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I, Vrinda Trivedi, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

It is entitled:

Gamification Principles Applied in an Undergraduate Lecture Environment

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Gamification Principles Applied in an Undergraduate Lecture Environment

A thesis submitted to the Graduate School

of the University of Cincinnati in partial fulfillment

of the requirements for the degree of

Master of Design

in the Myron E. Ullman Jr. School of Design

College of Design, Architecture, Art and Planning by

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ABSTRACT

Traditional lecture models follow a heavily teacher-centric approach where professors talk for a lengthy duration of time and students only listen. This methodology is not as effective anymore. The current Generation Z have grown up with a dependence of technology, who have a distinctive learning style and manner of perceiving information. This is because K-12 education has evolved and is using a more interactive approach. Gamification has become popular in the education sector due to the conviction that it provides enhanced learning outcomes and builds motivation for students. This case study investigates gamification principles applied in an undergraduate lecture environment to increase learning retention, participation and enjoyment. There is an argument for the use of gamification teaching methods that transform traditional lecture structures from passive learning environments into active, engaging experiences. A user-centered design course offered at a large Midwestern university follows a traditional lecture format and, for the purpose of this study, gamification strategies were introduced and evaluated for their impact on

student engagement in the course. 150 students were part of the study and data was collected through surveys and group interviews. The results suggest that gamification is an essential part of improving the education system, especially in the lecture environment. It is important to create an environment where students are included in the teaching and learning process. However, since gamification is new and emerging, professors are still unclear on how to implement this system and need guidance. As much as gamification is about improving students' learning experience, it is important to consider the professor's perspective and knowledge of the theory since learning is a two-way communication. The professor should be provided with a gamification toolkit which has guidelines on how and when to effectively use gamified tools. The researcher has designed a toolkit which can be used by professors. More research is needed to provide a clearer picture of how and when engagement occurs in the gamified activities and if the engagement varies by subject matter, depth of students' previous knowledge, or other factors.

ACKNOWLEDGEMENTS

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CHAPTER 1. INTRODUCTION

Growing up with a dependence on smartphones, iPads, and laptops, Generation Z (Gen Z) students have a distinctive learning style and manner of perceiving information (Rothman, 2016), in part because of their K-12 education. According to Pew Research, Gen Z consists of people born after 1997 (Dimock, 2019). Many Gen Z students are currently in K-12, and some methodologies being adopted in K-12s include blended learning, a combination of online learning techniques and in person instruction (Lim et al., 2007); inverted classrooms, where " the learner's role goes from passive observer to active participant" (Lage et al., 2000, p. 32); and active classrooms, an approach where students are involved in the learning process (Yerigan, 2008). Further, when these students come to college, they often expect the same teaching methods they experienced in their K-12 education (Rothman, 2016), although this is frequently not what they encounter.

In many undergraduate classrooms across the United States, courses often follow a traditional lecture format that, to Gen Z students, may seem

outdated. Traditional lecture models follow a heavily teacher-centric approach where professors talk for a lengthy duration of time and students only listen. In contrast, a more student-centric approach, one in which students are more active within the learning process, allows for students to express their opinions and receive affirmation that their ideas have been heard (Barr & Tag, 1995). To be relevant for the education needs of Gen Z students, a college classroom lecture experience should ideally evolve to encompass methods that support students' active engagement in the course material.

1.1 Goal of the Research

Following from this researcher's previous work in K-12 contexts and her current role as a teaching assistant in an undergraduate design classroom in a large Midwestern university, the researcher developed a case study to explore the application of interactive learning activities within an undergraduate design class. Further, there is an argument for the use of gamification teaching methods that transform traditional lecture structures from passive learning environments into active, engaging experiences.

The overarching goal of this research is to explore how gamification principles can increase student's (i) learning retention (defined as students' ability to collect information and store it in their long term memory with the ability to retrieve the information readily, (ii) participation (exemplified when a student voluntarily and willingly engages and voices their opinion in the classroom), and (iii) enjoyment in learning (defined as when a student experiences "fun" during a class activity).

