13 Fallacies: A Card Game to Promote Critical Thinking in At-risk College Students

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Abstract: Fostering undergraduates' critical thinking is a ubiquitous goal across disciplines (e.g. Gellin, 2003). How best to support the development of these skills has been a topic of debate. In this study, we investigated the design and effectiveness of a card-based game focused on student understanding of common fallacies. *13 Fallacies* **is designed with the intention to improve the quality of student reasoning by engaging them in exploration of common fallacies in thinking and associated social negotiation. There is strong theoretical support for** *13 Fallacies* **to yield positive learning outcomes. Using a design-based research approach, we have completed an iterative design** phase, play testing phase and have collected data on student learning outcomes as a result of classroom implementation of *13 Fallacies*. Results indicate that *13 Fallacies* improved student understanding of common fallacies in thinking.

Introduction

Fostering undergraduates' critical thinking and argumentative reasoning is a ubiquitous goal across disciplines (e.g. Gellin, 2003). It is important for students to understand errors in thinking and distinguish among opinion, reasoned judgments and fact (Halpern, 2003). How best to support the development of these skills, however, has been a topic of debate (e.g. Cavagnetto, 2010). Despite our natural tendencies to argue from a young age (Hay & Ross, 1982), there are many errors we commit in our daily thinking. Often, premises might be unacceptable, unrelated to conclusions or inconsistent (Kuhn, 1991). Moreover, experts that are cited may not be credible and important information might be missing from arguments. Recognizing the errors in our thinking can be a challenge since they often seem persuasive and resemble sound reasoning despite their unsound nature (Toulmin, Rieke & Janik, 1984). Whether committing these fallacies is intentional with the goal of persuasion or simply an oversight, it is important for undergraduate students to develop an understanding of them in order to defend against them while improving the quality of their critical thinking and the strength of the arguments they advance. In our information-rich world, distinguishing sound, credible reasoning is an imperative skill across both academic and civic domains.

Gaming as a way of learning and reviewing content has become an increasingly popular way to engage students. Many games go beyond domain knowledge (e.g. Squire & Jan, 2007) to focus on more general skill sets like argumentation that can be abstracted beyond specific domains. While digital games have become increasingly popular, card-based games have been found to bridge the digital divide (Bochennek, Wittekindt, Zimmermann & Klingebiel, 2007). Card-based games as pedagogy foster collaborative learning and essential 21st Century habits of mind (Reese & Wells, 2007). Considering broad critical thinking goals of higher education and game-based pedagogical approaches, we have designed and implemented a card-based game called *13 Fallacies*. This game is aimed at scaffolding students' recognition of fallacies in others' thinking and avoiding them in their own reasoning through social negotiation.

There are two hypotheses that have guided the design of *13 Fallacies*. The first hypothesis is that, through playing the game, students will develop a deeper, enduring understanding of common fallacies in thinking. This will include not only their ability to identify these fallacies in others' thinking, but also avoid them in their own reasoning in both formal learning environments and in their everyday lives. Second, playing *13 Fallacies* will improve students' argumentation skills and foster their development of well-reasoned, evidence-based arguments. We further hypothesize that these experiences will provide conditionally-admitted undergraduate students with general problem solving skills (Perkins & Salomon, 1989) that will, in turn, prepare them for future learning (Bransford & Schwartz, 1999) and success in other courses. In this paper we will focus on the investigation of our first hypothesis as guided by the following research question: Does engaging in *13 Fallacies* play promote students' understanding of common fallacies in thinking?

Theoretical Framework

As described in detail below, our research was conducted with conditionally-admitted undergraduate students at a Midwestern regional state campus. Aligned with this population, we have framed the development of *13 Falla-*

cies in Kuh's (2008) high impact practices, which have been shown to be beneficial for college students' learning outcomes, affect and overall development. These practices range from collaborative projects to service learning and have been found to increase retention and engagement. *13 Fallacies* connects to Kuh's high impact practices since it is a game-based learning approach designed to improve undergraduates' critical thinking skills while building a community of learners.

Our research is framed by the potential cognitive benefits of engaging in social game play (Gee, 2003). We are further guided by theories of argumentative reasoning (Toulmin, 1958). Toulmin, Rieke & Janik (1984) assert that the ability to recognize fallacies in thinking is an important component of reasoning and constructing sound arguments. Framed as "a kind of sensitivity training", Toulmin, Rieke & Janik define the distinction between recognizing errors in others' thinking as an important component of avoiding them in one's own thinking. Moreover, arguing to support explanations or theories is a social practice that involves communication and persuasion. Berland and Reiser (2009) recognize an epistemological distinction between the process of defending explanations and the process of creating them, two key but distinct components of sound reasoning (Kuhn, 2010). In *13 Fallacies* students are expected to both advance and defend the arguments they make about common fallacies. Through immersive engagement, students will be prepared for future learning (Bransford & Schwartz, 1999).

Data Source

The context of this research was an academic skills course for conditionally-admitted incoming freshmen college students at a Midwestern regional state campus. The course, U100, focuses on the development of essential academic and thinking skills aimed at preparing these students for future college courses and promoting retention. An essential component of this broad goal is to provide rigorous, relevant and relation-centered experiences for these students. Students enrolled in U100 are the University's most at risk population. They enter college with SAT scores as low as the mid-700's and possess minimal skills to navigate higher education.

Methodology

To conduct our research we used a design-based research approach (Brown, 1992; Collins, 1990). Using this approach allowed us to produce an instructional intervention and systematically examine resulting student learning in a classroom environment. We have separated iterations of design into two phases: *initial development* and *classroom implementation*. Initial development involved the design and play testing of *13 Fallacies*. The classroom implementation phase focused on the wide-scale introduction of the game that resulted from the initial development phase and its influence on student learning outcomes.

