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THE DESIGN AND DEVELOPMENT OF A MAGIC-BASED TEACHING METHOD IN FACILITATING CREATIVE DESIGN THINKING

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This design case introduces a design and development process of using magic performance as a method to facilitate students' creative design thinking in user-centered design. Magic performance is used not only as a creativity stimulus for facilitating design flexibility but also as a guiding tool for facilitating the design process. Specifically, three design iterations are presented along with design challenges, design solutions, and a discussion of student experiences. A goal of this design case is to inspire other designers to develop similar interventions based on unexplored but meaningful activities, such as magic performance.

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INTRODUCTION

Design fixation has been identified as a barrier for designers in finding and developing effective solutions, especially during the ideation phase of design thinking (Crilly & Cardoso, 2017). Although prior design experiences and domain knowledge help designers to solve problems efficiently, prior experiences or knowledge may also have negative effects that lead designers to maintain outdated ideas and to generate less creative solutions (Smith & Blankenship, 1989; Chrysikou & Weisberg, 2005; Crilly & Cardoso, 2017). Because most design fields emphasize the originality of the design solutions (Goldschmidt, 2011), it is important for teachers who teach design-related courses to help students develop a flexible mindset in their work toward design solutions.

This design case describes the design of a magic-based teaching method, in which magic performance was used to guide the creative design process of students. Specifically, we introduce the iterative design process of this method and emphasize the lessons learned from each implementation. We describe how the feedback collected from each iteration helped to refine the design and how the resulting design changes influenced students' learning experiences.

WHY CHOOSE MAGIC?

Magic is a performing art and always brings unexpected outcomes to an audience. Creativity studies had shown that when students experienced novel situations that conflicted with their beliefs or expectations, they tended to think more flexibly than they would otherwise (Ritter et al., 2012; Wan & Chiu, 2002). Specifically, the seemingly impossible illusions demonstrated in a magic performance helped create an alternative reality that encouraged people to be less constrained by their preconceptions of reality and to think more imaginatively. As designers, we anticipated that if magic were brought into a classroom, it could serve as a catalyst for helping students to think more flexibly, like a magician.

Additionally, the personal experiences of the first author in performing magic encouraged us to bring magic into the classroom. The first author has been learning and performing

magic for six years. As both an instructional designer and a magician, his special magic performing experience deeply influences his teaching and approach to instructional design. Similar to a magician, he attempts to create meaningful surprises in class to motivate students to learn, and he also considers ways of making his design product unique. This "magical" influence became the initial inspiration for using magic to facilitate design flexibility in the class.

Furthermore, the second author felt magic might encourage students to use curiosity as a conceptual tool for their creative design work. Curiosity can support exploration, divergent thinking, and experimentation. Both the creativity and design thinking literature has emphasized the value of exploration during the creative process, including the earlier stages where problems are initially discovered (Csikszentmihalyi & Getzels, 1971; Dorst & Cross, 2001; Studer et al., 2018). Divergent thinking, or the ideational skill of generating a high quantity of options, has been linked to the generation of high-quality design decisions and evaluations (Basadur et al., 2000). Experimentation has been identified as a key factor underlying the design thinking process (Blizzard et al., 2015; Razzouk & Shute, 2012; Schumacher & Mayer, 2018). The questioning orientation that characterizes curiosity seems to parallel experiences with magic performance and to support behaviors such as exploration, experimentation, and divergent thinking that are associated with creativity and design thinking.

The second author also felt the inclusion of magic as an instructional activity may have helped to create a psychological tone that placed emphasis and value on unconventional ideas. This openness to ideas could support a tone of psychological safety (Rogers, 1954), which has been linked to learning environments that facilitate creativity (Cramond, 2005). Finally, by implementing unconventional and creative instructional methods, such as magic performance, instructors have an opportunity to model and demonstrate a valuation of experimentation and innovation in their own work as instructors. Organizations that substantially demonstrate their value of creativity have been shown to motivate innovation in the workplace and creativity in employees (Amabile & Pratt, 2016). In these ways, magic performances might open doors to a range of attitudes and behaviors associated with creative design.

