AC 2009-749: USING AN INTERACTIVE THEATER SKETCH TO IMPROVE STUDENTS' PERCEPTIONS ABOUT AND ABILITY TO FUNCTION ON DIVERSE TEAMS

Cynthia Finelli, University of Michigan

Dr. Cynthia Finelli, Ph.D., is Director of the Center for Research and Learning North and associate research scientist in the College of Engineering at the University of Michigan. She consults with administrators, faculty, staff, and graduate students, offers workshops and seminars on teaching and learning, and supports college-wide initiatives in engineering education.

In addition, Dr. Finelli actively pursues research in engineering education and assists other faculty in their scholarly projects. She is PI on a multi-university collaborative research study assessing the ethical outcomes associated with the curricular and extra-curricular experiences of engineering undergraduates on a national scale, she leads projects to evaluate the effects of different kinds of instructional consultations on teaching, to assess the impact of an interactive theater sketch on student teamwork skills, and to determine the effects of an applied honors math course.

Dr. Finelli is Chair of the Educational Research and Methods Division of American Society of Engineering Education, is a member of the International Planning/Advisory Committee for the 2009 Research in Engineering Education Symposium, and is guest co-editor for a special issue of the International Journal of Engineering Education on applications of engineering education research.

Marie Kendall-Brown, University of Michigan

Dr. Marie Kendall Brown, Ph.D., is a Post-Doctoral Research Associate at the Center for Research on Learning and Teaching at the University of Michigan. She conducts research on improving engineering education and retaining undergraduate students in STEM disciplines.

Using an Interactive Theater Sketch to Improve Students' Perceptions about and Ability to Function on Diverse Teams

Key words: diversity, interactive theater, teamwork

The ability to work effectively on a team is an important skill for today's engineering graduates. The national report *The Engineer of 2020*[4] notes that "…because they will increasingly work as part of interdisciplinary teams, engineers must be able to explain their thinking to diverse audiences and partners as well as think with others in order to arrive at solutions to problems" (p. 55). Further, both employers and accrediting bodies expect students to develop and demonstrate teamwork skills. Research has demonstrated a variety of benefits for students who interact on *diverse* teams. For example, problem-solving teams comprised of diverse members consistently outperform teams of similar problem solvers[1, 5]. And, Gurin, Dey, Hurtado, and Gurin[2]have demonstrated that students' ability to engage in active thinking, their level of intellectual engagement, and their self-rated academic ability are all promoted by experiences with diversity.

Admittedly, simply working on diverse teams in the college classroom can help college students gain these skills. We describe an interactive theater sketch that features a diverse student team, common team dilemmas, and a conversation about strategies to resolve team issues as a way to further enhance students' ability to work effectively on diverse teams. The sketch builds on the successful history of the CRLT Players' interactive theater troupe at the University of Michigan[3]. The CRLT Players engage an audience by presenting a problem in theatrical form, then inviting the audience to discuss and offer solutions to the problem. This approach has been shown to promote powerful transformations in awareness and behavior: teaching assistants in science and engineering who viewed an interactive theater sketch about the chilly climate for women students in the sciences reported greater awareness about the experiences of women and minority students, reflected on how their own actions affected students, and ultimately altered their behavior as a consequence[3].

For this research, we hypothesized that having engineering students observe effective and ineffective interactions of a diverse team in the context of an interactive theater sketch and then debriefing the issues could help the students reflect upon their own behavior, analyze the characteristics of efficient teams, and incorporate new teambuilding practices based upon what they had learned. Accordingly, the research question we asked was: *What is the impact of an interactive teamwork sketch on students' perceptions of the value of teamwork and of diversity on student teams and on students' self-reported ability to work effectively in diverse teams*?

The Theater Sketch

An educational theater troupe at the University of Michigan, in cooperation with faculty, staff, and students from the College of Engineering, created the interactive sketch titled *Off-Course*. The sketch is designed to enhance students' perceptions of the value of teamwork and of diversity on student teams, introduce students to common dilemmas encountered by teams, and provide them with strategies for resolving issues. It is performed during a regular class period while the course instructor is present so he/she may integrate lessons learned from the sketch into ongoing class conversations about teamwork.

