FORM FOLLOWS FUN

INTEGRATING PLAY AND GAMES IN DESIGN CLASSROOMS TO FOSTER INCLUSIVE EXPERIMENTATION & COLLABORATION

DANA RAGOUZEOS / KOHAR SCOTT
SAN JOSÉ STATE UNIVERSITY

PAPER ABSTRACT: The integration of semi-structured games and play into design education prepares students for future success by giving them a chance to feel experimentation, curiosity, and failure in a low-risk environment, experience collaborative decision-making within clear constraints, and build cognitive recall and creative resilience. This is especially true with diverse student populations, where many students are under-represented in their chosen design field or lack a financial or social safety net, and for whom the popular advice to "embrace failure" feels dissonant. This case study describes the use of play and games in the design class setting as high-intensity active learning activities that go beyond surface-level "gamification" and supporting community, confidence, and comradery. Examples include the use of gameplay to teach manufacturing processes, design research methods, and design concept refinement.

Keywords: Design education pedagogy, gamification, inclusivity, collaboration, experimentation, Motivational design

1. INTRODUCTION

Experimentation, learning through doing, and learning from failure are key tenets of design practice and design education. Providing opportunities for students to truly understand how to apply experimentation and learn through failure as professionals is a critical task for postsecondary design educators. There is no substitute for hands-on, experiential learning for design students, which also provides more inclusivity for students of different learning styles, exposure to design practices, and levels of representation in design fields. Studies show that while students start out with the same interest in STEM, attrition for under-represented minorities (URM) and low-income students is attributed to achievement gaps that might be prevented through in-class high-impact active learning activities, alternative assessments, and gameful-play (Theobald et al., 2020).

This case study outlines the inspiration, context, structure, and preliminary results of integrating game-play into postsecondary design education. It presents a roadmap for further experimentation and research on this topic by design educators and their students, in hopes of bolstering game-play as a means for creating more inclusive design education.

The inspiration for this work came from three places:

1. The drive to facilitate experiential learning in the classroom setting to prepare students for transition to professional work with as much tangible experience as possible.
2. The desire to engage diverse student populations inclusively, with learning activities in the classroom that provide participation opportunities for those less consistently vocal during class discussions, crits, and activities.
3. The need to provide more inclusive alternative assessment methods to prepare students for exams with lower-stakes and leveraging high-intensity study in the classroom.

This article's authors teach Industrial, Graphic, and Interaction design studios in public universities where the majority of their students are historically underserved. Underserved can mean any and all of the following according to the equity portal of the California State University (CSU): first generation in their families to attend college, people of color, and Pell grant recipients. According to a CSU equity report, students from historically underserved backgrounds often face greater obstacles and have fewer resources to ensure academic success than their overrepresented counterparts (Course Equity Portal, n.d., retrieved April 09, 2023).

In this case study, gameful-play or gamification is defined as "the use of game design elements in non-game contexts", proposed by Deterding et al. (2011, p.10), to attract attention, modifying behavior, or solving problems (Kapp 2012; Seaborn and Fels 2015; Werbach and Hunter 2012; Yildrim 2017)." (Murillo-Zamorano et al., 2021). In the context of the design classroom, this gameful-play or gamification was used to create in-class, collaborative gaming geared toward learning outcomes. In the cases outlined here, these learning outcomes include:

- Understand manufacturing processes and their contextual application
- Recall specific terminology used in industry
- Apply design research methods and mindsets in unpredictable real-life settings
- Determine which UX Design method or tool is appropriate for specific parts of the design process
- Understand how to apply complex design theories in real life scenarios

The experiences outlined in this case study show how utilizing game play borrowed from well-known childhood games allows teachers to set the tone of low-risk experimentation in their classroom. It also allows teachers to gauge student progress and comprehension in real time, before more traditional evaluation practices such as exams, essays, presentations or crits, which have a delayed time frame from instruction to production. Game play also provides more opportunities for public, collaborative experimentation and trial and error that does not bear the evaluative weight of a formal presentation or critique.