CONTEXT AND DESIGN PROCESS

In February 2016, the first author began to collaborate with the second author, who was teaching an undergraduate level design course at a public university in the southeastern United States. This was an interdisciplinary course in which students came from different backgrounds, such as business, finance, education, etc. Most students did not have any previous design experiences, and the goal of this course was to teach them the basics of graphic design and user interface design. The course featured a project-based learning design with a focus on a final project that individual students designed, developed, and delivered over the course of the 15-week semester. Specifically, students needed to produce a design idea (such as a mobile application or web application) and spend the rest of the semester using digital tools (such as Marvel app or Adobe XD) developing responsive prototypes of their ideas. While students completed most of their project work during their own time, class meetings were held twice per week and were dedicated to the in-class activities selected to support students' creative design process.

FIGURE 1. Performing magic in the classroom.

The goal for the initial collaboration between the first and the second authors was to explore the possible connections between magic and creativity in the context of design-based educational interventions. Another goal was to understand students' general reactions to magic and decide what types of magic were appropriate for a classroom context and were preferred by students. Figure 1 shows a moment when the first author was performing magic in the classroom.

Initial Design Incubation

In this iteration, the POE (Predict, Observe, and Explain) teaching method (White & Gunstone, 1992) was adopted from science education for enhancing the effect of the magic tricks. The POE strategy uses discrepant events to elicit cognitive dissonances and, thus, raise students' curiosity in understanding the scientific concepts underlying the discrepant events. This strategy was adopted as a structure

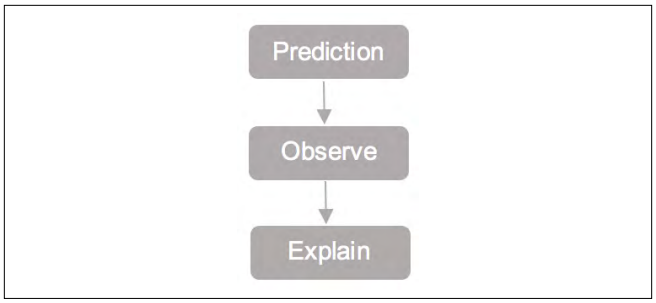

FIGURE 2. The initial magic activity structure.

for the intervention to raise students' interest in magic and motivate them to explore the secrets of the magic-using their imaginations. For instance, before watching the magic performance, students were asked to predict the result of a related event. Next, the magic trick was performed to demonstrate a different result. Students were then challenged to try to think of the secret behind the trick and asked to discuss their solutions with the other students.

Design Reflection

The magician (the first author of this article) visited the class every two weeks and performed magic about 10 minutes each time. After each visit, a journal was written to reflect on his performance and students' reactions, which helped in selecting the tricks that appealed to the students. By analyzing the journals, we found that students most preferred magic tricks using everyday objects. This is likely because these objects create a sense of familiarity, and such relevance is more likely to engage students (Priniski et al., 2018). Additionally, the more familiar students are with the objects, the more fixated they will be on a common solution (Van Belle et al., 2010). For instance, when asked how to move a ring from one finger to another, most students gave answers akin to moving the ring directly by the other hand. After witnessing how a magician approached the problem in a "magical" way, they were amazed by the magical effect that differed from their own predicted solutions and thus encouraged to explore the secret behind it. This dissonance helped students to realize how the mind tends to be fixed on previous experiences without considering other possible solutions. Therefore, using familiar stimuli is more likely to help students realize and recognize the fixations they have on everyday objects.

At the end of the semester, we sent a survey to students asking them to share their experiences and perceptions of the relationships between magic, creativity, and design. Students were asked to indicate their level of agreement with questions such as, "How much do you agree that the magic activity influenced your creativity?" and were also encouraged to leave comments. Forty-two students completed this survey, and the results showed that 100 percent of students agreed that magic engaged them in the class. Furthermore, 98 percent of students agreed that magic enhanced their creativity. However, students indicated that watching a magic performance did not help them generate creative design ideas, and they did not understand how magic related to the design focus of the class, as shown in the students' comments:

> *"It was sometimes hard to connect the magic trick to the actual design lesson besides creativity."*
>
> *"Sometimes I did not fully understand the correlation."*

The Second Iteration

Because the first iteration revealed the main problem of the lack of connection between magic and design, great emphasis was placed on designing activities to help students see those connections. Three design changes were made and were field-tested in the second iteration of the design.

