).

3.1.1. Good Coach/Bad Coach

The workshop opens with this activity which remained unchanged from the first edition. Participants were told that it was a simple icebreaker exercise to help them to get to know each other. In actuality, its main purpose was to introduce the main themes of the workshop by providing a concrete example of how effective and ineffective coaching can impact team performance. This allowed the participants to learn the importance of effective coaching based on their own positive and negative experiences. Two mini-design challenge stations were set up. The participants were split into two teams and each team worked on one of the challenges for 10 minutes. The teams then swapped positions and were again given 10 minutes to attempt their second design

challenge. Each challenge came with a facilitator acting as a coach. The coaches behaved in a “good cop/bad cop” fashion, presenting radically different ways of approaching their assigned team. One coach modelled a learner mindset (patient, encouraging, inclusive) while the other was impatient, dominating, and overly critical to the point of belittling the team. The activity concluded with a reflection discussion where the participants were let in on the purpose of the activity. The participants discussed how the ‘being’ (attitudes, mindsets, and actions) of the facilitators influence their effectiveness as a team, and ultimately the quality of the deliverable.

3.1.2. Crafting Stem Sentences

In the end, coaching is really about communication. This activity introduces participants to the use of stem sentences, the primary coaching tool presented in the workshop. These are open-ended questions or statements designed to induce self-directed thought. The open-endedness is important as it allows students to better understand their situation and make appropriate decisions on their own. Stem sentences are context-sensitive, they should be chosen in accordance with the situation at hand. Since many behavior patterns and situations reoccur commonly, a limited inventory of stem sentences can be sufficient. This activity provides participants with a set of stem sentences which they can immediately put to use with their students. This set is a starting point and participants were encouraged to augment it with their own ideas. Using stem sentences is not always obvious and a number of participants in the workshop’s first edition had difficulty with this. To clarify stem sentence use, we introduced a new three-step pattern:

1. Recognize the **situation**. What is happening with the students?
2. Decide on a **coaching goal**. What does the coach want to achieve in their interaction with the students?
3. Pick a **stem sentence** that can move the situation towards the coaching goal.

Two examples of this pattern shown in **Table 1**. The activity taught this pattern through a scaffolding approach. The workbook contained a table with 14 entries similar to those in **Table 1**. The first three entries were completely filled in, the next 6 had blank entries for stem sentences, and the final 5 only listed situations. Through group discussions led by the facilitators, participants decided on appropriate entries to complete the table. This activity also served as a preamble to the final activity, described below.

3.1.3. Interactive Coaching Demo

This activity was also reused from the workshop’s first edition. Here participants were given a chance to practice using stem sentences in an almost real-time. Two of the

facilitators played the role of students (S1 and S2) who were tasked with completing a simple design challenge. The third facilitator acted as a kind of meta-coach (MC) who facilitated the design challenge and paused the scenario from time-to-time to solicit guidance from the participants. S1 and S2 were intentionally difficult, frequently clashing with one another, being inattentive, ignoring instructions, etc. The action would be paused by MC at key moments and the participants were asked to 1) identify the situations 2) develop a coaching goal and 3) deliver an open-ended stem sentence to promote behavior conducive to a healthy team dynamic. The scenario would then play out between S1 and S2. This continued until the design task was completed.

Table 1: stem sentence use examples

Situation	Coaching Goals	Stem Sentences
One student feels that they are doing the bulk of the work	Balancing expectations and participations	How could we make sure that everyone feels like the tasks are delegated fairly?
The team has lost focus and is engaged in off-topic personal discussions.	Re-focus attention	Can anyone explain the problem in their own words?

4. WORKSHOP SUSTAINABILITY AND DISSEMINATION

Losing our expert coach after running the first edition forced us to consider the workshop’s sustainability into the future. Could we future-proof it so that it could be run by facilitators who may not have any connection to the original authors? This then led to the possibility of widely disseminating our workshop so that other universities could adapt it to their use.

The primary concern was whether the workshop could be run without an expert coach facilitator on hand. Coaching is subtle and it takes many hours of practice to become proficient [6]. However, this workshop is not intended to provide an in-depth training but rather to plant the seed of a new perspective. We decided that for the purposes of this workshop, it is sufficient for the facilitators to have a coach-like mindset, that is to say, an appreciation for the role of a coach and an interest in working with others in a supportive manner. Ideally, facilitators should also have experience working with students in a design environment.

We did not feel that our workbook and presentation slides were clear enough to use without further instructions so we have also created a facilitators’ guide.

We hope that this package of materials will allow future generations of GTA trainers to run our workshop on coaching at UVic. We also hope that it will be adopted by trainers at other universities. To simplify dissemination we have freely released all of these materials under a Creative Commons license [21]. All workshop materials are available for download at: <https://www.oac.uvic.ca/etacoach>.

5. RESULTS

We ran this new edition of the workshop twice, once at UBC and once at UVic. Both instances had 8 GTA participants.

To gauge the effectiveness of our workshop, we asked participants to answer a short survey before the workshop and one at the conclusion. We had also used such an assessment with the first edition of the workshop. Here we have modified the surveys to better target understanding of the role of a coach. We asked them to self-assess their comfort working with students and their level of experience in a coach-like role. We also quizzed them on their understanding of the role a coach plays and the appropriate use of open-ended questions (stem sentences). Overall, both groups responded well to the workshop and seemed to have grasped the main points. Comments indicate that participants became less anxious about working with students and planned to use stem sentences in their work.

The good coach/bad coach exercise (section 3.1.1) was very unobvious and most participants quickly understood what we were doing. Even so, they reported finding it surprisingly revealing. Each coach was able to affect participant mood and level of success in the activity. The bad coach consistently stressed and derailed his team, and the good coach consistently induced teamwork and a sense of achievement in his team.

