

WORK IN PROGRESS: Design, Creativity, and Creativity Techniques: Finding, Encouraging, and Developing the 'Voice of the Designer'

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Abstract

Design courses commonly discuss the importance of the voice of the customer and the voice of the product in the design process but the voice of the designer is often absent from the process. This is in contrast to the way that the vision and creativity of famous designers (*e.g.* Steve Jobs, Burt Rutan, Dean Kamen, *etc.*) are admired and celebrated. How do we help students to develop their creativity and incorporate their voice into the process? How can we also help them to improve the quality of the ideas that they inject into the design process?

A course in creativity and creativity techniques was developed as a prototype to test creativity teaching techniques for subsequent incorporation into a capstone design sequence. The primary creativity mechanism was to utilize art both as a prism for new ways of seeing and as a vehicle to explore design in collaboration with the Barnes Foundation of Philadelphia Pennsylvania. Students in this course explored techniques to help them find their creative core and ways to use art as a prism to see engineering design from multiple perspectives. To achieve these learning goals and to free students from potential self-limiting behaviors in discussing non-technical matters, role-playing as part of a popular role-playing game was utilized to enable students to approach creativity and creativity techniques from their character’s perspective.

Introduction

While design is becoming increasingly important to market share and profitability, the voice of the designer is largely absent from design curricula and engineering design textbooks¹⁵. When approaching engineering design problems, professional and expert practitioners value careful problem definition and information gathering, personal synthesis of that information based on previous experiences, and adaptable creative exploration^{2, 8}. However, these elements are absent or only lightly considered by traditional design approaches¹⁵.

This work introduces course content created to test new methods to both include the voice of the designer and to improve the creativity of that input. Novel pedagogical approaches were developed to help students develop new approaches to design and to be more comfortable in sharing and developing those approaches with classmates and design team members. The pedagogical approaches were developed and tested for the first time in a stand-alone senior-level course on creativity and creativity techniques with fourteen students. The lessons learned from this course will then be developed into modules to be used in a capstone design sequence. This paper discusses a sample of content developed in that creativity course for the subsequent capstone sequence. A summary of all course material that was distributed to all students is included in an appendix after the Bibliography.

Common techniques for brainstorming new ideas involve techniques to get students to view problems from a different perspective (seeing the problem from another person's perspective, changing the laws of physics, triggers, *etc.*). As will be explained, the novel approach used in this course was to use artwork and art techniques developed by the Barnes Foundation to develop different and unique approaches to problem solving. The primary benefit of this approach is that most engineering students and faculty have limited experience with artwork; this allows a "level playing field" in terms of comfort and familiarity with a nearly simultaneous exploration of new concepts by the entire class. The "level playing field" aids in reducing self-censorship when discussing and exploring the approaches in class, as there is no fear of sounding foolish in front of an expert, including the faculty instructors. The critical difficulty of this approach is that it requires a certain level of comfort with oneself and the other class members in order to allow for sharing and development of new techniques via exploration of artwork. Students were paired together to play characters provided to them as part of a popular role-playing game with the intent of shortening the development time of the comfort level of students with respect to sharing their observations and perspectives as well as enhance the *esprit de corps* of the class. The role-playing game utilized here is a cooperative game requiring students playing characters with different skills to overcome conceptual and combat challenges. The game was played in a lab section, with modifications to suit it to the purposes of the course. While the game was not the focus of the work, the comments in the course reflections indicated it was an effective way to facilitate student interaction and accelerate engagement with non-traditional material, so it is discussed in some depth here.

The Role of Role-Playing in the Engineering Classroom

There are certainly many examples of role-playing that have been utilized previously in the engineering classroom, with the intent of engaging students in different ways. Given the structure of higher education in the United States, it is probably also worth noting that the very classroom environment – containing a professor and many (or more than many) students – is already a form of role-playing. The professors and the students know their roles fairly well because they have worked with the 'rules' established for this sort of interaction. There are also different roles (and rules) adopted – perhaps not consciously – by faculty members (and students) when interacting outside of class, perhaps when answering questions about an assignment in the faculty member's office.

Some of the most widely-adopted changes in the engineering classroom in the last 20 years also involve role-playing. For example, the introduction of active-learning exercises has been shown to engage students in different modalities, even when used only occasionally¹³. In fact, active learning is role-playing in which students take on roles that involve anything but passively listening to a lecture and taking notes. Faculty members utilizing active learning also are role-playing: they are no longer the 'sage on the stage' and are now frequently out among the students engaging with them as they engage the material. Many of the concerns/resistance students initially have to the introduction of active learning into a course fundamentally come down to a sudden change in the rules of the 'game'. A commonly utilized step beyond active learning into a more involved 'game' is collaborative learning, in which students interact with each other while engaging in course activities¹³. Whether considered a subset of collaborative learning or

not, a more involved ‘game’ is that of cooperative learning, where student are working together towards a common goal under structured conditions and with individual assessment ¹¹. In this approach, the roles and the structured conditions are more clearly defined, so it is a little more clearly role-playing.