The first change was to clarify the magician's design process by revealing the secret of a particular magic trick and the general principles used by magicians to come up with creative magic ideas. The rationale was that those secrets and principles might help students understand the magician's creative mindset. The hope was that students might be motivated to use these principles to develop their own creative design ideas. Accordingly, reflection and revelation modules were added to the original activity model. Therefore, before revealing the secret, we reflected upon how a fixed mindset limited students' minds in figuring out the creative solution to the trick and explained the principles used by magicians to come up with the trick. The general principles (see Table 1) were developed based on the first author's own magic

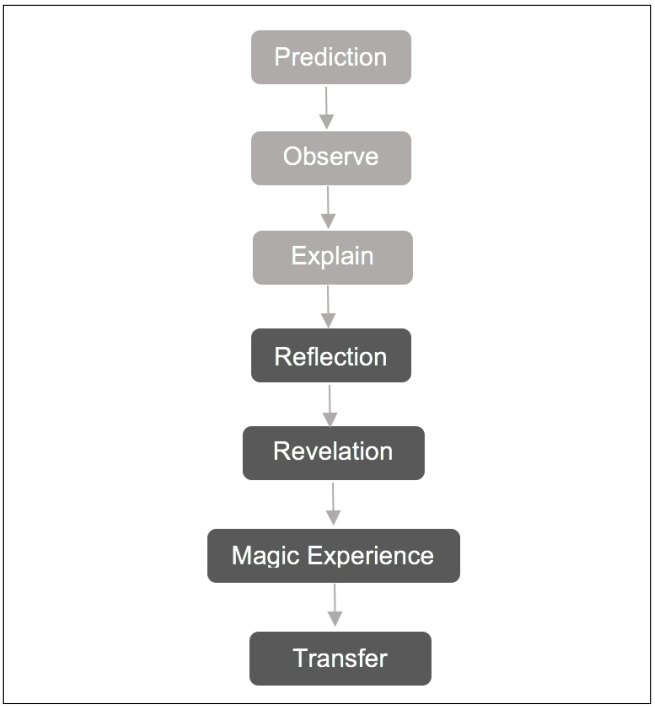

FIGURE 3. The updated magic activity model.

- Problem finding—what magical effects to create?
- Solution finding (a reverse thinking process):
  a. Analyzing the conventional thinking or assumptions.
  b. Challenging those traditional assumptions and thinking reversely.
  c. Generating as many solutions as possible.

TABLE 1. Magician's principles (adapted from Cohen's *Follow the Other Hand*).

performing experiences and Cohen's book *Follow the Other Hand* (2006), in which Cohen explained how the magic creating process could benefit entrepreneurs. Then, the secrets were revealed, which reflected one of the magicians' principles—to use a flexible mindset to challenge traditional thinking. For instance, in a magic trick involving a ring, the first author used the rubber band to simulate a real ring, which challenges the traditional definition of a ring.

Second, it was important to provide students with opportunities to perform magic to help them better understand the principles behind the trick. Therefore, a magic experience module was added to provide students with the experience of learning and performing magic to help deepen their understanding of the principles of magic.

Third, we provided examples to facilitate the transfer of a flexible mindset. Several design examples were collected in which the design principles and solutions were very similar to those that have always been used by magicians. A classic example we added was the redesign of an MRI machine as discussed by Kelly & Kelly (2013). The design problem demonstrated by this example was how the noise produced by MRI machines almost always scared young children undergoing an MRI scan. The creative solution was that instead of reducing the noise, designers suggested the MRI machine be artistically painted to resemble a boat so that the noise became an integral part of a pirate story. In this design example, like other magic tricks, the solution is simple but solves the problem in an unexpected way. For children, this solution parallels illusions created by magicians. Through learning examples like this, we expected students to connect the magic principles with real-world design creativity.

Design Reflection

The new design was implemented in the class a total of three times. Each activity lasted about 25 minutes and used different magic tricks. For each intervention, students not only watched the magic performance but also learned the secret of the magic trick and the underlying principles used by magicians. Additionally, students were given opportunities to learn and perform the trick. They also learned how to connect and apply principles from magic to design projects with the help of the design examples. After the three interventions, 15 students were interviewed to help the team understand how the design of this activity influenced student experience in this course. The collected interview data showed not only evidence suggesting that watching magic influenced students' creativity but also that the experience with the added activities had a positive influence on students' creative design thinking. As suggested by a participant's reflection on watching a magic performance in the class,

> *"… how did it happen? What was the first line of reason? I guess I was just like checking my boxes. Is the coin in his hand? Did he put it somewhere else? Where it supposed to be? I was really trying to get to the route of how this magic trick was done, or just like more out of those boxes and think less realistically."*

