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Biassociation for the Entrepreneurial Engineering Curriculum

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Abstract

Despite the apparent benefits of fostering creativity, the question largely remains at how to develop and deliver a curriculum that can stimulate such innovative thinking. Several models have developed on an attempt to ground creative thinking and its usage such as schema theory from Bartlett, Johansson's Medici Effect, Koestler's biassociation or Tom Kelley's faces of innovation. While the first three focused more on the structure and processes of innovation, Kelley's work took a more personal approach, defining several characters that play different roles in the creative process. Michael Michalko rebrands biassociation as "conceptual blending," but essentially works from the same base theory as Koestler.

Thus, biassociation--the process of combining seemingly unrelated concepts--has quickly become the operating frontrunner of theories on creative conceptualization. Implemented traditionally in entrepreneurial practices, this paper summarizes the current state of art in biassociation and techniques to help students to operationalize the concept. This paper explores what are the implications and possibilities for biassociation in the classroom and what a curriculum with biassociation as its fulcrum might look like.

Introduction

Entrepreneurship and innovation will be the key to America's future success. This can be seen, among other examples, by recent remarks from experts at the Kauffman Foundation, the push for the JOBS act from the White House, and the continuous expansion of entrepreneurial curriculums in colleges and universities across the nation. Engineering has always been seen as the powerhouse that helps innovate and assemble the building blocks of modern society. However, there is no common approach as to how to better prepare engineering undergraduates to become successful leaders in tomorrow's workforce.

A common theme when referring to engineering graduates is their underdeveloped "soft" skills, such as an ability to identify opportunities, team building, conflict resolution, communication skills, etc. Universities are trying to address this by offering minor degrees, combined classes with their business schools or adding entrepreneurial classes to their core curriculums [1]. The lack of standardization when it comes to helping engineering students develop these skills is not necessarily a bad thing, but it certainly highlights the need for a deeper understanding on how the creative process works and how to foster an entrepreneurial mindset in engineering students.

Understanding biassociation

The term biassociation was first coined by Arthur Koestler in 1964 as "a distinction between the routine skills of thinking on a single 'plane' as it were, and the creative act," or in other words "collision of two apparently unrelated frames of reference" [2]. Hitt et al. divides innovative actions as either "equilibrating" or "disequilibrating"--the latter associated with biassociation [3]. Ireland et al. follows on this train of thought, renaming "equilibrating" and "disequilibrating" actions as "sustaining" and "disruptive" creativity, respectively. Ireland et al. argues that "creativity affects the quality and quantity of both disruptive and sustaining innovations," but "actors with a breadth of [interdisciplinary] knowledge [...] are likely to be creative in developing sustaining innovations" [4].

Tom Kelley takes a different approach somewhat similar to biassociation in his book "The Ten Faces of Innovation." Similarly to the concept of personality types, Kelley's book introduces a variety of characters that play different roles in a working environment. He calls the person who "can create something new and better through the unexpected juxtaposition of seemingly unrelated ideas or concepts" the cross-pollinator. The individuals who fit this description have a set of specific characteristics that in contrast makes them unspecific. Kelley claims that cross-pollinators will usually enjoy reading about different areas of knowledge, their interests will reach multitudes of disciplines, and they will be dedicated note-takers [5].

Michael Michalko, on the other hand, rebrands biassociation as "conceptual blending" in his book Creative Thinkering, calling it "a creative thinking process that involves blending two or more concepts in the same mental space to form new ideas". It is argued that our whole thought process is based on a historical approach and hence we cannot achieve true innovation given that new ideas do not exist in the past. Furthermore, current education systems induce engineering students to separate disciplines. Drawing lines and distinguishing topics makes us focus on particular aspects of that discipline, losing the big-picture perspective, the universality that is so necessary to become innovative through biassociation [6].

One of the most hazardous results of our educational process is a phenomenon called "structured imagination". This theory argues that the emphasis in structuring is so extreme that often times we cannot escape accessing the most common instances of our brain, limiting our imagination, and as a result, our ideas become "heavily structured in highly predictable ways" [6].

Given the nature of biassociation and the similar theories and models, examples of biassociation are simply examples of groundbreaking innovation that revolutionized the models of the time. For example, the ingenuity of the Montgolfier brothers led them to craft the first successful hot-air balloon in Annonay, France, in 1783 [7]. In a fantastic display of biassociation, they believed warm air could be connected with the idea of flight, and they were right.