1.2 Research Problem

This case study emerges from the challenge of engaging undergraduate students' motivations for learning within a user-centered design course. This user-centered design course offered at a large Midwestern university follows a traditional lecture format and, for the purpose of this study, gamification strategies were introduced and evaluated for their impact on student engagement in the course. With this in mind, what gamification principles can be applied in the undergraduate lecture environment to increase student's learning retention, enjoyment, and participation?

1.3 Gamification in Education

According to Gartner, an active, engaged, and playful learning experience can be achieved through gamification (2014). Gamification applies “game elements in a non-game context” or involves a “phenomenon of creating gameful experiences” (Deterding, Dixon, Khaled, Nacke, 2011, p.7). Gartner argues that gamification is an emerging trend that is drawing attention because it can potentially increase user engagement and change behaviors (2014). For example, various studies have been conducted where a gamified educational platform consisting of points, leaderboard, badges has been adapted to classroom settings. The findings from these studies highly suggest that applying gamification is effective for student engagement (Geelan et al., 2015; Kuo & Chuang, 2016; Nevin et al., 2014).

As noted above, one reason that gamification has become so popular in the education sector is due to the conviction that it provides enhanced learning outcomes and builds motivation for students (Source?). Gamification in education can be as simple as giving a challenge to students during class time, providing them with continuous feedback on their

progress, and rewarding them for a successful outcome such as completing a project with all the necessary requirements. Within these challenges, students can see their progress in real time through the accumulation of points and visual progress tracking. For example, as students are working on a project, they are able to track their progress on an online platform and view their overview journey. They will also experience personalized learning, opportunities for peer to peer collaboration, more forms of interaction with course concepts, and a safe space to take risks and fail.

1.4 Drawbacks of Research

Of course, there are various drawbacks to implementing gamification and not all users benefit from it. Mayer and Johnson state that “entertainment features of games may distract the player from the academic content of the game and reduce the players’ efforts to process the material more deeply” (2010, p. 248). Although gamification is supposed to enhance user engagement and learning retention, there are a limited number of studies to support the real impact. Different game elements have different impacts on user engagement and participation levels. Each course needs its own

strategy to make sure gamification is effective for the students. Another issue is measurement; according to Taylor and Parsons' research, "education institutions measure the level of students' achievement not the levels of student engagement in learning" (2011, p.4). It can be challenging to measure student engagement. This research will only be investigating specific gamification principles (challenges, feedback, rewards) that aligned with the course objectives.

CHAPTER 2. LITERATURE REVIEW

As discussed above, Generation Z students rely on technology in their daily lives. This literature review focuses on several topics that illuminate the research.

2.1 Generation Z and Technology

Students are constantly interacting with technology, especially their cellphones (Gressick & Langston, 2017). In most college classes, students have access to their phones and laptops throughout the entire class time. This can make it easy to get distracted and use these devices. Prior research states that students are checking their personal devices for three different reasons: “boredom, checking for emergencies, and texting to resolve work conflicts” (Womack & McNamara, 2017). Usage of a smartphone is essential to many students’ lives, and these habits transform the classroom environment, as well. It is likely that many students use their phones constantly to feel socially connected and to reduce the anxiety and fear of missing out. A recent study on the relationship between smartphones

and undergraduate academic performance found that 57% of students multitask during class (Womack & McNamara, 2017, p.2). The study demonstrated that students have an obsession with using their phone for texting and social media purposes during class and imply that cellphone usage is a distraction which negatively corelates to the overall GPA for the semester.

2.2 Gamification in Education

In 2002, the term ‘gamification’ was coined by Nick Pelling. He defined gamification as “applying game-like accelerated user interface design to make electronic transactions both enjoyable and fast” (Ratten, 2019, p. 185). This trend increased in popularity in 2010 when companies such as SAP, Microsoft, and Deloitte decided to integrate aspects of games into their software. Ever since then, research educators have been looking at new pedagogies and tools to improve the quality of learning and student motivation. Gamification is slowly being adopted in the education field and has had an impact on student engagement. (e.g. Domínguez et al., 2013; Ibanez et al., 2014; Kim, 2013; Kuo & Chuang, 2016; O'Donovan,

Gain, & Marais,2013). For example, Ibanez et al. (2014) conducted a study in a C Programming course, where a gamified platform called Q Learning was built using game elements such as points, leaderboard, and badges. The data collected indicated that students were mostly motivated by points to engage and participate in the class activities. Leaning (2015) also performed an experiment in an undergraduate course in which it was concluded that students taking the gamified version of the course were actively engaged and put in more effort.

