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 students’ 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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CONTEXT

Design fixation became a barrier for designers in finding and developing effective solutions, especially during the ideation phase of design thinking (Crilly & Cardoso, 2017). Design fixation was referred to as “a state in which someone engaged in a design task undertakes a restricted exploration of the design space due to an unconscious bias resulting from prior experiences, knowledge or assumptions” (Crilly & Cardoso, 2017, p.6). Although prior design experiences and domain knowledge help designers to solve a problem efficiently, prior experiences or knowledge may also have negative effects that lead designers to maintain outdated ideas and generating less creative solutions (Smith & Blankenship, 1989; Chrysikou & Weisberg, 2005; Crilly & Cardoso, 2017).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 designers to develop a flexible mindset.

Recent design research has indicated that exposing students to novel design solutions enhances the number of new design solutions generated (Perttula & Sipilä, 2007; Dugosh & Paulus, 2005). Similar findings can also be found in literature from the fields of creativity and social psychology. For instance, creativity studies showed that when students experienced novel situations that conflict with their beliefs or expectations, they tended to think more flexibly than they would otherwise (Ritter et al., 2012; Wan & Chiu, 2002). Social psychology studies also reported that people were encouraged to generate more creative solutions after witnessing counter-stereotypical examples (such as a hippy lawyer, a woman-rugby player, etc.) (Gocłowska, Crisp & labuschagne, 2013). Researchers referred to the method of using novel events or examples to facilitate creativity as schema disruption strategy. However, there is no previous research indicating how to use this strategy in facilitating design flexibility in the classroom. Therefore, this design case aims to propose an innovative schema disruption strategy.
using magic performance to guide the creative design process.

WHY CHOOSE MAGIC?

Magic is a performing art and always brings unexpected outcomes to an audience. A well-done magic performance can entertain, engage, and motivate people to think of all the possible ways magic can be done. As suggested by Ritter et al. (2012), the active engagement of the individuals in the schema disruption process is needed for this strategy to be effective. Specifically, the seemingly impossible illusions demonstrated in a magic performance created an alternative reality that encourages people to think more with their imagination and be less constrained by their preconceptions of reality. If magic was 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 an instructional designer and also a magician, his special magic performing experience deeply influences his teaching and instructional design style. Similar to a magician, he always thinks of creating 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 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 have 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, Daly, McKilligan, & Seifert, 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, Runco, & Vega, 2000). Experimentation has been identified as a key factor underlying the design thinking process (Blizzard et al., 2015; Razzouk & Shute, 2012). The questioning orientation that characterizes curiosity seems to parallel experiences with magic performance and abilities such as exploration, experimentation, and divergent thinking associated with creativity and design thinking.

The second author also felt the inclusion of magic as an instructional activity might help to create a learning environment that valued unconventional ideas. In this way a tone of psychological safety might be established that 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 model and demonstrate their value of experimentation and innovation in their own work as instructors. Organizations that substantially demonstrate their value for 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.

DESIGN PROCESS

In February 2016, the first author began to collaborate with the second author who was an instructor teaching an undergraduate level design course at a public university in the southeastern United States. This course was designed to attract students from multiple disciplines and to provide them with opportunities to learn creative design thinking and development by designing and developing a product (such as a software application, website, etc.) using technology. The instructor wanted to include magic in his class to create a relaxed and playful learning environment, which could inspire students to think creatively. The goal for the collaboration was to explore the possible connections between magic and creativity in the context of design. 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 showed the moment when the first author was performing magic in the classroom.
Initial Design Incubation

In this iteration, the POE (Predict, Observe, 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 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 are asked to predict the result of a related event. Next, the magic trick is performed demonstrating a different result. Students are then challenged to try to think of the secret behind the trick and discuss it with the other students.

FIGURE 2. The Initial Magic Activity Structure

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 design journal was written to reflect on the performance and students’ reactions, which helped in selecting the tricks that were attractive to students and required little preparation. By analyzing the design journal, 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, Hecht & Harackiewicz, 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 of students were to give answers akin to moving the ring directly by another 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 them 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 the 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. In the survey, students were asked their level of agreement with the questions such as “How much do you agree that the magic activity influenced your creativity?” Students were also encouraged to leave comments. Forty-two students finished this survey and the results showed that 100 percent of students agreed that magic engaged them in the class. Furthermore, 98% 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 did not fully understand the correlation"

The Second Iteration

Since 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 field tested in the second iteration of the design.