During the performance, the facilitator (usually the director of the theater troupe) introduces the *Off-Course* by asking students in the audience to recall instances when they have worked in teams. The facilitator then solicits comments from the students about challenges they may have encountered and explains that the students will be viewing an interactive theater sketch about a problematic team scenario in an engineering class. The audience's task is to help the team by generating strategies for working together more effectively, with the goal being that when they themselves encounter these types of situations, they will be able to employ the strategies to prevent problematic team behavior.

The sketch itself involves four undergraduate engineering students (three male and one female) who are assigned to group project in which they must use an unclear assignment with ill-defined project specifications to program a robotic car to follow a given path at a constant velocity. The team members represent a unique group of motivations: an over-achieving student who dominates the project, a student who doesn't pull his share of the load, a shy student who doesn't speak up, and a student who takes on a task without finishing it. The sketch also alludes to deeper issues relative to male-female gender dynamics, poor communication and follow-through, and frustration about unsatisfactory group dynamics.

After *Off-Course* ends, the facilitator discusses the performance with the audience using a variety of interactive learning strategies: pair sharing, large group discussion, and Q&A between the sketch characters and the audience. That is, the characters from the sketch remain on the stage and the students in the audience interact directly with them (as they remain in character) by asking questions about the individual motivations, actions, and decision-making processes of the characters. The facilitator also utilizes the dramaturgical technique of "time-out" to freeze one or more of the characters so that the others may respond confidentially to the audience about his or her experience working with the group.

The actors then exit the room, and the facilitator focuses the conversation on what worked well in the group and what needed improvement. The facilitator invites the audience to offer strategies for how to improve the group dynamics while a scribe notes the suggestions on the board so the students and instructor may have a record of the conversation. Finally, the actors return, they review the strategies noted on the board, and they draw upon the advice offered by the students to re-play the *Off-Course* sketch. The re-enactment demonstrates how simple suggestions, strategies, and considerations can vastly improve a teamwork experience.

Research Design and Methods

At the University of Michigan, engineering undergraduate students are first exposed to teamwork in Introduction to Engineering (ENG 100), a required course for all first-year engineering students. ENG 100 integrates technical problem solving and engineering design with technical communications, ethics, and teamwork. There are multiple sections of ENG 100 offered each term, and first-year students choose to enroll in the course during either their first or second term.

In the first year the *Off-Course* sketch was performed, there were 17 sections of ENG 100 – students in nine sections saw the sketch while students in the other eight sections did not. To assess the impact of the sketch, students from five of the eight ENG 100 control sections and in all nine sketch sections completed an in-class survey. The survey included 15 items about

teamwork and self-reported ability to address several common dilemmas. A sixteenth item, "capacity to address team dilemmas," was created by combining students' responses to the five items about how well they could address particular dilemmas. The survey was administered in both the control sections the sketch sections at the beginning of the term (pre-test) and again at the end of the term (post-test). Table 1 contains details about the number of sections surveyed and the number of surveys completed, and Table 2 contains the average response for each item.

Differences in the mean response for each item are also presented in Table 2 for four cases: control group versus sketch group at pre-test, control versus sketch at post-test, control group over time (pre-test versus post-test) and sketch group over time. To compare the differences, independent samples T-tests were computed. Differences that are statistically significant in Table 2 are noted with asterisks.

Since one of the primary purposes of the sketch was to provide students with strategies for resolving common team issues, the most relevant measures of the impact of the sketch had to do with improvements in students' ability to address dilemmas. Thus, the five items addressing specific team dilemmas and the overall capacity to address dilemmas were further analyzed. The mean responses for the control and sketch groups at pre-test and post-test are presented graphically in Figure 1.

Table 1. Number of sections surveyed and number of surveys completed at each administration time, overall and for each group.