Research affirms the positive cognitive effects of game play (Gressick & Langston, 2017). For example, the way a game is designed can determine participants' motivation and perseverance—important attributes to encourage in the classroom. Through games, mistakes and failures can be minimized, thus creating a safe place for students to want to keep learning. In addition, a game design can create a context of encouragement by using incentivization such as badges and points to give the player a feeling of accomplishment (Flatla et al., 2011). In the context of a classroom, when players become immersed in a game, they tend to engage on a

deeper level and retain what they are learning better (Seaborn and Fels, 2015; Robson et al., 2015; Barata et al., 2013; Groh, 2012).

Professors are incorporating games into the curriculum not only to make the class more fun and interesting but also because games make the learning process more engaging. Games provide a reason for interaction, collaboration, and competition (Nerantzi & James, 2015) while encouraging students to be involved and participate in classes. Quinn and Iverson believe that students "need to be engaged more and to be put at the centre of the learning experience to change from 'passive vessel' to 'active participant'" (Pannesse & Carlesi, 2007, p. 438-439). Decades of research from *The National Survey of Student Engagement* indicates that student engagement depends on cognitive, emotional, and social factors, all of which are needed in order for students to perform well in large university lecture classes (Kuhet al., 2008).

Studies on gamification in universities have been conducted in computer science and game design courses (Dicheva et al., 2015) and these courses have used game elements to display visible progress of the

students through badges, points, levels, and leaderboards (Dicheva et al., 2015). Other elements such student engagement, freedom to fail, and continuous feedback were also tested. Most results of the studies suggest that the students gave positive feedback and that motivation, attendance, and participation did increase in the classroom. Some other studies received mixed responses about gamification, where students found gamification to be “complex and overly competitive” (Berkling & Thomas, 2013; Domínguez et al., 2013; Haaranen et al., 2014). Barata, Gama, Jorge, and Goncalves 2014, p.57) believe that students are drawn to different aspects of gamification such as points, leaderboard, and badges.

Huang and Dilip suggest that in order to enhance student engagement in the education field, the professor must set up an environment that implements gamification principles in an appropriate way. They came up with a five-step process on how to apply gamification in the classroom in the Figure 1 below.

Figure 1 – Five Step Process

Stanculescu et al, (2016) says that game mechanics such as leaderboards, badges, points, awards, avatars, and levels are tools that help users reach their desired goals. A leaderboard is a platform that displays names, ranks, and scores. Everyone can see their position on the leaderboard, and this encourages competition amongst users. Avatars are used to create a visual representation of the user and badges are awarded to users when they complete various activities. Points are recorded and tracked in the scoring system.

Game levels are created in a gamified system to build more achievements for the user. Levels can consist of points and badges, which are then converted into awards given towards end of a challenge in the gamification system. These gamified tools help build intrinsic motivation

and utilize game mechanisms to encourage people (Gressick & Langston, 2017).

Top Hat, a digital teaching platform, not only lets professors present the lecture material, but also provides opportunities for students to interact with the application. For example, during the lecture the professor can assign activities for the students in real time and the answers are displayed on a common smart board. The students receive points for participating in the event. This is a great example of using technology to encourage student interaction and participation.

2.3 Student Engagement

Student engagement is defined as “the time and effort students devote to activities that are empirically linked to desired outcomes of college and what institutions do to induce students to participate in these activities” (Kuh , 2009, p.683). Engagement is a complex paradigm wherein people can express themselves physically, emotionally, and cognitively.