There are definitely many, many examples of more formal role-playing in the engineering classroom, but a few general approaches are briefly described here to provide context for the ways in which role-playing is being utilized in the current work. Generally speaking, in approaches in which role-playing is specifically identified and implemented by a faculty member for a class, the role-playing is intended to have the student take on a ‘role’ and through the interactions in this new role, be able to engage course material in a different way, or from a different perspective, *etc.* A well-known form of role-playing is one in which students assume the roles of various professionals in a faux company and tackle a task ³. The intent of this type of role-playing is to introduce students to a professional environment and to enable to not only focus on their technical skills but also on their professional skills. Related styles of role-playing may have students not only role-play different potential company positions, but also be scored using game-style grading to advance to new positions ^{1, 12}.

Role-playing has also been utilized to let students assume the roles of expert witnesses being interviewed in a mock trial with the intent of having the students encounter ethical dilemmas and practice responding as professionals ^{5, 6}. By placing students into a situation which forces them to ‘make the call’ in their role, the instructor is more likely to engage the students as they learn engineering ethics than having the students listen to a lecture about ethics. Still another example comes from the teaching of software architecture in which the students role-play software components and cooperatively solve problems in different architectures ¹⁰. By interacting with the other pieces of code involved in the program, students can gain a deeper understanding of the overall impact of the architecture style.

Role-playing in engineering education has been widely utilized in a range of classroom and . Next the way in which role-playing was employed to help students learn creativity and creativity techniques will be described.

How Role-Playing was Utilized in The Present Course

Dungeons & DragonsTM is a popular role-playing game (RPG) that asks players to role-play as a character during the course of “adventures” or segments of game play. Two significant aspects of this RPG is that it has classes of characters (*e.g.* thief, fighter, magic-user, healer) that each work together toward a common goal by using the strength of their character class. The rules of this game were used to develop an adventure using art exploration concepts as part of the adventure (Caverns & Creativity). Each pair of students was given a character with a brief explanation of the basics of the game and then asked to engage in the RPG in class through their characters to explore the caverns of creativity with the rest of the party (meaning the other characters being role-played by the other students in the course). During subsequent classes, students developed the back-story and a “Litany Against Fear” for their characters and discussed the artwork through their characters. The students come in to class and arrange themselves

around a large common table in pairs according to their character that is part of the “adventuring party”, *i.e.* two students play the paladin, two for the rogue, two for the barbarian, and so on for the wizard, sorcerer, druid, and cleric. The students have previously developed a name, back-story, and alignment (good – neutral and lawful – chaotic, *e.g.* the paladin is lawful good and the wizard is chaotic good). During the lab period each week, the adventuring party was given information about their current surroundings, what they see, *etc.* by the game master (an instructor also role-playing), although in the game upon which this role-playing is based, this person would be referred to as the dungeon master, or DM.

Example of Laboratory Period

Let us use part of the ‘slow-looking experience’ lab adventure as an example: once the party of adventurers is assembled and ready the DM informs them that they have just entered a passageway blocked by a river of flowing lava. After some close inspection by the party, the DM reveals that despite the river of lava, there is no heat radiating towards the party. When they walk into it they realize it is an illusion. They can then advance into a cavern that is empty except for what appears to be a leather coat folded up and laid on the floor in the corner. Curiosity gets the best of one of the party members and they go and touch the ‘coat’. Once the coat is touched it becomes clear that it is actually a creature, specifically a “distractor beast”, and it attacks the offending party member. When the party seeks to help defend their party member, the distractor to defend their party member (the combat is handled via the game mechanics of Dungeons & Dragons™ 5th Edition rules), the distractor appears as if it were four different, identical creatures in different locations to hide its real position and it hits the party with a cacophony of sound to distract them. The party has to fight together to drive it away. Once they do, the DM explains that a wall of the cavern has become a wall of the Barnes and that the artist Paul Cezanne has appeared (Cezanne, role-played by an instructor, acts as a guide, provides perspective and is a regular guest during the adventures). Cezanne asks the adventurers to look at the wall slowly and carefully. To do so they must clear their minds of all distractions (drive out the ‘distractors’) and observe what they are shown slowly and carefully (in the same way that they got through the lava). The class is then free to observe as their character (by saying “my character would say...”) or just share their own observations.

Role-Playing Game Approach

The benefits to utilizing an RPG approach here is that when student are role-playing their character in the in-class game, they are expressing the thoughts and fears of their character, rather than expressing their own thoughts or fears. Most engineering students do not frequently share their thoughts and feelings in class – so the RPG approach provides a way to make them more comfortable. An additional, and significant advantage of the role-playing as utilized in this course is that it increased the comfort level of the students with each other and with the instructor by shared experiences working toward a common goal. The RPG portion of the lab times was reduced as the course progressed and as students became more comfortable with sharing their own thoughts with one another.