2. LITERATURE REVIEW: PLAY, ACTIVE LEARNING, AND CLOSING ACHIEVEMENT GAPS

Design is missing truly diverse perspectives when less than 5% of designers are Black. The disproportion starts at the undergraduate level with only 10% of Black students enrolled in design schools (Segran, 2022). Inclusivity in the classroom ultimately benefits industry by providing diversity in the workforce when graduates from underrepresented populations are supported (Segran, 2022).

The practice of inclusive design for diverse learners is important to ensure a more resilient future, is further supported and discussed by Watkins et al, in their article titled, *Inclusive Design for Learning: Creating Flexible and Adaptable Content with Learners* (Watkins et al., 2020).

In their article, *Scaffolding for Failure Helping Students Navigate Engineering Design Failure,* Lottero-Perdue and Parry explain the importance of discussing the language we use to define success and failure in the learning environment). They describe how defining words around failure and success can cultivate a growth mindset and benefit students beyond their academic studies into everyday life (Lottero-Perdue & Parry, 2019).

Active learning as a significant way of reducing achievement gaps and creating more inclusive classrooms is discussed in the article by Theobald et al, *Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math*. The value of active versus passive learning is further confirmed through several studies on achievement gaps in STEM fields. Gameful-active learning activities could be a valuable way to further decrease equity gaps, increase class participation, and better prepare students for careers upon graduation (Theobald et al., 2020). Although at the end of the study URM+low-income student groups still scored lower than non-URM+low-income student groups, the achievement gap was reduced by 33% and passing rate increased by 45% by implementing active learning instruction in the STEM classrooms (Theobald et al., 2020).

Gameful-play was noted as generating higher extrinsic and intrinsic motivation which in turn resulted in student satisfaction and eventually translated into higher skills and competencies according to Murillo-Zamorano in their article titled, *Gamification and active learning in higher education: is it possible to match digital society, academia and students' interests?* (Murillo-Zamorano et al., 2021).

3. METHODS AND PROCESSES: SEE, PLAY, DO

The process of designing and facilitating game play as a design learning activity takes different forms depending on the topic, learning objectives, and students' skill levels. No matter the content and skill level, the process fairly consistently follows these steps:

Step	What	How	Why
1	**Define the <u>learning goals,</u> similar to determining the Core Dynamics of a game (Brathwaite, 2009, p.6-9).**	Similar to drafting learning objective for a syllabus or lesson plan, articulate the level of proficiency students need to achieve (Dirksen, 2015, p.69-73).	Students need to feel that this activity is going somewhere, and that there's a relevant point in order to engage and commit to it.
2	**Find inspiration from an <u>existing game</u> with**	Ask your students what games they like to play or are familiar with. The authors have found success with games-play inspired by	The more time spent on instruction, the less interest students will bring to the activity.

	relatively wide cultural recognition for students	Pictionary, Charades, Apples to Apples, Dungeons & Dragons, Uno, and Jeopardy.	
3	**Adapt the Mechanics of that game to group play on the topic in the classroom (Brathwaite, 2009, p.28-30).**	Break down the rules, progression of play, and player actions that make the game interesting and fun to play. Then brainstorm ways to integrate relevant content into that existing structure.	Existing games are successful for a reason. They were designed with intention to keep players' attention throughout and caring about the progression and outcomes.
4	**Front-load information gathering or instruction prior to game play so that everyone starts with equal information on the topic.**	Prior to game play, provide key information via lecture, readings, or other activities. Give students enough time to process the information at their own pace.	Recall of information and application of new skills benefits from some individual reflection time between input and output of information. (Dirksen, 2015, p.197-204)
5	**Introduce game play quickly and form groups quickly**	Provide written or illustrated instructions and, if groups are competing against each other, keep group size to 3-5 students	Multi-modal instruction increases accessibility and understanding of information (Watkins et al., 2020)
6	**Conduct a final reflection & Facilitate application of principles**	Ask students to reflect on key questions about the activity and it content. Ensure their next assignment or project includes application of skills/content covered.	Immediate reflection and application will help build their competency and recall.