Mark Gatenby, writing from the standpoint of business, believes engagement is a two-way street between the firm and the employee,

leading to the creation of an “engagement culture” (2008). An Employee Engagement Task Force was established in 2011, and it defined engagement as when the firm has to set up a good work atmosphere for the employees to grow freely, change, and reach their potential. Chris Argyris and Edgar Shein also developed a similar concept called a “Psychological Contract,” where the relationship between the employer and the employee is crucial (Kular et a., 2008). The model states engagement depends on two factors: the dedication of the employee and how they are treated by the employer. The two frameworks mentioned can also be applied in the education field. The environment a professor establishes for their students contributes to the engagement and commitment of the class.

In order for students to be engaged, interactivity in the classroom is another important factor. Interactive can be defined as “reciprocally active, acting upon or influencing each other, allowing two-way flow of information between a device and a user, responding to the users’ input” (Zimmerman, n.d., p. 158). Eric Zimmerman’s framework states that there are four modes of interactivity: cognitive, functional, explicit and meta interactivity.

Traditional Lecture	Gamified Lecture
Teacher Centric	Student Centric
Teacher presents lecture and students listen	Teacher presents lecture and students participate through online discussions, class discussions, activities and collaborative sessions
Homework>Exams>Grades	Challenges>Feedback>Rewards

Figure 2 – Traditional and Gamified Lectures

From the literature review we can see that the usage of technology every day is pervasive. Whether professors like it or not, students will be using their smart devices for their personal use; however, there will always be different forms of distractions in the classroom. Professors need to focus on what will motivate their students to learn, participate, and enjoy the class. Students also want to feel involved in the learning process. In order to address this issue, gamification principles can be introduced in the classroom. It has been proven that gamifying the class builds motivation and encourages students to be more involved in the learning process (Gressick & Langston, 2017). The purpose of the thesis is to understand

what gamification principles can bring in the context of an undergraduate lecture.

CHAPTER 3. THEORETICAL FRAMEWORK

But what gamification principles can be applied in the undergraduate lecture environment to increase student's learning retention, enjoyment, and participation? This question, and the research topic itself, are contextualized within Jerome Bruner's theory of constructivist learning. There are four aspects of constructivism that can be applied to students' education: "(1) predisposition towards learning, (2) the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner, (3) the most effective sequences in which to present material, and (4) the nature and pacing of rewards and punishments (Smith, 2002)." Bruner's theory revolves around the concept that students should be learning actively and should be ready to go beyond to gain new knowledge. The professor should follow a teaching approach that encourages students to explore and discover principles on their own. Students should feel motivated to do so, and the curriculum should let students continue building on their knowledge.

Active learning

A major part of constructivism is active learning. Active learning is a teaching strategy where students are involved in the learning process and are the center of attention. It emphasizes how students are learning and building on their skills more than what they are learning. The teachers challenge the students in the classroom, but it is the student's responsibility to understand their own role in their learning process. When active learning strategies are implemented, students will be more engaged, and participation will increase in the classroom. Silberman states that by practicing this process model, students are using their brains to solve problems and are implementing what they are learning (1998). This often leads to students collaborating and working together. The teacher plays the role of a facilitator in the classroom, which allows the “focus to shift from teaching to learning” (Silberman, 1998, p. 19).

Inverted model

The inverted classroom model can be defined as a classroom in which “events that have traditionally taken place inside the classroom now take

place outside the classroom and vice versa" (Lage et al., 2000, p. 32). This model allows student interactions to increase between the teacher as well as with their peers. In-class activities encouraged more collaboration amongst students and prompted them to participate and clarify any issues they were having. This method also gave students individual attention from teacher and has proven to help students understand the material covered in class. Teachers and students working through problems together is an effective approach to improve students' learning retention.

Blended Learning

Gamification techniques are not considered blended learning as traditionally defined, but gamification involves technology in ways that may relate to Gen Z's experiences in K-12 classrooms or technology use in their daily life. There is a need to redefine undergraduate lectures and break away from traditional pedagogies. The theory of gamification is important to test, as it will not only help students increase their learning retention but also will guide professors on how to teach the Gen Z.