The surprising magical effects raised this participant's curiosity about the secret of the magic trick, which further motivated him to generate various possible explanations. Because it was difficult to develop a satisfying explanation using realistic thinking, students were led to use their imaginations to consider other possibilities. As suggested by another participant,

> *"Watching [magic] definitely creates a curiosity. I think it helps inspire creativity because you think differently than you normally would. It kind of opens up the world of possibility as there are more or less limitedness,"*

We also found that the revelation of the magic secret in the class influenced students' understanding of creativity. As stated by one participant,

> *"Ok, a very simple technique creates a very magical thing. I think that helps especially me to think creatively. Even little things can make something super awesome, like the rubber band ring you used for the ring trick. It is not like you did something special. It is just that a little thing created something big. That made me believe the impossible."*

Similarly, another participant described the experience of knowing the secret as a light-bulb moment, which made him believe "that you can be creative with everyday objects, you can think of a ring as a rubber band…that definitely opens up creative thinking for me, whereas normally, I probably stay in my routine just like everyday stuff." Also, the magic experience section worked as expected and appeared to support students' understanding of a magician's mindset and principles. As one student mentioned,

> *"My mind wants to pretend to grab the coin, but my body actually wants to really take it. I think even when you told us how to do it, seven out of the ten times I would actually grab the coin. Because that's how your brain was trained*

almost to follow a robot mode, the normal way of life, you do not think outside of the box."

This students' experience with the magic session helped him notice how his mind tended to associate traditional ideas with everyday experiences and how magicians challenge traditional assumptions to make "magic" in the minds of observers. Students' experience with these performances of magic helped them connect the principles of magic with design creativity, as said by a student:

"My app is about gift-giving. There is a certain way that everyone gives gifts. But it does not have to be that way. You do not have to see and pick it [the gift] up yourself. There will be an easier way to do it, a more effective way."

Although the new design encouraged students to reflect on their fixation and generate creative design ideas, the data collected did not show any evidence suggesting its application toward the development of their ideas. In other words, the magic activity may have encouraged students to think of unique or creative solutions to design problems, but such influence was limited to the conceptual or inspiring level. Anderson et al., (2014) defined innovation using two stages. The first stage is creativity and idea generation. The second stage is the implementation of those ideas. Given that one of the course's learning goals was for students to learn to be more innovative in their work, it was not enough that students simply generate creative ideas—they must also implement those creative ideas before their work might be qualified as innovative. More scaffolding activities were needed to guide students in applying principles learned from magic to the product development process.

The Third Iteration

In August 2017, the first author became the instructor of the course, which provided him with more opportunities to interact with students and expand the magic intervention. This shift in roles motivated the first author to rethink the structure of this course and come up with ideas to align magic activities with students' development activities in the class.

Interview data from the previous semester suggested interesting ways to influence students' development processes. A few students talked about how learning to perform magic encouraged them to focus more on their audience's feelings and less on themselves. This is because, in order to successfully "trick" the audience, students must focus on their audience's reactions and refine their performance accordingly. This leads to the design assumption that developing empathy for the audience by performing magic might also encourage students to consider the needs of the target users for their products. This might help students become more willing to refine their design ideas based on users' suggestions and thus become more flexible and user-centered in their design methodologies.

To facilitate such connections, the first author developed a magic prototyping kit based on Nodder's (2014) paper prototyping method. As indicated by Figure 4, the kit contains a deck of blank index cards, a mobile phone frame, colorful sticky notes, and a paper keyboard. Students could draw each interface of their app on the index cards. The colorful sticky notes simulated the interaction between the app and the users. Yellow notes represented the links on which users can click. Pink notes represented the areas into which users can enter input. During testing, once users click on the yellow notes, the designer switches the current "interface" to the linked one. Whenever users "click" on the pink notes, the designer moves the paper keyboard to the new screen, thus allowing users to "type" in the information. This kit made students' prototyping process easier and enabled them to get design feedback immediately, paralleling the immediate feedback they received for their magic performances.

To motivate students to use this prototyping kit, the first author adapted a magic trick called "Gag phone 20" (produced by Aska, video demo link) to help students understand the benefits of paper prototyping. The trick demonstrated a "superphone" made of paper, which could change its size and even transform it into an "I-pad." After showing this trick, students were asked to interact with this "superphone" and then asked their opinions about it. Through this trick, students experienced how the paper prototyping technique helps designers visualize their ideas and receive user

FIGURE 4. The magical prototyping kit.