FIGURE 3. The Updated Magic Activity Model
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 is 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 coming up with the trick. The general principles (see Table 1) were developed based on the first author’s own magic performing experiences and Cohen’s book *Follow the Other Hand* (2006), in which Cohen explained how the magic creating process can benefit entrepreneurs. Then, the secrets were revealed, which reflected one of the magicians’ principles—challenging traditional thinking with a flexible mindset. 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.

![Image](https://via.placeholder.com/150)

**TABLE 1.** Magician’s principle (Adapted from Cohen’s *Follow the Other Hand*)

- 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 ideas as possible.

Second, it is important to provide students with opportunities to perform magic so as to understand the principle behind the trick. A magic experience module was added to the lesson to provide students with the experience of learning and performing magic like a magician so as to deepen their understanding of the principles of magic.

Third, we provided examples to facilitate the flexible mindset transfer. 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 is that the noise produced by MRI machines almost always scares patients who are young children. The creative solution is that instead of reducing the noise, the designer turns the MRI machine into a boat so that the noise becomes an integral part of a pirate story. In this design example, like other magic tricks, the solution is very simple but solves the problem in an unexpected way. For children, this solution is similar to an illusion created by magicians. Through learning examples like this, we expect students to understand the real world applications of those magic principles.

![Image](https://via.placeholder.com/150)

**FIGURE 4.** Creative MRI Machine Problem Solution (Kelley & Kelley, 2013)

**Design Reflection**

The new design was implemented in the class three times in total. Each activity lasted about 25 minutes using different magic tricks. For each intervention, students not only watched the magic performance but also learned the secret of the magic and the principles used by magicians. Additionally, students were given chances to learn how to perform the trick. They also learned how to 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 their experiences in this course. The interview data collected not only shows evidence suggesting how watching magic influences their creativity but also demonstrates the positive influence of the added activities on students’ creative design thinking. As suggested by a participant on watching magic performance in the class,

“…. how did it happen, what is the first line of reason, for example, I guess it is just like checking my boxes, like is it in his hand, did he put somewhere else, where it supposed to be, but really try to get to the route of how this magic trick was done, or just like more out of the boxes … think less realistically.”

The astonishing magical effects raised this participant’s curiosity about the secret of magic trick, which further motivated him to generate various possible explanations. Since it was difficult to develop a satisfying explanation using realistic thinking,
students were led to imagine other possible ways using their imagination. 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 to create very magical thing. I think that helps especially me to think creatively. Even little things can make something super awesome. I think it is a little thing in your magic, like the ring is just a rubber band, 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 like that (as a rubber band)... that definitely opens up creative thinking for me, whereas normally I probably stay in my routine just like everyday stuff.” Additionally, the magic experience section also worked as expected in terms of facilitating students’ understanding of a magician’s mindset and principles. As one student mentioned,

“Because my mind wants to [pretend to] grab the coin, but my body actually wants to really take it, I think even when you are telling us how to do it, seven out of the ten times I would actually grab the coin, not thinking, 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.”

The magic experience section made this student realize how his mind tended to follow traditional ideas and everyday experiences but that a magician challenges traditional assumptions to make magic happen. Providing students with magic performing experience did help them understand such principles. Additionally, the interview data also indicate that the design ideas generated by students were also influenced by the magic principle:

“My app is about gift-giving. There is a certain way that everyone gives gifts, 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 facilitation regarding the development of their ideas. In other words, the magic activity might encourage students to think of unique or creative solutions to the design problem, but such influence only remained on the conceptual or inspiring level. Anderson, Potonik, and Zhou (2014) define innovation using two stages. Creativity is the first stage where ideas are generated. The second stage is the implementation of those ideas. Given one course learning goal was for students to learn to be more innovative in their work, it was not enough that students simply generate creative ideas—they must implement those creative ideas in order to be innovative. More scaffolding activities were still needed to guide students in applying the principle learned from magic to the product development process.

![Diagram](image)

**FIGURE 4.** The design success and failure identified in the second iteration

**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 role shift 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.

One interesting idea that emerged to enhance the influence on students’ development processes was inspired by the interview data collected in the previous semester. A few students mentioned in the interview that learning how 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 have to 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 the user’s suggestion and thus become more flexible and user-centered. In order to facilitate such connection, a magic prototyping kit was developed based on Nodder (2014)’s paper prototyping method. This kit made students’
prototyping process easier and enabled them to get feedback immediately, similar to the way of collecting feedback for their magic performances. Specifically, students could draw each screen of their app on the index cards. When they finished drawing, they asked other students to interact with the paper version app and give feedback after testing. This enabled them to visualize their ideas and receive user feedback during the early development stage.