To understand how gamification principles can be applied in the undergraduate lecture environment, a user-centered design class was used as a laboratory to implement diverse gamification approaches. This class was taught once a week for 2 hours and 50 minutes and followed a traditional lecture approach. This user-centered design class had 150 students and was a required elective for fashion and communication design students. The professor, D.J. Trishler, used an emerging digital platform called Top Hat to present the lecture. The course was about using design methodologies and philosophies by putting the user at the center of the design process. Students learned how to analyze and identify users' needs by anticipating their behavior.

The purpose of including gamification in this course was to see if, by providing the students with challenges, feedback and rewards would motivate them to learn, participate in, and enjoy the user-centered design class. This class in particular was selected as the study site because of the researcher's access to the population. The researcher was the teacher's assistant in fall 2018 and fall 2019, providing two sample populations and giving the researcher experience in assisting the teaching of the class. This

gave the researcher a unique perspective on the differences observed between the two semesters when gamification techniques were applied as compared to when they were not used. In both instances of teaching the course, the professor's goal was to make the class interesting for students and build on their engagement, but their techniques in achieving this goal differed between fall 2018 and 2019.

CHAPTER 4. METHODOLOGY

This is a mixed-methods case study of an undergraduate user-centered design course of 150 students taught between August 26 and December 2, 2019 at a design school in a university in the midwestern United States. Case study methodology was selected because it allowed for an in-depth exploration and understanding of students' learning retention, participation, and enjoyment by providing them with gamified tools. Within the case study, interview and survey methods were used to generate data regarding the students' experiences in the course.

Over the course of ten weeks, different gamified activities were conducted and explored with the students in the user-centered design class. The first three classes in fall 2019 followed a traditional lecture format, but as the semester continued various forms of gamified activities were introduced. Feedback from these activities was received through group interviews and online surveys, and class activities were altered based on the feedback. In the context of gamification, these activities were defined as

challenges for the students. Eight different gamified activities were conducted:

1. Digital Interactive Questions
2. Worksheets
3. Collaborative Group Discussions
4. Interactive Mapping
5. Card Sorting
6. Process Mapping
7. Think Aloud Protocol
8. Kahoot vs. Top Hat

CHAPTER 5. RESULTS

Data was collected on each activity through surveys and focus groups. Overall, the data demonstrates positive feedback from students in that the gamified activities were perceived as helpful. In Figure 3, one can see the correlation each of these activities to the gamification principles.

CHALLENGE	*Medium*	*Frequency*	FEEDBACK	REWARDS	*What did students gain?*	*Gamification sub principles*
TopHat Interactive Questions	Digital	Every class	Class Discussion	Points	Partipation Learning Retention	Interaction
Worksheet	Analog	Four	Students and Professor Interaction	Tool to help with Project (No points)	Enjoyment Learning Retention	Personalization, Interaction, Collaboration, Safe Space to Fail
Collaborative Group Discussion	Analog & Digital	Four	Students and Professor Interaction	Tool to help with Project (No points)	Enjoyment Learning Retention	Collaboration, Interaction, Failure
Interactive Mapping	Digital	Once	Students and Professor Interaction	Tool to help with Project (No points)	Participation Learning Retention	Interaction
Card Sorting	Analog	Once	Group Interaction	Tool to help with Project (No points)	Partipation	Collaboration, Interaction, Safe Space to Fail
Process Mapping	Digital	Five	Students and Professor Interaction	$25 gift cards	Enjoyment Learning Retention	Visual Progress Tracking, Safe Space to Fail
Think Outloud Protocol	Analog & Digital	Once	Class Discussion	Tool to help with Project (No points)	Learning Retention	Personalization, Interaction, Collaboration
Kahoot	Digital	Once	Class Exam	Class Competition (No points)	Enjoyment, Participation Learning Retention	Personalization, Interaction, Collaboration, Safe Space to Fail

Challenge:
Students are given different activities to do every class through analog and digital tools. This helps students work towards to their projects in class. These activities provide three different purposes: partipcation, learning retention and enjoyment in the classroom.

Feedback:
Class discussions, collaborative group session and online Tophate interactions are various feedback mechanisms relating to their project and general knowldge of research methodologies.