Figure 1. The process of designing and facilitating game play as a design learning activity

3.1 EXAMPLE 1: MENTIMETER QUIZZES AS INCLUSIVE ALTERNATIVE ASSESSMENTS

Learning goals
The learning goals for this example were to:
- Recall vocabulary from course lectures, readings, and field trips
- Gain proficiency in clearly describing manufacturing processes and their application

Game inspiration
Mentimeter is an online web platform that allows for students to log into the game and actively participate in timed quiz questions to test their knowledge and comprehension of course topics. This game was selected because it provides a low-stakes, active learning activity to prepare students for higher-stakes course exams and to provide faculty with an alternative assessment of students' comprehension of course topics at regular intervals before moving on to other topics.

Instruction/Information gathering
A flipped classroom approach was taken in the instruction for the Materials and Manufacturing course. Course topics were organized in modules where lectures were posted ahead of time, along with readings, discussions, and quiz contribution questions on each topic. Each week students posted discussions of their top 3-5 take-aways or questions they wanted to discuss further from the reading, and then submitted three true/false or multiple-choice questions that would be pooled into the

Mentimeter quiz the following class period. The Mentimeter quiz was given after a brief lecture on a given topic of the week.

Game play
Students co-created the Mentimeter quiz through their diverse contributions to the question pool. The Mentimeter platform tracked points awarded for those who answered the correct answers in the shortest amount of time. A leaderboard tracked their scores throughout the competition and highlighted the winner of each round. Students were motivated to compete against each other to test their knowledge and excited about being able to post their winning results to their social media.

Reflection
While students enjoyed hearing their questions being read and the low-stakes, high-intensity active learning experiences to review course topics in class, the online platform was sometimes overly constraining in T/F or multiple-choice formats that were often awkwardly worded or confusing. Students sometimes understood the concepts but submitted the wrong answer because they didn't grasp the question clearly. These challenges reflect similar shortcomings of traditional academic exam assessments and provide students and faculty with a low-stakes way to clarify terminology they might later see on future exams and even industry.

Application
Clarifying confusion surrounding course topics and quiz wording during these activities provided an opportunity for the faculty to design more inclusive final exams with language that was co-created during Mentimeter quiz skirmishes and discussions. While course exam scores were consistent with dataset results mentioned by Theobald et al.'s 2020 article discussed previously, when the Mentimeter quiz format was used to prepare students for our Central Shop test required to use shop equipment, 100% of the students who participated passed their shop test compared to 84% of students who did not.

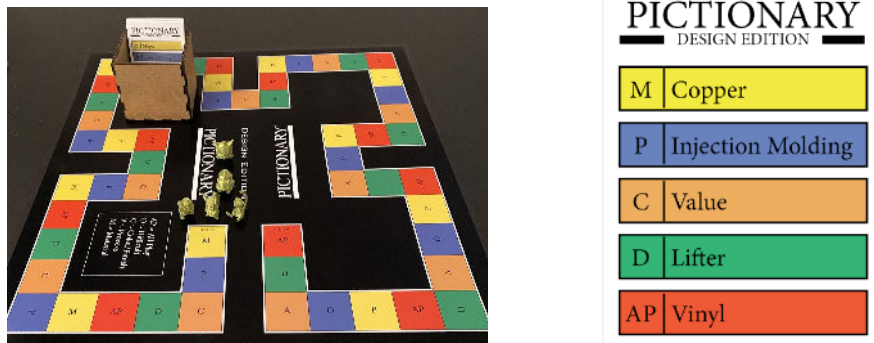3.2 EXAMPLE 2: PICTIONARY FOR MANUFACTURING PROCESS COMPREHENSION & RECALL

Figure 2. Left, Custom Pictionary 'Design Edition' board game for a Design Materials and Manufacturing class; Right, card example

Learning goals
The learning goals for this example were to:
- Recall industry vocabulary from course lectures, readings, and field trips

- Understand manufacturing processes and their contextual application

Game inspiration

Materials and manufacturing classes are traditionally taught passively through reading assignments, lectures, and exams to assess comprehension. Students who excel in these academic settings produce high academic scores. However, many underserved student populations struggle with these traditional classroom formats and lack resources to improve their academic success (Course Equity Portal, n.d., retrieved April 09, 2023).

