Educating the Whole Engineer: Transforming an Introductory Engineering Survey Course

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Background

- Engineering education is the delivery of knowledge through the classroom experience
- The "banking" model used at the expense of developing the cognitive capacity
- "Self-authorship": the development of an internal voice; beliefs, identities and social relationships [1]
- Groundwork of self-authorship needs to start at the freshman level[1]

Research Questions

1. Does inclusion of a discussion opportunity improve student development in (a) integrative learning and knowledge and (b) lay the groundwork for self-authorship beginnings?
2. At the end of the course, is the student more confident in declaring a major?

Formerly Engineering 110

- Delivered as a 2-day per week lecture style; in an auditorium seating over 350 students
- Little interaction between student and instructor
- Each department had a lecture session
- Included 40-minute departmental presentations
- Approximately 300 first year students enroll

Course Transformation

- A lecture/discussion style
- Launched Fall 2014, 263 students enrolled
- 15 discussions sections of 20 students or less.
- Upper level engineering students were peer facilitators
- Lecture content focused on the "grand challenges" of engineering
- Departmental presentations reduced to 15-minute timeslots, 3 per lecture session

Discussion Topics
1. Professional Image
2. Common Reading Experience
3. StrengthsFinder [2]
4. Sustainability in Student Life
5. Globalization of the Engineering Field
6. Values, Priorities and Responsibilities
7. Metacognition & Academic Resources
8. Identity - Understanding Differences and Perspectives
9. Co-Curricular Opportunities
10. Professional Responsibility and Role in Society
11. Department Exploration Day
12. My Journey (Peer Facilitators Stories)
13. Goal Setting and Educational Planning

Survey Instrument

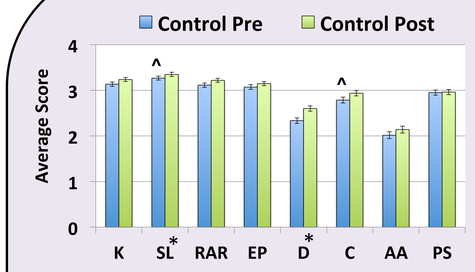
- Developed, using a modified Self-Authorship Survey (SAS)[3] and a modified Integrative Knowledge Portfolio Survey self-assessment instrument [4]
- Resulted in a 33-item survey
- Extracted 8 sub-factors

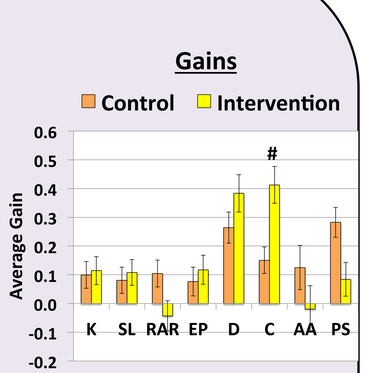
Type	Course Name	Section #	No. of Students Enrolled
Control	Engr. 100	150	63
Control	Engr. 100	900	48
Control	Engr. 100	600	51
Control	Engr. 101	100	242
Control	Engr. 101	200	253
Intervention	Engr. 110	All (15 sections)	263

Concept Name	Factors represent respondent capacity for:
Knowledge (K)	1. Knowledge gained within and across specific contexts
Self-Learner (SL)	2. Understanding and directing oneself as a learner
RAR Learner (RAR)	3. Becoming a reflexive, accountable, and rationale learner
Ethics & Perspectives (EP)	4. Identifying and discerning one's own and others' ethics and perspectives
Digital (D)	5. Developing a professional digital identity
Career (C)	6. Course specific goals, relate to career choices
Autonomous Action (AA)	7. Emotional and behavioral independence
Problem Solving (PS)	8. Need to reflect on their beliefs

Conclusion

- Students increased confidence in choosing a major
- Time that students spent on factors was helpful, but not significantly influential
- Clear indicator of student engagement, the final teaching evaluations students ranked the peer facilitators as
  - 4.8 out of 5.0 (average score), "The facilitator made me feel valued in the course"
  - 5.0 out of 5.0 (average score),"The facilitator was an excellent teacher"





Future Work

- Conducting Focus Groups
- Longitudinal studies
- Explore more specific learning outcomes
- Scalability of the course

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