	# sections surveyed	# pre-test surveys	# post-test surveys
Control group	5	373	245
Sketch group	9	634	536

Results

At the beginning of the term, there were no statistically significant differences between mean control group and sketch responses for 14 of the 16 items, implying that both groups had approximately the same perception of teamwork as measured by those items. For two items (item 11–ability to address an issue involving an obvious lack of communication and item 12–importance of a clear plan of action), the control group responded, on average, more positively ($p > .05$). At the end of the term, there were statistically significant group differences on one item (item 13). On average, students in the sketch sections responded more positively about perceived ability to address an issue on a team that lacked a clear plan of action ($p > .05$).

Students in the control sections showed significant increases over time on one item (item 15–ability to address lack of team unity, $p > .05$). These same students exhibited a significant *decrease* in their perception of the importance of everyone doing their fair share of the work (item 8; $p > .05$) and the importance of a clear plan of action (item 12; $p > .05$). By contrast, students in the sections that saw the sketch showed significant improvement on nine of the sixteen items, with the most significant improvements in ability to address lack of communication (item 11; $p > .001$) and lack of team unity (item 15; $p > .001$). Interestingly, students in the section that saw the sketch also showed a significant decrease in the importance they placed on teammates doing a fair share of work (item 8; $p > .001$).

Table 2. Mean responses and differences in mean responses for control and sketch group. Responses are coded using a 3-point Likert scale with 0=not at all to 2=very well.

	Mean responses				Differences in mean response			
	Control group		Sketch group		Control vs. Sketch		Pre-test vs. Post-test	
	Pre-Test N ≤ 373	Post-Test N ≤ 245	Pre-Test N ≤ 634	Post-Test N ≤ 536	Pre-Test	Post-Test	Control Group	Sketch Group
1. How important is it to learn how to work in a group for ENG 100: Introduction to Engineering?	1.89	1.84	1.88	1.90	0.01	-0.05	0.05	-0.02
2. How important is it to learn how to work in a group for your *other* engineering undergrad courses?	1.61	1.60	1.58	1.57	0.03	0.03	0.01	0.01
3. How important is it to learn to work in a group for your engineering career?	1.92	1.93	1.88	1.90	0.04	0.04	-0.01	-0.02
4. How efficient do you think most teams in ENG 100: Introduction to Engineering are?	1.05	1.07	1.01	1.05	0.04	0.02	-0.02	-0.04
5. For a team to function effectively, how important is it for the team to have a diverse composition?	1.14	1.13	1.06	1.15	0.08	-0.03	0.01	-0.10*
6. For a team to function effectively, how important is it for members to take different roles for different projects?	1.49	1.57	1.48	1.55	0.01	0.02	-0.09	-0.07*
7. If your teammates unfairly assumed you'd take the same role all the time, how well could you address the issue?	1.40	1.42	1.42	1.44	-0.02	-0.01	-0.03	-0.02
8. For a team to function effectively, how important is it that everyone do their fair share of the work?	1.95	1.90	1.93	1.85	0.03	0.04	0.06*	0.07***
9. If you were on a team where someone was not doing their fair share, how well could you address the issue?	1.34	1.33	1.35	1.36	-0.01	-0.03	0.01	-0.01
10. For a team to function effectively, how important is it that there be clear communication?	1.97	1.94	1.95	1.92	0.02	0.02	0.03	0.03*
11. If you were on a team with an obvious lack of communication, how well could you address the issue?	1.39	1.38	1.32	1.44	0.07*	-0.05	0.01	-0.12***
12. For a team to function effectively how important is it to have a clear plan of action?	1.87	1.80	1.82	1.84	0.05*	-0.04	0.07*	-0.02
13. If you were on a team that obviously lacked a clear plan of action, how well could you address the issue?	1.43	1.40	1.42	1.51	0.01	-0.11*	0.03	-0.09**
14. For a team to function effectively, how important is it that all team members feel a sense of unity?	1.53	1.57	1.54	1.64	-0.02	-0.07	-0.04	-0.10**
15. If you were on a team where you felt a lack of unity or lack of belonging, how well could you address the issue?	1.16	1.27	1.18	1.31	-0.02	-0.04	-0.11*	-0.13***
16. Capacity to address team dilemmas (created from items 7, 9, 11, 13, & 15)	1.34	1.36	1.34	1.41	0.01	-0.05	-0.02	-0.07**

* $p > .05$, ** $p > .01$, *** $p > .001$

Figure 1. Mean response for "If you were on a team that …,how well could you address the issue?" (Significance from independent samples T-test: * $p > .05$, ** $p > .01$, *** $p > .001$).