**FIGURE 4.** The magical prototyping kit

**FIGURE 5.** Align magic performance with product prototyping

This identified connection between magic and design encouraged the first author to find other similarities between the magic creating process and the app/product development process (see Figure 6). The idea of using the magic creation process to guide the design process began to emerge. These two parallel processes gradually became the main structure for this course. All the activities throughout the semester were organized following these two parallel lines: the magic creating process and the user-centered creative design process. 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 manifested this principle. On the other hand, students were motivated to generate their own ideas and identify their target audience. 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. Therefore, the two processes facilitated each other and helped students understand and apply the principle collectively. In order 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 entire semester finishing the assigned task and answering the questions provided as the design process unfolded.

Although the structure for this course had been changed, the magic activity in each class still followed the original model developed in the second iteration (see Figure 2). The magic presented in each activity demonstrated a specific principle and motivated students to explore the principle in great depth. More tricks were tested to realize this goal. Table 4 lists the selected magic tricks and their respective targeted design phases.

**FIGURE 6.** The Magic Creating Process and the Product Development Process
<table>
<thead>
<tr>
<th>Magic</th>
<th>Props Needed</th>
<th>Magic Effect</th>
<th>Magic Principle</th>
<th>Design Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Teleportation Effect”</td>
<td>Sponge Ball, Coin, The little ghost</td>
<td>An object teleport from magician’s hand to</td>
<td>For the same magic effect “teleportation”, magician choose different objects for</td>
<td>Identify the magical effect and target audience.</td>
</tr>
<tr>
<td></td>
<td>hand</td>
<td>audience’s hand.</td>
<td>different audience. The needs of the audience decide which magic used.</td>
<td></td>
</tr>
<tr>
<td>The Magic Ring</td>
<td>The rubber ring</td>
<td>A ring “magically” move from one finger to</td>
<td>Analyzing conventional thinking and challenge traditional assumptions.</td>
<td>Identify other similar design products and analyze the design patterns of those</td>
</tr>
<tr>
<td></td>
<td></td>
<td>another.</td>
<td></td>
<td>products. Challenge the design patterns and think about what makes your own</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Make the ball penetrate through the box.</td>
<td></td>
<td>product unique.</td>
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<tr>
<td></td>
<td></td>
<td>Take the cylinder out of the cube without</td>
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<tr>
<td>The Magic Cube</td>
<td></td>
<td>using fingers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Magic Phone</td>
<td>Special Magic Cards</td>
<td>An audience plays the role as a magician to</td>
<td>This trick was invented by the first author based on the audience feedback.</td>
<td>Testing and Design Improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>find the card chosen by another audience.</td>
<td>Magicians always get inspired by audience’s suggestions.</td>
<td></td>
</tr>
<tr>
<td>Pick a Card</td>
<td></td>
<td>The paper made “phone” functions like a</td>
<td>Magicians demonstrated their future ideas using paper prototyping.</td>
<td>Paper Prototyping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transformer. It can expand itself and even</td>
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<tr>
<td></td>
<td></td>
<td>turn into an I-pad.</td>
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<tr>
<td>The “Blank” Deck</td>
<td></td>
<td>Turning a deck of blank cards into normal</td>
<td>This trick demonstrates the advantage of paper prototyping. After watching this</td>
<td>Paper Prototyping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>deck with patterns.</td>
<td>trick, students will be asked to draw their design ideas onto index cards.</td>
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</tbody>
</table>

**TABLE 4.** List of Magic tricks and Targeted Design Process
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 after they finished a particular design phase. From the interview data, we did see that students formed a deeper understanding of the connection between the principle used by magicians and its application to the product development process. For example, one student said,

"...thinking like how my design works is like to be a big part of execution (in magic), how do you translate the effect you want to have for people into a software program. I know if I want someone to open it, 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 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 do it, like carving, you need to change this, also change that, you fine-tune it, you get to a better place, then eventually you had this full smoothly executed function...”

It was interesting to learn how this student benefitted from the magic performing experience and to understand his definition of design as a smooth execution. For him, this smooth execution depended on the iterative testing and refinement of his product, which is similar to how a magic performance is refined based on the ongoing practice. This quote demonstrated a positive attitude toward unexpected design outcomes. Another student also 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 are 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...”

