

Aesthetics and Emotional Engagement: Why it Matters to Our Students, Why it Matters to Our Professions

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We propose a special session which would take the form of a guided discussion, using a hands-on flow visualization exercise as focal point.

Goals

To foster conversation and document ideas about how the aesthetic qualities of engineering topics can be used to deliberately draw the emotional engagement of students. To gauge how the FIE community currently views the aesthetics of engineering, and brainstorm new visions for how aesthetics could be used to improve recruitment and retention of a diverse student population as well as lead to innovative methods for the teaching and learning of core engineering content. To explore the feasibility of viewing aesthetics-driven emotional engagement as a necessity and not an ancillary benefit in course design.

Description of Session Content

Aesthetics can be defined both as a metric for art (is it art? Is it good art? [1]) and as a psychological measure of affect [2]. With a few pointed exceptions, neither definition has received much consideration in engineering education. Instead, cognitive gains, technical competence, utility and objectivity are our most highly prized virtues. Despite improvements, the complexity of the problems that remain call for a broader approach; we propose that aesthetics and the attendant emotional engagement as possible solutions to long standing problems in diversity, technical literacy, and retention.

New emphasis is being placed on students' emotional engagement, in works such as *The Whole New Engineer* [3] and in studies relating emotion to cognitive gains [4], [5]. Issues of affect, emotion and identity are tangled, but certainly overcoming engineering stereotypes, which often highlight being

socially awkward or emotionally stunted, requires transformation of our cultural practices in education. Acknowledging that aesthetics is a valid motivation for science and engineering may provide an important avenue for increased inclusion of diverse thinkers; conversely, ignoring the aesthetic dimension of engineering masks the enthusiasm and creativity engineers have for their work. How can we lead more students to Richard Feynman’s joyous reaction that, “There are all kinds of interesting questions that come from a knowledge of science, which only adds to the excitement and mystery and awe of a flower. It only adds. I don’t understand how it subtracts” [6]?

This line of questioning developed from an intervention in fluid mechanics that improved students’ perceptions and attitudes. Flow Visualization, a course in which engineering and art/film students make artistic images of fluid flow, has been shown to improve attitude towards a notoriously difficult topic [7]. However, efforts to extend this success to other subdomains have been only partially successful.

This workshop will generate and collect a wide range of perspectives on what aesthetics means in the context of engineering practice and education, and explore how aesthetics can generate emotional and intellectual engagement.

Agenda:

Participants will be in small groups (4-6 people). They will be given a small but beautiful fluid dynamics experiment to perform. This will be used as a discussion starter for the role of aesthetics in comprehending specific physics concepts and improving student engagement. Facilitators will circulate to assist discussion where needed and document report-out using video.

Activity	Time, minutes
Pre-readings drawn from EER, PER, art education, psychology and neuropsychology of aesthetics will be available for participants interested in digesting contextual information prior to the session.	N/A
Introduce the facilitators and goals of the session; settle participants into groups	5
Groups perform Flow Visualization experiment; record results using camera phones. Participants will be asked to reflect on and document personal reactions to the experience as well.	20
Groups report-out reactions to the experiment; whole group discussion	15
Using the Flow Vis. experience as a possible model for aesthetics in their own domains, groups generate other models and discuss possible implementation strategies in formal and informal learning contexts.	20
Groups report-out previous discussion.	15
Whole group discussion on dealing with potential obstacles to these changes; Closing	15

Proposed peer-reviewed paper

A structured summary of the pre-readings and an abbreviated description of the session details will form the basis of the four-page paper that will be offered for review and inclusion in the FIE

proceedings. Please note that our preliminary research in this area is being submitted as a work-in-progress to FIE, and will be referenced in the pre-readings.

Audience:

This session is expected to draw from several subsets of FIE attendees:

- 1) Those who value aesthetics already, such as visually creative individuals and artists (being an engineer does not preclude membership in this group).
- 2) Those who are interested a definition of diversity that extends beyond demographics and perspectives defined by demographics.
- 3) Those who are interested in humanistic engineering approaches, including efforts to develop well-rounded students.
- 4) Those who are interested in issues of the affective domain, including attitudes, beliefs, motivation, values, and identity.

Expected outcomes will be reported:

Within two weeks of the session we will post (on YouTube) preliminary results in the form of the video recordings of the report-outs (Model consent and IRB approval will be secured as needed). Within one year we plan a peer-reviewed journal article placing a summary of the discussions in the context of a review of the appropriate literature.

Justification and Future Work:

Aesthetics and the resultant emotional engagement are topics that are not well-represented in engineering education research. In addition, many engineering educators are uncomfortable with these topics. We hope that in the process of facilitating this special session we will begin to establish a community of researchers and practitioners who can help move this area forward. This engagement will be possible only with the degree of interaction afforded by an FIE Special Session. Finally, this discussion, and the video record of it, can be the seed participants take home to begin this conversation at their own institutions.

- [1] T. Barrett, *Why Is That Art?: Aesthetics and Criticism of Contemporary Art*, 2nd ed. Oxford University Press, USA, 2011.
- [2] S. E. Palmer, K. B. Schloss, and J. Sammartino, "Visual aesthetics and human preference," *Annu. Rev. Psychol.*, vol. 64, pp. 77–107, Jan. 2013.
- [3] D. E. Goldberg and M. Sommerville, *A Whole New Engineer*, 1 edition. Douglas, MI: ThreeJoy Associates, Inc., 2014.
- [4] P. J. Munoz-Merino, M. Fernandez Molina, M. Munoz-Organero, and C. Delgado Kloos, "Motivation and Emotions in Competition Systems for Education: An Empirical Study," *IEEE Trans. Educ.*, vol. 57, no. 3, pp. 182–187, Aug. 2014.
- [5] T. Thompson and J. Mintzes, "Cognitive structure and the affective domain: on knowing and feeling in biology," *Int. J. Sci. Educ.*, vol. 24, no. 6, pp. 645–660, Jun. 2002.
- [6] R. P. Feynman, *"What Do You Care What Other People Think?": Further Adventures of a Curious Character*, Reprint edition. New York: W. W. Norton & Company, 2001.

- [7] J. Hertzberg, B. Leppke, and K. Gray, "Art for the Sake of Improving Attitudes towards Engineering. AC 2012-5064.," in *ASEE Conference Proceedings*, San Antonio, TX., 2012 [Online]. Available: www.asee.org/public/conferences/8/papers/5064/download. [Accessed: 07-Oct-2011]