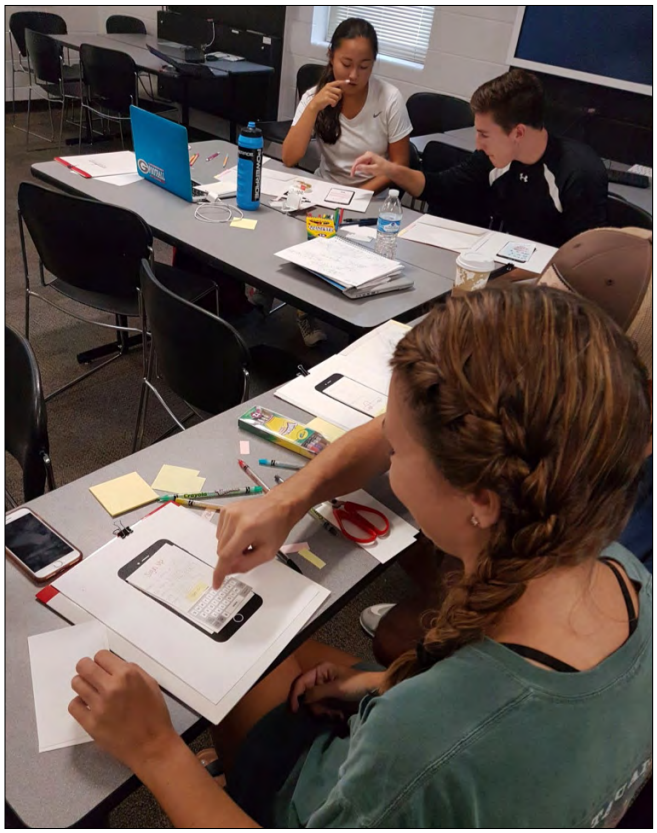

FIGURE 5. Align magic performance with product prototyping.

feedback during the early development stage. Therefore, students were more likely to use the prototyping kit to develop their own paper prototypes.

Identifying the connection between magic performance improvement and product refinement encouraged the first author to find other similarities between the audience-centered magic creating/improving process and the user-centered app design/development process (see Figure 6). The idea of using the magic creation process to guide the entire design process of the students began to emerge. These two parallel processes gradually became the main structure for this course. For instance, in the first two weeks of the semester, students learned the principle of focusing on the target audience through magic, and all the magic demonstrated and learned in the class reflected this principle. In tandem, students were motivated to identify their target audience and generate an app idea. For the next few weeks, the topic for magic shifted to the principle of challenging traditional assumptions. Accordingly, students were encouraged to differentiate their app ideas from other similar apps. In this way, the two processes facilitated each other and helped students connect and apply the principles collectively. To clarify these two parallel processes to students, a *creative design guideline* (see Table 3) was also developed. Students followed this guideline and spent the semester finishing the

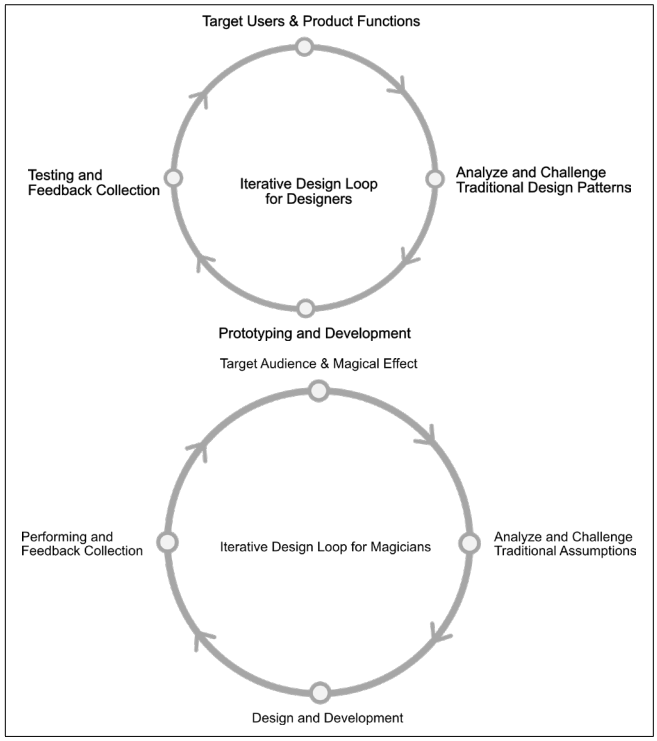

FIGURE 6. The magic creating process and the product development process.