Pictionary is a board game that involves players taking turns to draw their renditions of clues from cards for their teammates to guess correctly within a given time limit. Rapid visualization and communication are core skill sets in industrial design and are also critical to play successfully in Pictionary. This board game platform lent itself perfectly to combine drawing skills practice, and a more inclusive alternative assessment of industry vocabulary, and comprehension from readings, lectures, and field trips. Instead of relying on traditional assessment skills such as multiple choice, this assessment provides students with an opportunity to apply broader skill sets to exemplify their learning and comprehension.

Game play

The game was played with pawn pieces on a board that had a start and finish line. Teams were formed randomly to mix up student interactions. Dice were rolled each turn, and the pawn was advanced to a position on the board corresponding to the number on the dice. Each student had a turn to draw and for their teammates to guess the word on their card. The words on the cards were selected from topics of study throughout the term, so the game was played at Mid-term and/or before Finals. This high-intensity activity provides an opportunity for students to either recall the words from their studies, or it is an opportunity to clarify the clue with faculty, or they could 'Google it' (with a one-minute time limit). Either way, students were immersed in the topics of the course and whether they were guessing what one person was drawing, or whether they were the person drawing, they were reinforcing course content through playful discourse.

Students learned to work as a team and were motivated to do well to keep advancing on the board. They could see their progress on the board, which provided a visual tracking system for their efforts. There were minimal rules which kept the play continuous and active and the room became highly energized as the competition progressed. When students stumbled on topics, it provided the faculty with an opportunity to provide clarifying instruction and bridge comprehension gaps.

Figure 2. A student's illustration for 'progressive die-stamping' during an active learning game of custom Pictionary provided an elaborate classroom discussion clarifying the difference between regular die-stamping and the advantages of progressive die-stamping.

.

Reflection

Open conversations to clarify confusion on topics can be difficult to cultivate in a traditional classroom, but the levity of the interaction and shared vulnerability during the game seemed to allow students to voice their need for greater clarification on the topics.

Application

While this course is designed to be knowledge-building and not applied knowledge per se, the hope is that the recall and reinforcement of course topics will surface in future studio courses as applied knowledge. The culminating exam for the materials and manufacturing course included concepts discussed and drawn during the game.
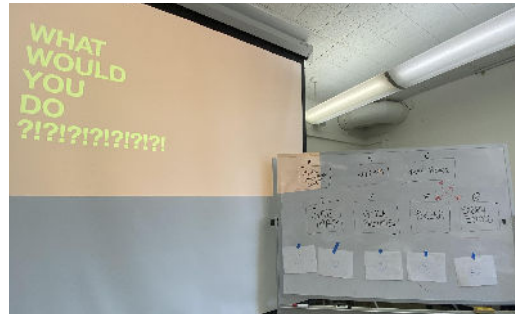

Figure 3. Slides and white board set up with scenarios and design tools for students to select as part of a game about navigating real-life UX Design challenges.

3.3 EXAMPLE 3: APPLES TO APPLES FOR DESIGN RESEARCH & UX DESIGN METHODS & MINDSETS

In this example, the author adapted elements of game mechanics from Apples to Apples and Dungeons and Dragons to lessons for Fourth-year Industrial and Interaction Design students to help them begin to apply lessons on Design Research and UX Design

Learning goals

The learning goals for this example were to:
- Understand how to apply primary design research methods
- Understand how and when to adjust and pivot one's approach based on changing research contexts
- Analyze when and how to choose and apply different design research and UX design tools and methods

Game inspiration

The instructor chose basic game mechanics of "Describe, Decide, Roll" from Dungeons and Dragons (Vox, 2018, 00:03:35) and the mechanics of proposing and ranking of ideas from Apples to Apples. The reasons for choosing these two games for inspiration was that, in both games, there is no clear right or wrong answer, and both games put players/students in the position of debating potential options based on contextual details. Just as in Design Research, and UX Design, there is not often a clear binary to choose between, and one's success in each practice often depends upon their own lessons learned from past project experience.