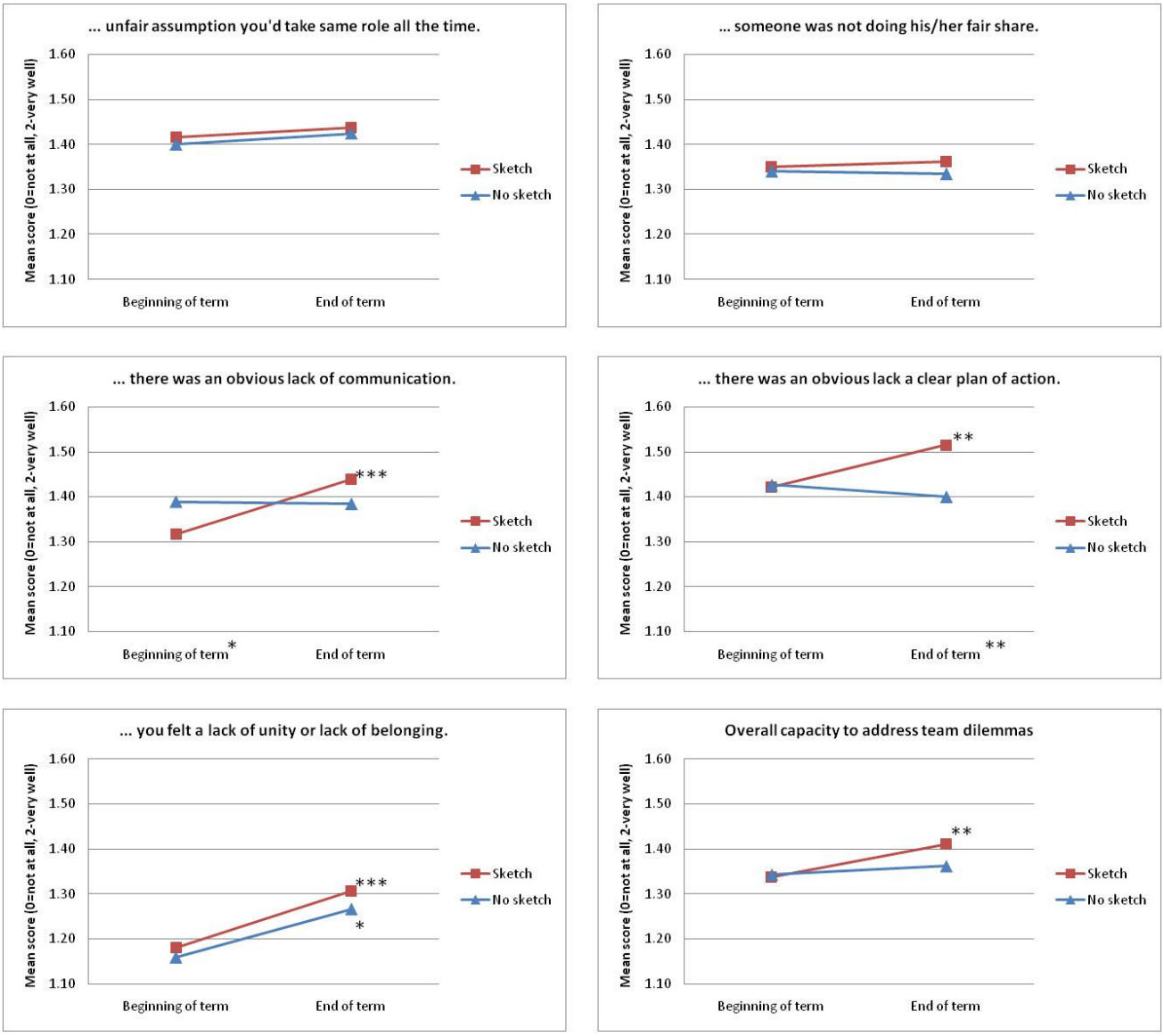

Figure 1 further illustrates differences between the control group and sketch group in students' perceived ability to address common team dilemmas. Students who saw the sketch showed statistically significant pre- to post-test gains in their ability to resolve three specific common team problems (i.e., lack of communication, $p > .001$; lack of a plan of action, $p > .01$; and lack of team unity, $p > .001$) as well as in their overall capacity to address team dilemmas ($p > .01$). By contrast, students who did not see the sketch showed significant improvement on only one of these items (i.e., ability to address lack of team unity, $p > .05$).

Discussion and Implications

Findings from this study suggest that the interactive theater sketch *Off-Course* provided students with strategies for resolving team dilemmas and demonstrate that the sketch did have significant benefits for first-year engineering students. Students in the sketch sections showed significant ($p > .05$) increases in their perception of both the importance of diversity on a team (item 5) and of team members taking different roles for different projects (item 6). Seeing the sketch also provided students with strategies for resolving common team dilemmas. Students who saw the sketch reported being more prepared (and statistically significantly so) to address issues related to teamwork (specifically around lack of communication and lack of unity) than those who did not. These students also showed significant gains in their overall capacity to address team dilemmas.

Interactive theater is one useful tool for increasing college students' awareness about working in diverse student teams in order to better prepare them for the engineering workforce. By observing the characters in the *Off-Course* sketch—all of whom are themselves undergraduate students at the University of Michigan—and the ways in which the characters each approached a team project, engineering students were given the opportunity to think about their past experiences working in teams. The cognitive task of recalling one's own experiences, comparing them with the dilemmas encountered by the characters in the sketch, and discussing and debriefing how and why certain behaviors lead to problematic team dynamics encourages students to think concretely about the challenge of working in a student team during college. When prompted, students who were in the *Off-Course* audience easily generated both examples of difficulties they had experienced working in teams and suggestions for how the characters in the sketch could improve the