Stem sentences were still somewhat difficult for participants to initially grasp. We had designed the stem sentence crafting activity (section 3.1.2) to be done in small groups, but participants were uncertain as to how to proceed. We modified the activity partway through into a group activity with more direct guidance from the facilitators.

The last activity, the interactive coaching demo (section 3.1.3) was well received. Most participants actively took part, a few were less outgoing and had to be drawn out by the facilitators. Ensuring a balanced participation in this exercise is important as the activity is likely most valuable to shyer participants who may be less eager to directly engage with their students.

6. FUTURE WORK

The introduction of stem sentences still presents participants with difficulties. A new activity might help with the introduction of the subject, or perhaps the two

existing ones could be modified so as to clarify the subject.

A formal study on the workshop's learning outcomes and ultimate influence on undergraduate students should be performed.

Reports from any outside groups who adopt our workshop would also be welcome.

7. CONCLUSIONS

We have presented an updated edition to our previously developed workshop aimed at training GTAs to act more like coaches. We have developed materials including a workbook and a facilitators' guide which should allow the workshop to be delivered by new facilitators who may not be coaching experts. Pre and post-workshop surveys show that GTAs who participated in this workshop seemed to have understood what coaching is and how they can apply coaching principles in their work with undergraduate engineering students.

Acknowledgements

The authors are indebted to Roslyn Gaetz and Kiku Tupper who enthusiastically shared their insights into coaching and teaching. Financial support was provided by the Natural Sciences and Engineering Research Council (NSERC) of Canada.

References

- [1] C. L. Dym, A. M. Agogino, O. Eris, D. D. Frey, and L. J. Leifer, "Engineering Design Thinking, Teaching, and Learning," *Journal of Engineering Education*, vol. 94, no. 1, pp. 103–120, Jan. 2005.
- [2] J. W. Dally and G. Zhang, "A freshman engineering design course," *Journal of Engineering Education*, vol. 82, no. 2, pp. 83–91, 1993.
- [3] M. Stains *et al.*, "Anatomy of STEM teaching in North American universities," *Science*, vol. 359, no. 6383, pp. 1468–1470, Mar. 2018.
- [4] S. A. Ambrose, Ed., *How learning works: seven research-based principles for smart teaching*, 1st ed. San Francisco, CA: Jossey-Bass, 2010.
- [5] A. Dimopoulos, K. Bubbar, R. Gaetz, and P. Wild, "Training Teaching Assistants as Coaches," in *Proceedings of the Canadian Engineering Education Association*, Toronto, Ontario, Canada, 2017.
- [6] International Coach Federation, "ICF Credential," *International Coach Federation*. [Online]. Available: <https://coachfederation.org/icf-credential>. [Accessed: 05-May-2018].
- [7] Accomplishment Coaching, "ICF - Definition of Coaching," [Online]. Available: <https://acaffiliates.coach/wp-content/uploads/2017/02/ICF-Definition-of-Coaching.pdf>. [Accessed 24 04 2018].
- [8] Accomplishment Coaching, "International Coaching Federation: About Coaching," [Online]. Available: <https://acaffiliates.coach/wp->

- content/uploads/2017/01/ICF-About-Coaching.pdf. [Accessed 24 04 2018].
- [9] P. Cranton, "Teaching for transformation," *New directions for adult and continuing education*, vol. 2002, no. 93, pp. 63–72, 2002.
 - [10] B. W. Tuckman, "Developmental sequence in small groups.," *Psychological Bulletin*, vol. 63, no. 6, pp. 384–399, 1965.
 - [11] S. Kaner, *Facilitator's guide to participatory decision-making*. John Wiley & Sons, 2014.
 - [12] D. Greenaway, M. Sinclair, A. Trowhill, and L. Roy, "Coaching in the context of work," Adler Faculty of Professional Coaching Inc., Toronto, Ontario, 2013-2011.
 - [13] V. Rousseau, C. Aubé, and S. Tremblay, "Team coaching and innovation in work teams: An examination of the motivational and behavioral intervening mechanisms," *Leadership & Organization Development Journal*, vol. 34, no. 4, pp. 344–364, 2013.
 - [14] S. R. Daly, E. A. Mosyjowski, and C. M. Seifert, "Teaching creativity in engineering courses," *Journal of Engineering Education*, vol. 103, no. 3, pp. 417–449, 2014.
 - [15] J. P. Guilford, "Varieties of divergent production," *The Journal of Creative Behavior*, vol. 18, no. 1, pp. 1–10, 1984.
 - [16] S. Bill, "Ever heard of the groan zone?," *InnovationManagement.se*, 29-Jan-2013. [Online]. Available: <http://www.innovationmanagement.se/2013/01/29/ever-heard-of-the-groan-zone/>. [Accessed: 05-May-2017].
 - [17] S. Sinek, *Start with Why*. New York, NY: The Penguin Group, 2009.
 - [18] G. G. Dess and J. C. Picken, "Changing roles: Leadership in the 21st century," *Organizational Dynamics*, vol. 28, no. 3, pp. 18–34, 2000.
 - [19] S. B. Kaufman, "Why Inspiration Matter," *Harvard Business Review*, 08-Nov-2011.
 - [20] T. M. Thrash, E. G. Moldovan, V. C. Oleynick, and L. A. Maruskin, "The Psychology of Inspiration," *Social and Personality Psychology Compass*, vol. 8, no. 9, pp. 495–510, 2014.
 - [21] Creative Commons, "Frequently Asked Questions - Creative Commons," *Creative Commons*, 07-Mar-2018. [Online]. Available: <https://creativecommons.org/faq/#what-are-creative-commons-licenses>. [Accessed: 05-May-2018].