.

Instruction/Information gathering
Prior to in-class game play, students read short readings and received short lectures on topics such as conducting design research interviews, observations, and synthesis methods. When the topic was on UX design, they did short readings and received short lectures on methods and tools such as storyboarding, site mapping, wireframing, and storytelling. Time between instruction and game play varied from just 10 minutes to a week.

Game play
At the start of the game, instruction was given in under 5 minutes, and if students were not familiar with how to play Apples to Apples or Dungeons and Dragons, the instructor tasked their classmates to describe game play. Then, teams were created randomly through a variety of randomization methods, such as counting off. Once teams were formed, the instructor posed a scenario to the class by verbalizing it and writing it on the board, or projecting it on a slide. Examples of scenarios include:
- You're starting a project designing an app for recent college graduates to manage their money responsibly. Your boss says you have "little-to-no budget for research." How do you propose getting started?
- You're about to interview Sandra, a working mother in her forties, about how she manages her own wellness. How do you start the interview in a way that informs her about your project and makes her feel comfortable talking with you?
- You're working on a project on personal safety for college students, and you created detailed storyboards that you feel really showcase your concept, but no one seems to really get it. What might be some other tools that could help you get your point across.

Once the scenario is proposed, students have 0.5-1 minute to discuss as a team how they would respond to the scenario. They write down and share their proposal, and then the class debates which is the best and why for up-to 5 minutes before the next scenario is posed. The rapid time frame and the opportunity for lively debate is where the most laughter occurs, as students are forced to make quick decisions and not allowed time for perfection and over-thinking.

Reflection
After multiple rounds of game play, students reflect as a whole class on what they learned from the game, responding to specific prompts from the instructor, such as, what was your hardest decision, and why? What made this fun for you? What did you learn? What surprised you? What will you take into your next assignment or project?

Application
Games and scenarios are timed to occur immediately before the tools, mindsets, and methods covered are applied in their homework and project work. For example, a game about research scenarios and methods will play out right before students go out on their own to conduct interviews, and reflections from game play provide an additional touch point for post-interview in-class reflections.

4.   RESULTS: MORE PLAY, MORE PARTICIPATION
Analysis was conducted through a mix of observations by instructors, surveys, and qualitative feedback from students. The authors of this article observed a baseline average of 6 out of every 25 students

.

consistently and actively participating in class discussion and critique throughout their combined 27 semesters of teaching. When using game play in class, that average participation increased to 15 out of every 25 students. Their observations also covered student recall of information during classes after game play, where they observed students more able to recall detailed information about topics that were covered in class game play than what was covered in pure lecture.

In a 2023, anonymous survey of 26 of the authors' 4th-year interaction and industrial design students, 24 stated that they enjoyed playing the games in class. Twenty-two stated the games helped them learn complex concepts covered in class. When asked to rank, on a 5 point Likert scale, how effective the game play was in creating a more inclusive classroom environment, the average score was 4.2, where 1="not effective" and 5="highly effective".

Qualitative feedback from students, through anonymous surveys and qualitative interviews, included the following quotes:
5. "I like the activities because I got to talk to some people I never talked to before. It was helpful to revisit the terms and concepts we learned before and to improve my brainstorming skills."
6. I enjoy brainstorming through small game activities in class more than just the lecture itself. I had time to reflect more on different methods we should use in designing research which enhances my learning on the topics.
7. I like the activities we do in class, I feel like it helps students stay out of their comfort zone and create that comfortable environment by getting to know each other more.
Qualitative feedback from students also highlighted the student's satisfaction from getting to know each other better through game play in class. This was an unintended benefit, one worth exploring further as students still cope with the isolation and other consequences felt from being a student during the years of Covid-19.

