Identifying the Sources of Undergraduate Engineering Students’ Self-Efficacy

N. A. Mamaril, E. L. Usher, D. R. Economy, & M. S. Kennedy

1Department of Educational, School, and Counseling Psychology, University of Kentucky, Lexington, KY, USA
2Department of Materials Science and Engineering, Clemson University, Clemson, SC, USA

Engineering Self-Efficacy and Its Sources

- Engineering self-efficacy, the belief students hold about their capabilities to perform engineering-related tasks, has been shown to influence students’ continued matriculation in engineering programs (Mara, Rodgers, Shen, & Bogue, 2009).
- Bandura (1997) contended that students’ interpretation of information from multiple sources undergirds their beliefs about what they can do.
  - Mastery experience involves the interpreted result of one’s own performances.
  - Vicarious experience occurs as individuals observe the experiences of others.
  - Social persuasion often takes the form of evaluative judgments or encouragements that people receive from others.
  - Physiological states refer to the feelings evoked by performing a given task.

Purpose of the Study

The purpose of this study was to examine engineering students’ efficacy-relevant experiences to better understand the ways in which their engineering self-efficacy has developed.

- Examine the sources of self-efficacy students describe.
- Address experiences directly related to engineering.
- Explore men’s and women’s descriptions of the sources of self-efficacy.

Method

Participants

Undergraduate engineering students (N = 145) from two research-intensive universities in the southeastern United States were invited to participate in the study in the 2012 fall semester. Of the participants, 63% were male, 84% Caucasian, 6% African American, 4% Asian/Pacific Islander, 30% freshmen, 34% sophomores, 19% juniors, and 12% seniors. Students were from the following engineering programs: mechanical (28%), civil (23%), bioengineering (17%), chemical (11%), materials science (10%), and mining (5%).

Instrumentation and Data Analysis

Students completed an online survey about their attitudes and beliefs about engineering. The survey included five open-ended items that focused on eliciting information about the four theorized sources of engineering self-efficacy.

Analyses

- Conducted first-level coding to summarize sections of data.
- Coded responses into more specific themes and/or constructs.
- Analyzed patterns in responses by sorting data by similarity, difference, and correspondence.
- Examined commonalities and differences in students’ perceptions of the sources of self-efficacy as a function of student gender.
- Cross-checked data and worked toward a high degree of intercoder reliability (90%).

Results

Table 1

<table>
<thead>
<tr>
<th>Codes and Sample Responses, by Source</th>
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<tbody>
<tr>
<td>Codes</td>
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<tr>
<td>-------</td>
</tr>
<tr>
<td>Mastery Experience</td>
</tr>
<tr>
<td>Vicarious Experience</td>
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<tr>
<td>Social Persuasion</td>
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<tr>
<td>Other</td>
</tr>
</tbody>
</table>

What events have affected your confidence in your engineering skills? Please describe how you typically feel when doing engineering work.

In what ways were you exposed to engineers?

Key Findings

- Mastery experiences were the most common source of engineering self-efficacy reported. Our findings are consistent with those of Hutchinson et al. (2006). Men and women reported similar trends in the sources of their engineering self-efficacy, and mastery experience was a powerful source. This is contrary to Zeldin et al.’s (2008) finding that social persuasions and vicarious experiences were the primary sources of women’s self-efficacy beliefs.
- Vicarious experience (i.e., through engineers in the family) and social persuasions (i.e., encouraging messages from others) were important factors that convinced students that they can become engineers.
- Although students may find engineering challenging, they do feel a boost (e.g., pride for accomplishing task, excitement with finding a solution) from engaging in their work.

Conclusion

- Students’ success in the engineering classroom and workplace (through internships and cooperative education programs) led them to believe that they can become engineers. Many students reported also being exposed to engineering and seeing what engineers do.
- Opportunities to perform real engineering tasks helped students to evaluate their capabilities to successfully perform similar tasks in the future.
- Students’ efficacy judgments are not only informed by results of their own performances but also by their interpretation of the actions of others and what others say about their capabilities.

References


For more information, please contact Natasha Mamaril at tamamaril@uky.edu

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