Art Approach

The authors worked with the Barnes Foundation to utilize the techniques the museum had developed as part of their educational programs. The primary techniques explored here were mindful observation of individual art, careful observation of assemblies of art, and techniques to use existing works to help students find and develop their own voice. The careful observation approach, developed by the museum's education group, was modified and implemented into the slow-looking and prisms portions of the course. Overall the artwork was used as a mechanism to see engineering design from a unique perspective by exposing students to unique artistic techniques, such as the use of perspective and line by Cezanne, followed by connection to unique engineering designs such as the first graphics user interface from Xerox PARC.

Design Related Content

Slow-looking, the approach discussed in the example above, uses the study of works of art to help design students observe carefully and gather information on what they are observing deliberately, valuable techniques to practicing engineers⁸ and also expert designers². The slow-looking approach was initially applied to artwork but was later applied to architecture, engineered products, and finally students were asked to apply it to a design of their choosing with tremendous results.

Another art-based approach developed in this prototype course is developing new prisms by initially discussing artwork, the approach of the artists to that work, and from that conceptualizing a "prism" to see it the way the artist might see it. RPG characters were useful here as well in that the development of the backstory served as a prism to inform the students as to how they might see the world, a particularly useful approach when considering the voice of the customer. Not only does this approach serve as an alternative to design concept generation methods⁹, it also serves to help develop alternative designs and explore the design space more creatively, both of which are valuable techniques for professional designers⁸.

Finally, and significantly, an early and recurring topic is dealing with fear. This is a significant barrier to the generation of new ideas and exploration of possible outcomes that are critical to professional designers⁸. In addition to developing their characters "Litany Against Fear", as discussed earlier, several fear-defeating techniques used by artists were discussed in class^{4,7,14}.

Results

The effectiveness of the course was evaluated by reflective prompts throughout the term as well as summative reflective essays at the conclusion of the term. The results of the role-playing and art-based elements of the course were evaluated to be very successful, with universal approval for both (from a, granted, small pilot group). A few notable comments from student summative reflections:

"I liked having a central game by which we came together and created group dynamics."

"This class in general opened my eyes to who I am and not what the school was making me into. It brought back my individuality."

"I really appreciate you both bringing back a part of me that I thought was gone long ago."

"I'm really glad I took this course, as it teaches us lessons that no textbook can convey."

Based on the student evaluation comments, these techniques will be modified and implemented into the capstone design sequences in the coming year. Additionally, a participant focus group will be performed during the spring term, prior to the ASEE meeting.

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Appendix: Summary of Creativity Techniques Utilized in this Course

Creativity Tools and Techniques Summary

Seeing:

As Cezanne taught you, there is so much to see, so much that others overlook. If you look closely you can see the magic. Keep looking and you see the joy. Find a thread and start pulling. They are everywhere once you look closely.

Fear:

Remember the Fearcaster? It is hard to defeat and relentless. It is on you all the time. Do not give in to it. You have a litany against fear. You have a bracelet of fearlessness. You have other adventurers who will fight with you. Find the places you need to protect you from it. You can make your world so bright it has nowhere to hide.

Distractions:

Remember the Distractor Beast? It is filling your head with nonsense and noise. It takes you away from the good you have to do. It is taking you away from your friends. You are not alone – your party is fighting it too. Your Prism of Seeing will help you see the truth through the distraction. Surround yourself by those who can see through the distractions too.

Slow Looking:

The next step in seeing, once you are past fear and distraction, is to look deeply. Clear your mind and dig in. See more. See all that is there.

Prisms:

Now that you can see what is there, see through it – see what its creator saw. See what they saw. See all that you look at every day in a new way, through that new prism. When all seems stale and old, find a new prism to see it anew.

Inspiration:

Use slow looking and prisms to inspire you to do new things. Steal like an artist. Imitate thoughtfully and you will have insight into the original work while making it your own. Put together the work of others with your vision to make something new. Integrate all you see, with all of the ways you have of seeing it, into something that is new and yours alone.

Finding the Guiding Voice Within:

Use writing, art, walking, anything that will help you to reflect and find the things you need to know within you. To find the world you want when the world you see is not what you think it should or could be. Find something that helps you find the small voice inside you that is your compass and your teacher.

Ask: What Would Your Character Do?

The rogue finds what is ahead of the party stealthily and finds the traps that others cannot see but needs the support of the party to survive. The fighter rushes into danger and absorbs the damage that would destroy others but needs support and healing. The magic-user has immense capabilities but needs protection and healing to be able to wield their power for the good of the party. The healer is often in the background but their work is critical when things look grim and all seems lost. Sometime you will be the rogue and sometimes the healer. Know your role but also see that you are stronger with the support of the party.

Finally:

We had a crazy vision to help engineers find creativity, to find their inner artist. We had a crazy vision of how to teach it using role-playing and art. We put it together but you all made it better. That is the way things are when you find the right people – they will take all the good things you give and return them improved and multiplied. Together we created something better than any of us could have made on our own.

We have started this all together but please don't ever, ever stop this journey. Rest if you need to, but don't ever stop. Explore new roles and find new prisms. You will never be done but, hey, who wants to be done when there is so much good work to do?