5. CONCLUSION
The goal of this case study is to encourage design educators to integrate more game play into design education, in order to provide more inclusive, rapid, experiential learning and aid students in a successful transition to their professional lives. Design educators play a significant role in empowering historically underrepresented students to succeed in their chosen design professions. Enabling them to feel experimentation, failure, trial and error, and recall in low-risk game play is one way to build capacity, comfortability, community, and resilience. This is because games are intentionally structured to facilitate collaborative experimentation with specific learning outcomes in mind. Further exploration on this topic should include more qualitative and quantitative metrics gathering to better correlate classroom game play to student outcomes, more clearly compare and contrast game-play with other teaching models, and provide longitudinal data on the impact of game-play in the classroom on students' professional success.

6. REFERENCES

Babineau, K. (2018). *Closing the Gap: An Overview of the Literature on College Persistence and Underrepresented Populations.* In Cowen Institute. Cowen Institute. https://eric.ed.gov/?id=ED593497.

Brathwaite, Brenda. (2009). Challenges for Game Designers. Course Technology.

Course Equity Portal. (n.d.). Retrieved April 9, 2023, from https://course-equity-portal.dashboards.calstate.edu/public/home.

Dirksen, J. (2015). *Design for How People Learn (Voices That Matter)* (2nd Edition). New Riders.

Segran, Elizabeth. (2022, September 15). *Diversity in Design is working toward an industry filled with Black creatives*. Fast Company. https://www.fastcompany.com/90767913/diversity-in-design-is-working-toward-an-industry-filled-with-black-creatives.

Henry, M. A., Shorter, S., Charkoudian, L. K., Heemstra, J. M., Le, B., & Corwin, L. A. (2021). Quantifying fear of failure in STEM: Modifying and evaluating the Performance Failure Appraisal Inventory (PFAI) for use with STEM undergraduates. *International Journal of STEM Education*, *8*(1). https://doi.org/10.1186/s40594-021-00300-4.

Hung, A. C. Y. (2018). Gamification as Design Thinking. *International Journal of Teaching and Learning in Higher Education*, *30*(3), 549–559.

Hutson, J., Fulcher, B., & Weber, J. (2022). Gamification in Education: A Study of Design-Based Learning in Operationalizing a Game Studio for Serious Games. *Journal of Intelligent Learning Systems and Applications*, *14*(04), 115–131. https://doi.org/10.4236/jilsa.2022.144010.

Lottero-Perdue, P., & Parry, E. (2019). Methods & Strategies: Scaffolding for Failure Helping Students Navigate Engineering Design Failure. *Science and Children*, *56*(7), 86–89.

Murillo-Zamorano, L. R., López Sánchez, J. Á., Godoy-Caballero, A. L., & Bueno Muñoz, C. (2021). *Gamification and Active Learning in Higher Education: Is It Possible to Match Digital Society, Academia and Students' Interests? International Journal of Educational Technology in Higher Education, 18.* https://doi.org/10.1186/s41239-021-00249-y.

Practice Co-Design | The Inclusive Design Guide The Inclusive Design Guide. (n.d.). Retrieved March 31, 2023, from https://guide.inclusivedesign.ca/practices/practice-co-design/.

Saxena, N. (2020). Working "Failure" into your Learning Design. *The Emerging Learning Design Journal*, *7*(1). https://digitalcommons.montclair.edu/eldj/vol7/iss1/2.

Theobald, E. J., Hill, M. J., Tran, E., Agrawal, S., Arroyo, E. N., Behling, S., Chambwe, N., Cintrón, D. L., Cooper, J. D., Dunster, G., Grummer, J. A., Hennessey, K., Hsiao, J., Iranon, N., Jones, L., Jordt, H., Keller, M., Lacey, M. E., Littlefield, C. E., … Freeman, S. (2020). *Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and math.*

.

Proceedings of the National Academy of Sciences of the United States of America, 117(12), 6476–6483. https://doi.org/10.1073/pnas.1916903117.

[Vox]. (2018, June 24). Dungeons and Dragons, Explained [Video]. Youtube. https://www.youtube.com/watch?v=2PEt5RdNHNw.

Watkins, C., Treviranus, J., & Roberts, V. (2020). Inclusive Design for Learning: Creating   Flexible and Adaptable Content with Learners. Knowledge Series: A Topical Start-Up Guide to Distance Education Practice and Delivery. In *Commonwealth of Learning*. Commonwealth of Learning.