To evaluate the effectiveness of *13 Fallacies*, we administered isomorphic pre- and post-assessments. The assessments measured students' ability to identify the common fallacies covered in the game. *13 Fallacies* was played 10 times over the course of five weeks in the Fall semester of 2014. Each gameplay session lasted 30 minutes. Before the first session students completed a pre-assessment and a post-assessment was administered on the last day of the semester. 72 students consented to participate and successfully completed both the pre- and post-tests.

Description of *13 Fallacies*

13 Fallacies was designed to be played in groups of 4 to 6 students. The game is designed around a mechanic similar to that found in *Apples to Apples*, a popular word association card game. Figure 1 provides an illustration of *13 Fallacies*. In a turn of play, each player draws 5 fallacy cards that provide a definition and example of a specific common fallacy in thinking (e.g. card stacking, appeal to pity). One player serves as the judge, and this position rotates among all players to comprise a round of play. The player in the judge role flips a "scenario" card that provides a situation that contains at least three fallacies. The scenarios are framed as relevant civic instances that relate to the experience of undergraduate students at a regional state campus. For example:

> *There should not be an attendance policy for college classes. Students are either trusted to show up to class, or they are treated like grade school kids. Just look at all that college students have accomplished. Be a teacher who really cares about your students and drop the attendance policy.*

Figure 1. The card game *13 Fallacies*.

The game is organized into four phases, described in Table 1. Each player other than the judge plays a fallacy card and then justifies why theirs best describes the scenario. The player selected by the judge receives a point signifying the best response, and the player with the most points at the end of the game is the winner.

Phase	Description
Phase 1	*"This is what I'm thinking…"* (Judge's initial ruling)
Phase 2	*"Arguments"* (open discussion among players)
Phase 3	*"Final judgment"* (awarding of token to winner)
Phase 4	*"Justification"* (by the judge, to the whole group)

Table 1. Phases of play in 13 Fallacies.

Results and Discussion

Phase 1: Designing *13 Fallacies*

To design *13 Fallacies*, we began with a merger of academic goals, theories of learning, and game design mechanics (Schell, 2008). After developing a prototype, we play tested the game through three iterations. During each play test we collected field notes, then conducted follow-up discussions with participants which were groups of four to six students. After our first test, we identified areas that needed improvement. They included the number of cards each player would have in their hand, and a mechanism for students to confirm whether the judge's ruling was accurate for a specific scenario. As a result we modified the game's rules to include players having five cards rather than 12; we also provided a key for the instructors in order to check the accuracy of the judge's ruling. Evidence from field notes and player interviews supported these improvements. A new concern that arose was how to scaffold the social negotiation that occurs once all of the cards are played. After our second play test, we developed four phases of the game, described in Table 1. During a third play test we observed that both mechanism and approach were engaging students and we proceeded to produce the game for wide-scale implementation.

Phase 2: Classroom Implementation

Our quantitative analysis of student's pre and post-test data showed that student's ability to identify common fallacies improved after playing *13 Fallacies*. The average pre-test score was 28% (SD = 14.83). This suggests that students' initial knowledge of common fallacies prior to gameplay was limited. The post-test score average was 70.25% (SD = 12.75). The average individual gain between pre- and post-test was 36.92% (SD = 16.08). The gain in student scores was statistically significant, $t(71) = 19.509,\ p<.001$, which indicates that *13 Fallacies* helped students learn to identify common fallacies in thinking.

Anecdotal analyses of student writing following the post-test indicated that students were able to not only identify common fallacies in others' thinking, but to provide written justifications of their reasoning. This is illustrated by the examples in Table 2.

Statement	Identification and Justification
When Max's teacher asked why he was late for class, Max responded, "Did you get my journal graded? You didn't have it for me last class."	This is the red herring fallacy because Max changes the subject in order to direct the teacher's attention away from her original point that he was late.
When I was young, I rode a horse and it ran me into a fence. I will never ride a horse again.	This is a hasty generalization. The person is saying that because an accident happened one time, that means it will happen every time they ride a horse (which is probably not the case).

Table 2. Student justifications of fallacy identifications.

Conclusions and Scholarly Significance

This research contributes to a larger discussion on how to promote undergraduates' critical thinking and argumentation skills by focusing on learning about common fallacies. Through adopting a 'lightly-contextualized' approach, students are provided with an opportunity to actively engage with their peers while analyzing their own and others' thinking as a means to develop habits of mind necessary for academic success in higher education. Further, since our research targeted conditionally-admitted undergraduate students, our goal was to provide a scaffold for the skills of productive argumentation that are often nuanced or bound to explicit contexts, hidden in a way that prevents abstraction and transfer to new domains (Perkins & Salomon, 1989). Through playing *13 Fallacies*, we make explicit the common errors in thinking and provide an opportunity that promises to promote enduring understanding, prepare students for future learning, and create a more equitable learning experience for students who might have limited development and prior knowledge of these skills. Moreover, *13 Fallacies* has the potential to be adapted to the context of other courses as a way to not only promote students' critical thinking and argumentation skills, but to also deepen their understanding of domain-specific course content. Additionally, this study contributes to our "cognitive roadmap" (Kuhn, 2005) of the types of skills needed to improve students' critical thinking, and connects to Kuh's (2008) high impact practices aimed at providing engaging learning experiences for undergraduate students.

While results of initial analyses indicate statistically significant learning gains, there is still room for improvement. For our next iteration of play we plan to integrate multimedia scenarios into *13 Fallacies*. Players would view the scenarios on a mobile device during game play. We hypothesize that blending multimedia with face-to-face gameplay will promote student engagement and result in a more robust, enduring understanding of the common fallacies covered in our curriculum.

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