On the other hand, the data also indicated that the “change traditional assumption” principle did encourage students to differentiate their designs from other similar designs:

“... it doesn't matter if it's the same idea behind it, but what makes yours different? How do you differentiate yourself? Then I think that's one of the golden moments where creativity needs to kick in as a moment for them to try to be creative and come up with a unique solution to it. So I think it's a great guideline to follow...”

<table>
<thead>
<tr>
<th>TABLE 3. Creative Design Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Identify magical effect and your audience.</strong></td>
</tr>
<tr>
<td>(Try to investigate and explore the needs of your target audience. Based on their needs, think about what kind of magical experience you want to bring to them through your design. What are your initial possible solutions?)</td>
</tr>
<tr>
<td><strong>2. Analyzing conventional thinking/assumptions.</strong></td>
</tr>
<tr>
<td>(Search and review previous design solutions or general assumptions about the possible solution. Try to list all of them.)</td>
</tr>
<tr>
<td><strong>3. Challenging previous assumptions and thinking reversely.</strong></td>
</tr>
<tr>
<td>(Do not always follow the trends. Try to come up with unique design ideas that distinguish your design from others.)</td>
</tr>
<tr>
<td><strong>4. Prototyping and Improving.</strong></td>
</tr>
<tr>
<td>(Sketch and develop your ideas. Show your design prototype to your targeted audience, and collect feedback from them. Based on their feedback, challenge your assumptions about your previous design, and make changes.)</td>
</tr>
<tr>
<td><strong>5. Showing magic on the stage.</strong></td>
</tr>
<tr>
<td>(Marketing your design product and collecting more feedback.)</td>
</tr>
</tbody>
</table>
Additionally, the magic and paper prototyping helped students visualize their design ideas and improve their design confidence, as suggested by one student’s comment on the magic “transformer” paper phone trick used in class to facilitating the paper-prototype process:

“It really was an eye opening moment for me when you showed that, you know, a phone that can become long or wide because one of the thoughts I had is, 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 where that's an old idea now. And when I saw your idea, I was really kind 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. … It (paper-prototype) gave me more confidence, the confidence to continue into what I'm into my project here, whether that's beyond this class or just for the end of the semester. It's just gave me more confidence to continue to pursue what I'm doing. Because. So you're some crazy ideas, but you may think, oh, I have made, can be more crazy than sure. It basically gets rid of your fear trying to go outside the boundaries.”

Another student also commented similarly on the benefit of making a paper-prototype:

“As you actually prototyping it, you can actually, I do not know, I like being visually to see it. because everything is conceptual until, when we even we did our conceptual map, it is hard to put it together and see it in a full form, and also we get a sense of like accomplishment when we were doing that, you can see the prototype when you can see it like drawing out on cards like I feel like wow this is like a real thing.”

**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, reviewing the related literature regarding schema disruption, creativity and design thinking also enhanced this idea and encouraged them to collaborate and begin the exploratory design process.

The in-class exploration and students’ feedback played important roles in terms of identifying the potential design challenge and finding possible design solutions. As summarized in Table 5, the data collected helped identify the existing design problems of the intervention, which became the potential design challenge for the next iteration. On the other hand, analyzing students’ experiences and reactions can inspire 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 causes them to care about their audience. Those feedback kept motivating the design team to build connections with other ideas and embed them in our design.

<table>
<thead>
<tr>
<th>Design Elements</th>
<th>Initial Idea Formation</th>
<th>The Second Iteration</th>
<th>The Third Iteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Challenge</td>
<td>How to use magic to facilitate creative design?</td>
<td>The connection between magic and design remains unclear.</td>
<td>How to facilitate idea development process?</td>
</tr>
<tr>
<td>Idea Inspiration</td>
<td>-Literature</td>
<td>-Literature</td>
<td>-The Interview Data</td>
</tr>
<tr>
<td></td>
<td>-Personal magic performing experience</td>
<td>-Collaboration with instructor</td>
<td></td>
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<tr>
<td></td>
<td>-Design Experience</td>
<td>-Magic performing experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Design Experience</td>
<td></td>
</tr>
<tr>
<td>Solution</td>
<td>-Performing Magic in the class</td>
<td>-Reveal the secret and related principle</td>
<td>-Align Magic Creating Process with the design development process</td>
</tr>
<tr>
<td></td>
<td>-The POE Structure</td>
<td>-Provide students with opportunities to perform Magic</td>
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<tr>
<td></td>
<td></td>
<td>-Added Design Examples</td>
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</tr>
</tbody>
</table>

**TABLE 5. The Design Evolution**

**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 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 designed
fostered the students’ awareness of their thinking fixation and engaged them in the creative design process. 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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REFERENCES