Animal and biological research has greatly influenced engineering along with many other disciplines and given rise to many biassociations. This process is called "biomimicry," and is defined as "the design and production of materials, structures, and systems that are modeled on biological entities and processes" [8]. Biomimicry inherits the principle of biassociation and looks for ways to connect human problems with apparently unrelated animals, bacteria, flora, vegetation or oceans. One of the most astonishing examples in the aerospace industry is the design of the B-2 stealth bomber and its resemblance to a hawk during flight.

Some contemporary examples relating directly to the combination of engineering and entrepreneurship include Taco Bell's Doritos Locos Taco, Nike's Fuelband and company "Wines that Rock". Years ago Todd Mills was enjoying one of his homemade taco salads with Doritos when he thought about using Doritos as taco shells [9]. Mills was unsuccessful pitching his idea to Frito-Lay. Taco Bell, however, incorporated it into its menu, becoming one of its most successful products and allowing Taco Bell to financially benefit from those who like Doritos. Nike combined the display of a retro scoreboard with a wristband, creating Fuelband. Fuelband is a workout accessory that targets the growing fitness market [10]. "Wines that Rock" recommends wine selections to buyers based on their musical tastes [11]. This combines two of the most loved passions in peoples' lives and turns them into innovative profit.

Bringing entrepreneurial thinking to the classroom

The struggle then is finding a way to effectively incorporate entrepreneurial thinking into the classroom. There are 3 primary ways professors could integrate biassociation into their teaching practices: (1) attention to current issues, (2) competitions, and (3) open-criteria grading.

The first step in biassociation is increasing familiarity with different disciplines. Professors can introduce new disciplines through current issue discussions. For example, professors could have students bring in news pieces that discuss current issues in other disciplines and asking them to find engineering solutions. This format invites student participation and direct involvement in the type of education students receive. It stimulates creative thinking and rewards innovative thought. Professors could take this format further by linking the selected topics, when appropriate, to lectures, which engages students' interests in other disciplines with classroom lessons. These connections will show students how to blend fields together and to pay attention to unexpected sources of knowledge.

A second platform of entrepreneurial integration in the classroom is through competitions. Professors can instigate entrepreneurship among students by helping them participate in competitions both locally and nationally. For example, professors at Parks College at Saint Louis University host weekly innovation challenges where students use everyday items to solve a problem or complete a task. Creating small design competitions, such as Saint Louis University's innovation challenges, stimulate the student's blending skills, especially if the challenges require the application of different engineering fields. These challenges should include a business component requiring students to think about the marketability of their solution, the cost-effectiveness of their design, a short presentation and some sort of reward to motivate competitiveness among participants.

National engineering competitions represent a great opportunity for students to improve both their engineering knowledge and their soft skills, while promoting mentoring between professors and students. By working on problems that often have multiple approaches and solutions students have to incorporate interdisciplinary theories. In fact, engineering competitions usually involve designs that need different fields of expertise, fostering cross-pollination. The process of trial and error involved in competitions helps overcome fear of failure and increase creative risk.

The open-criteria of grading in competitions--the variability in possible solutions--is a third feature that professors could use in the classroom to promote an entrepreneurial mindset. By changing homework assignments to problems that can have different approaches students are given the opportunity to hone their deductive skills, their curiosity and their strategic thinking. Substituting tests for class projects and presentations encourages students to ask for help, collaborate with others, leads them to spend more time learning about the subject, and allows the professor to better assess the student's competencies. While this grading format can be difficult and sometimes unrealistic for teaching staff, if a form of standardization in grading practices could be designed, then the pros would greatly outweigh the cons of open-criteria projects.

Professors can only do so much without the assistance of University administrative assistance. Universities and colleges need to change their programs of study to accommodate more business-related classes in the schedule of engineering students. No matter how much schools try to encourage students to be interdisciplinary, if their schedules are rigid with a traditional curriculum that does not allow for diversity, then they will not be able to participate in other disciplines.

Conclusion

In summary, engineering students should become cross-pollinators, holding deep knowledge in their field of study but with working knowledge in many other disciplines. An interdisciplinary mindset will in turn enable them to innovate by blending seemingly unrelated fields into new creative solutions for existing and future problems. Finally, the continuous combination of fields will negate the effects of structured imagination, giving students the tools to not only identify opportunities but also benefit from them. It is up to professors and university structure to find a way to integrate an entrepreneurial framework into the classroom through modes such as attention to current issues, competitions, and open-criteria grading. If universities manage to stimulate innovative thought, they will be able to differentiate their graduates from the rest in this increasingly competitive market.

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