MAGIC	PROPS NEEDED	MAGICAL EFFECT	MAGIC PRINCIPLE	DESIGN PROCESS
"The Teleportation Effect"	Sponge balls, regular coins, and "the little hand" (Inventor: Michael Ammar).	An object is teleported from magician's hand to audience's hand.	For the same magic effect "teleportation", magicians use different objects for different audience groups. The needs of the audience decide magicians' performance.	Identify the target audience of the design project, analyze their needs, and think of the "magical effect" of the product.
"The Magic Ring"	"Odyssey" (Inventor: Calen Morelli)	A ring "magically" moves from one finger to another.	Identify assumptions held by the audience and challenge those assumptions to create magic tricks.	Identify other similar design products and analyze the design patterns shared by those products. Challenge those design patterns and think of unique product features.
"The Magic Box"	"Burglar ball" (Producer: Tenyo Magic)	A magician makes a solid ball penetrate a sealed box.		
"The Magic Cube"	"Shake" (Producer: CMC)	A magician takes a cylinder out of a cube without using his fingers.		
"Pick a Card"	"Svengali Deck" (Inventor: Burling Hull)	An audience plays the role of a magician to find the card chosen by another audience.	This trick was invented by the first author based on the audience feedback. This trick communicates to the students that magicians always seek inspirations from their audience.	Feedback Collection
"The Magic Phone"	"Gag Phone 20" (Producer: Aska Magic)	A paper-made "cellphone" functions like a transformer, which can expand itself and even turn into an I-pad.	Magicians demonstrated their future ideas using the paper prototyping technique.	Paper Prototyping
The "Blank" Deck	"Mental Photography Deck" (Inventor: Ralph W. Hull)	Turning a deck of blank cards into normal deck with faces and backs.	This trick was used as a metaphor to explain the development of paper prototype. After watching this trick, students were given the magical prototyping kit to draw their design ideas onto index cards.	Paper Prototyping

TABLE 2. List of magic tricks and target design process.

assigned task and answering the guideline's questions as the design process unfolded.

Although the structure for this course was revised as compared to the second iteration, the magic activity in each class still followed the original model developed in the second iteration (see Figure 3). The magic presented in each activity demonstrated a specific principle and motivated students to explore the principle in greater depth. More tricks were tested to realize this goal. Table 2 lists the selected magic tricks and their respective targeted design phases.

Design Reflection

The goal for the third evaluation was to understand how much the "magic-design" parallel processes influenced students' design and development process. Regarding the data collection, instead of collecting data at the end of the semester, students were interviewed as they completed specific design phases. From the interview data, we did see that students formed a deeper understanding of the connection between the principles used by magicians and their application to the product development process. For example, one student said,

> *"…thinking how my design works is like a big part of execution (in magic), or like how to translate the effect you want to have for people into a software program. I know if I want someone to open my app, the first reaction I expected could be impressed by it. But I need different responses from people, pinpoint what users are looking for, more than senses of their reaction. For instance, if I try to pull off*

Creative Design Guideline

1. *Identify the "magical effect" and the target audience.*
   (Investigate and explore the needs of your target audience. Based on their needs, try to identify what kind of magical experience you want to bring to them through your design product. What are your initial possible solutions?)
2. *Analyzing conventional thinking and assumptions.*
   (Search and review previous similar design solutions. Try to identify the common design patterns.)
3. *Challenging previous assumptions and thinking reversely.*
   (Do not always follow the trends. Try to develop unique features that distinguish your design from those similar products.)
4. *Prototyping and Improving.*
   (Sketch your idea and develop a prototype. Then, let your target audience interact with your prototype and collect feedback from them. Based on their feedback, rethink of your previous design and make changes accordingly.)
5. *Showing magic on the stage.*
   (Marketing your design product and collecting more feedback.)

TABLE 3. Creative design guidelines.

