A SUMMER LEADERSHIP DEVELOPMENT PROGRAM FOR CHEMICAL ENGINEERING STUDENTS

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INTRODUCTION

Engineers capable of innovation and positive change will need more than technical skill; they will also require leadership ability. The Engineering Leaders of Tomorrow program (LOT) is a comprehensive leadership development initiative in the Faculty of Applied Science and Engineering at the University of Toronto. The program includes curricular, co-curricular and extra-curricular components. The 14-week summer program takes place in the Department of Chemical Engineering and Applied Chemistry and offers summer research students an intensive leadership development experience. Sessions are highly interactive and practice-based with focus on personal leadership, team leadership and societal leadership. Pre-surveys and post-surveys have been completed for the last three years to assess student learning and program impact.

PROGRAM GOALS AND PEDAGOGY

LOT was born out of the belief that the full potential of engineering graduates to contribute to society was not being realized and that engineers with significant leadership skills contribute more societal value than those without. Since the summer of 2007, the program has been delivered in three, themed segments: (1) 'Personal Development' - emphasizing the importance of self-awareness to effective leadership; (2) 'Group Leadership' - the skills needed to lead, and contribute to teams; and (3) 'Leadership in Society,' promoting the role of engineers as engaged citizens and change agents in the world. As well as attending seminars and workshops, students participate in research and design team projects, tour local industry facilities and engage in community service activities.

Experiential learning is emphasized throughout the program. As expressed by Kolb's experiential learning theory, learning should not only involve cognition, but also thinking, feeling, perceiving and behaving [1] (Kolb: 1984). Facilitators include staff from the LOT Office as well as other educators from within the University of Toronto and beyond. Facilitators are chosen for their ability to engage students in active learning, offering opportunities for students to learn new skills and immediately put them into practice. This kind of active learning is meant to build confidence and offer students the necessary experience to appreciate the challenges involved in leading. Reflection is also emphasized in many sessions.

PROGRAM ASSESSMENT

Assessing learning outcomes has been a consistent feature of the planning process for the last three summers. Pre- and post-program surveys have been administered since the summer of 2007. In 2007, 43 pre-surveys and 31 post-surveys were completed. In 2008, 26 pre-surveys and 12 post-surveys were completed. Finally in 2009, 28 pre-surveys and 21 post-surveys were completed. All participants were undergraduate engineering students who had completed one, two or three years of a four-year undergraduate program.

Students are asked to rate their perceived skill level in a number of competencies before and after the program such as listening, resolving conflict, acknowledging the contributions of others and facilitating groups and meetings. They were also asked to rate on a scale of 1-5 how strongly they value self-awareness in group interactions. Other questions involved rating the importance of leadership values such as inclusivity, empathy and integrity. Finally, students were asked how responsible they felt as engineers to 'be technologically innovative,' 'contribute to the development of public policy,' and 'communicate the impact of advances in science and engineering to the general public.'

For all cohorts, and for many of the specific competencies measured, there was a clear increase in perceived confidence. For all groups, there was an increased appreciation of the value of self-awareness after the program: in 2007 the incoming average was 3.3 which rose to 4.3; in 2008 the average rose from 3.9 to 4.3; and in 2009 an increase from 4.0 to 4.3 was observed. Other competencies examined included: listening, resolving conflict, acknowledging the contributions of others in group settings, making ethical decisions, delegating tasks, clearly articulating views, and critical thinking. For all questions scores went up, except for the 2008 cohort whose score went down when comparing their ability to acknowledge the contributions of others and the 2009 cohort's assessment of their ability to articulate their viewpoints clearly and think critically.

A challenge related to program assessment involves the changing nature of sessions each summer. In 2007 pre- and post-surveys were designed to reflect the key learning outcomes of the summer program. In 2008 different sessions were offered but the survey was not changed to reflect programmatic changes. In 2009 additional questions were added to the survey to gather data on the impact of specific sessions. Also, from reviewing the summer schedule for the last three cohorts, programming varied in emphasis. In 2007 seven out of fourteen sessions related to self-awareness and four focused explicitly on team development and group dynamics. Consequently responses to questions related to self-awareness and application of leadership values were highest for this cohort. In 2008 four of fourteen sessions related to self-awareness and three to team work; the increase in student response was not as dramatic. And in 2009 three sessions related to self-awareness and four to team work.

DISCUSSION

Moving forward, we are keen to clarify and deepen our assessment measures so as to gather accurate data from student participants. The survey for our current 2010 cohort has been updated to include questions related to competencies which will be emphasized. Additionally we have included scenario questions where students will be asked to describe how they would respond to typical team challenges. We hope to see a notable change in students' pre- and post-survey responses. For more information please visit www.lot.engineering.utoronto.ca.

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REFERENCES

1. Kolb, David. *Experiential Learning: Experience As The Source Of Learning And Development* Prentice-Hall: NJ 1984.