teamwork experience. Interactive theater may be particularly effective because students' collective expertise is pooled to generate concrete solutions. Further, the combination of individual-level recall, observation, pair sharing, public discussion, and group problem solving appears to have an important impact on students' level of awareness. In addition, the list of concrete strategies that the audience collectively generated provides a collection of approaches to apply to future team work situations.

Obviously, not all engineering educators have access to an interactive theater troupe; however, some elements of the learning experience reported here may be used to achieve similar goals (e.g., enhance students' perceptions of the value of teamwork and of diversity on student teams, introduce them to common dilemmas encountered by teams, and provide them with strategies for resolving issues). For example, engineering faculty could create some basic scripts depicting common team dilemmas and then invite student volunteers to role-play the scenarios for the class. Then, the class could engage in a conversation about possible ways to productively address the situation. Alternatively, as a class assignment, faculty could ask teams to reflect on the characteristics of successful teams in which they have been involved, discuss challenges they have encountered, and list strategies for resolving conflict. Also, engineering faculty could share real-world group or project experiences they have encountered so that students can gain a better understanding of the complexities involved in creating and working in a diverse team. In any case, by creating an open and frank exchange about the challenges of working on diverse student teams and about how to resolve these challenges, faculty can go a long way to helping engineering students develop the skills, knowledge, and awareness they will need upon graduation.

References

1. Gurin, P., Dey, E. L., Hurtado, S., & Gurin, G. (2002). Diversity and higher education: Theory and impact on educational outcomes. *Harvard Educational Review, 72*(3), 330-366.
2. Hong, L., & Page, S. E. (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *PNAS, 101*(46), 16385-16389.
3. Kaplan, M., Cook, C. E., Steiger, J. (2006, May/June). Using theatre to stage instructional and organizational transformation. *Change Magazine, 38*(3), 32-39.
4. National Academies of Engineering. (2004). *The engineer of 2020: Visions of engineering in the 20th century*. Washington, DC: National Academies Press.
5. Page, S. E. (2007). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton University Press.