> *a magic trick, someone will tell me: 'Oh I saw the ball held in your hand, I can see the trick,' I say: 'Ok, I need to improve on it, I need to make it better.' Then you take action. Like carving, you need to change this and also change that. You fine-tune it and you get to a better place. Then eventually you had this full smoothly executed function..."*

It was interesting to learn how this student benefited from his magic performing experience and to understand his definition of design as a smooth execution. For him, smooth execution depended on the iterative testing and refinement of his product, which parallels how magic performances are refined based on ongoing practice. This quote demonstrated a positive attitude toward unexpected design outcomes. Another student expressed a similar view toward design failures and regarded them as a valuable learning experience:

> *"Especially messing around magic tricks, but also like—it is ok you made mistakes. I feel like there is a lot of pressure now toward that you cannot fail. But failure leads to improvement as long as you take it constructively. You can only figure out where you can improve when you fall short…"*

We also found that the "superphone" magic trick and magical paper prototyping kit helped students visualize their design ideas and improve their design confidence, as suggested by students' comments:

> *"It really was an eye-opening moment for me, when you showed that trick, you know, a phone that can become long or wide. For a couple of years now, the majority of the phone manufacturing company has been investing a lot of money into flexible LED screens so that the phone can be bending, which is an old idea now. And when I saw your idea, I was really like, why not? Is there some kind of material where you can actually stretch your phone and shrink it down, instead of just making it bendable? That was really cool. The trick just gave me more confidence to continue pursuing what I'm doing. Because you showed us some crazy ideas, and it basically gets rid of my fear trying to go outside the boundaries."*
>
> *"As you actually prototype it, you can visually see it. Because everything is conceptual until we complete the prototype. Without a paper prototype, it is hard to put everything together and see our design in a full form. Also, we get a sense of accomplishment when we finish our prototype. You can see the prototype when you draw it out on cards. I feel like wow this is like a real thing."*

Moreover, the influence of students' experience with magic appeared on both the conceptual level and in their actual design practice. Specifically, we found how the "challenging traditional assumptions" principle in magic and the *creative design guideline* influenced students' design process. For instance, one student in the class tried to develop a mobile application called "My Menu." In his *creative design guideline* submission, the "magical effect" of his design was described as an enabling of people from ages 18-35 to have healthy eating experiences without the constant chores of recipe searching, grocery shopping and cooking. His idea was to develop a meal delivery app that delivered healthy meals to peoples' homes.

By analyzing other meal delivery apps on the market, he concluded the general patterns they adopted: Asking their target users to register a user account, suggesting they pay a fee for their services weekly or monthly, and then having the ingredients delivered to them.

Similar to a magician who always challenges traditional assumptions, he proposed a design model similar to "Uber," which differentiated his app from previous designs. Unlike other companies that only allow users to register as consumers, people who use his app could register as featured cooks

