Evaluating an Engineering Overview Brochure for Educational Outreach to Elementary Schools

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Outline of Presentation

- Background
  - Engineering outreach to K-12
  - Variety of media in engineering outreach
  - Hierarchy of effects model
- Current experiment
  - Overview of brochure design
  - Method
  - Results
- Conclusions & Implications
Engineering Outreach to K-12

- US students show little interest in engineering studies
- Wide range of engineering K-12 outreach strategies
  - Integrate engineering into K-12 classroom
  - School visits by engineers, field-trips to engineers
  - After-school clubs, summer camps
Media in Engineering K-12 Outreach

- Computer-based presentation and interactions
- Hands-on activities
- Printed recruitment materials
  - Brochures
  - Flyers
  - Postcards
  - Handed out during outreach events/activities or mailed to students or schools
Hierarchy of Effects Model

- Dominant theoretical model concerning goals of advertisement materials: Steps:
  - 1) awareness of the product/brand
  - 2) knowledge of what it has to offer
  - 3) positive perceptions
  - 4) preference above other options
  - 5) desire to purchase
  - 6) purchase

- Primary functions of advertising:
  - cognitive functions, ideas and information (steps 1 & 2)
  - affective functions, attitudes and feelings (steps 3 & 4)
  - conative functions, consumer action (steps 5 & 6).
Design of Brochure

- Collaboration with communications professionals in Ira A. Fulton Schools of Engineering at Arizona State Univ.
- Iterative process, our team of psychologists, educators, and engineers provided feedback, 7 iterations
- Brochure introduced 10 engineering fields
Excerpt from Brochure

Engineers discover and design ways to make people’s lives easier, safer and better.

biomedical engineers develop technology to help diagnose and treat disease
Lifelens, a smartphone app to diagnose malaria, was developed by five graduate students.

chemical engineers create everything from cleaner fuel to new shampoo
New “smart” bandages react to a person’s body chemistry and signal infection by turning purple.

computer engineers create MP3s and video game technology
Mark Zuckerberg was still in college when he developed the site that led to Facebook.

construction engineers create bridges, roads, dams and solar facilities
The Hoover dam in Arizona was constructed in less than five years.
Method

- Participants: 100 4th grade students (56% Hispanic, 13% Other, 11% Native American, 10% White, 8% African American)

- Procedure
  - Pre-survey
  - Brochure study (7 minutes)
  - Post-survey
Survey

1) Rej. gender stereotypes, Cronbach $\alpha = .74$
2) Neg. eng. stereotypes, $\alpha = .75$
3) Self-efficacy, $\alpha = .76$
4) Interest, $\alpha = .77$
5) Utility, $\alpha = .68$

Total of 15 items, three per construct

Post-survey: 3 addl. items for “brochure liking”
<table>
<thead>
<tr>
<th></th>
<th>Pre-survey (N = 100) M (SD)</th>
<th>Post-survey M (SD)</th>
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<tbody>
<tr>
<td>Rejection of gender stereotypes</td>
<td>3.96 (0.71)</td>
<td>4.24 (0.77)</td>
</tr>
<tr>
<td>Neg. stereotypes of engineering</td>
<td>2.60 (0.74)</td>
<td>2.38 (0.70)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>3.24 (0.87)</td>
<td>3.72 (0.89)</td>
</tr>
<tr>
<td>Interest</td>
<td>3.39 (0.95)</td>
<td>3.89 (0.92)</td>
</tr>
<tr>
<td>Utility</td>
<td>3.45 (0.80)</td>
<td>3.95 (0.77)</td>
</tr>
</tbody>
</table>
Results cont’d

- Significant pre- to post-survey improvements:
  - Rej. gender stereo, $t(99) = 4.55, p < .001$
  - Neg. eng. stereoty., $t(99) = 3.57, p = .001$
  - Self-efficacy, $t(99) = 5.28, p < .001$
  - Interest, $t(99) = 5.30, p < .001$
  - Utility, $t(99) = 6.47, p < .001$
  - Brochure liking, $M = 4.20$ [out of 5], $SD = 0.83$
Discussion, Conclusions

- Short exposure to print brochure had a significant positive impact on student perceptions toward engineering.
- Expensive outreach activities, such as departmental open houses, summer camps, and mentorship programs, may be easily supplemented using low-cost print recruiting materials.
Displaying a diverse set of students in brochure may improve the perception of the brochure due to the similarity-attraction effect.

Generally, students prefer to learn from agents that are similar to the students in external characteristics, such as age, gender, and ethnicity.

Limitations:

- No control conditions without a brochure - > compare pre-post-survey surveys without exposure to brochure
- Specific population (4th graders, SW US) - > test in variety of K-12 grade levels and locations