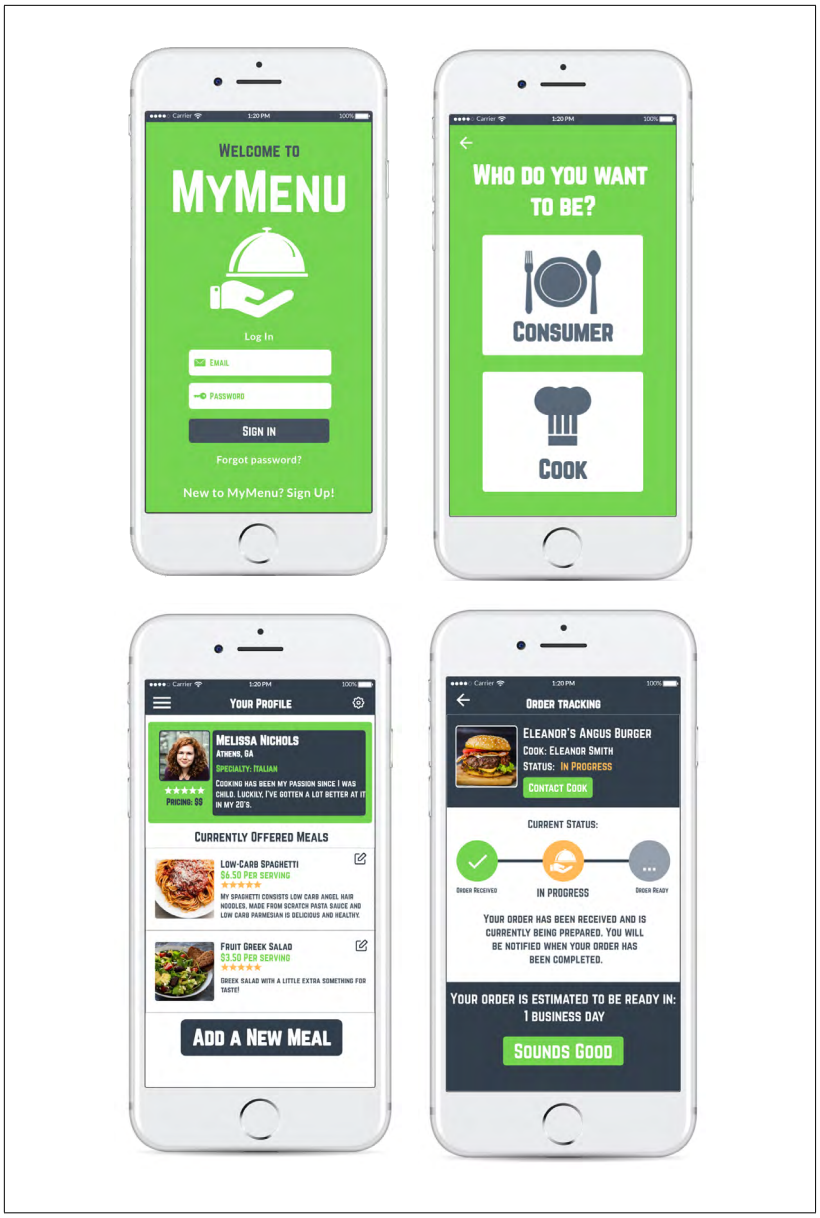

FIGURE 7. Student's design work: "My Menu,"

to provide food cooking and delivery services. People who registered as consumers could order food directly from those users registered as cooks. Figure 7 shows the screenshots of the final responsive prototype he developed, which showcases this unique feature of his app.

REFLECTION ON THE ENTIRE DESIGN PROCESS

Many instructional designers suggest that designers' subjectivity should be regarded as a source for generating design ideas and leading scientific research (Smith & Boling, 2009; Rowland, 2008). In this design case, it is interesting how the initial idea of this intervention was informed by the first author's personal magic performing experience and the second author's sense of the potential positive influence of magic on students' creativity. Furthermore, a review of the related literature regarding schema disruption, creativity, and design thinking expanded this idea and encouraged the authors' collaboration and initiation of the exploratory design process.

The in-class exploration and students' feedback played important roles in terms of identifying potential design challenges and finding possible design solutions. As summarized in Table 4, the data collected helped identify the existing design problems of the intervention, which became the potential design challenges for the next iteration. Moreover, analyzing students' experiences and reactions inspired the design solutions. For instance, we would never have thought of using magic to facilitate students' design empathy if the students had not shared their insight that performing magic caused them to care about their audience. Student feedback kept motivating the design team to build connections with other ideas and embed them in our design.

The second author was not a magician but was inspired by this research to emphasize in-class activities that supported the practice of observation and perception. Students' attention and subsequent reflection on the demonstrations of magic seemed to elicit developmental gains for some students' design creativity. Might other kinds of interventions elicit similar gains? For example, the second author identified some activities (Yenawine, 2013) that involved the observation and group review of artwork that were intended to give students practice with observation and multiple perspective-taking. In this way, it was possible for a non-magician instructor to leverage activities that encouraged curiosity, openness to experience, and appreciation of multiple perspectives as experiences intended to expand students' design methodologies.

CONCLUSION

The focus of this paper was to illustrate the process of developing a teaching method based on magic performance for facilitating students' creative design thinking. The entire design process has lasted for about three years. The design focus is not only on using magic performance to enhance students' creativity in general but also on helping students apply the principles learned from magic throughout their design process. The results showed that the method we

	INITIAL IDEA INCUBATION	THE SECOND ITERATION	THE THIRD ITERATION
Design Challenge	How to use magic to facilitate creativity?	The connection between magic and design remains unclear.	How to facilitate the idea development process?
Idea Inspiration	• Literature review • Authors' "hunches"	• Literature review • Authors' experiences of using magic in the class	• The interview data • Students' design work
Solution	• Adopting the POE teaching strategy • Performing Magic in the classroom to explore possible connections	• Reveal the secret and related principles • Provide students with opportunities to perform Magic • Add Creative Design Examples	• Align the magic creating process with the design development process

TABLE 4. The design evolution.

designed fostered the students' awareness of their thinking fixation and engaged them in creative design. We hope the design process of this method will encourage more designers to explore less popular topics that might have the potential to be developed as meaningful resources for students.

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