Rewards:
Students are given participation points, grades, gift cards and tools to help them reach their end goal of the projects.

Personalization:
A chance for students to add their own experience and learning, feeling like they are involved in the learning process.

Collaboration:
Students working in groups, encouraging team building skills, in order to understand problems and create solutions.

Interaction:
Students communicating through digital tools, analog tools or in person. Speaking, listening and presenting visually helps students develop their communication skills.

Safe Space for Students to Fail:
The gamified activties prompt to students to think critically, design creative solutions and discuss amogst themselves. It creates an environment for students to feel secure

Figure 3 – Data Collection of gamified activities

1. Top Hat Interactive Questions

To build higher learning outcomes and engagement in the course, online interactive questions were assigned to students through the platform Top Hat during the lecture. As questions were assigned to the students, they would open their smart device and enter answers during class. They would then be rewarded points for correct answers. This was a simple strategy that would build student's learning retention. This is an example of gamification, as students are being challenged to answer questions and receive a reward, such as points, towards their final grade. In turn, it encourages more interactivity between students and the material being taught in the classroom.

The interactive questions being asked through Top Hat during lectures did help reinforce what students were learning.

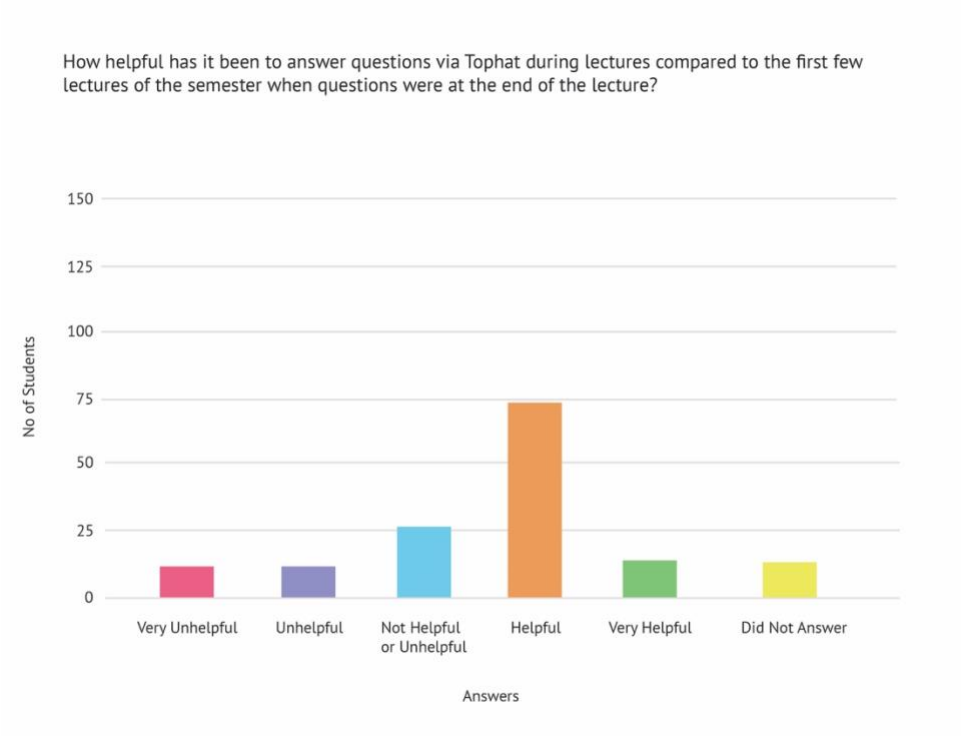

Figure 4 – Data Collection of Top Hat Interactive Questions

2. Worksheets

Throughout the semester, students were provided with in-class worksheets that would help them achieve specific goals for their projects. Four different set of worksheets were given to the students. These consisted of worksheets on Maslow's hierarchy, the frame your design challenge,

personas, and ideation selection. These worksheets handed out in class helped students understand the concept, personalize their experience, make it enjoyable, organize and track their thought process, and it also turned out to be a useful guide.

On the other hand, students said that the worksheets could have been done digitally and although they were helpful, they were not always necessary.

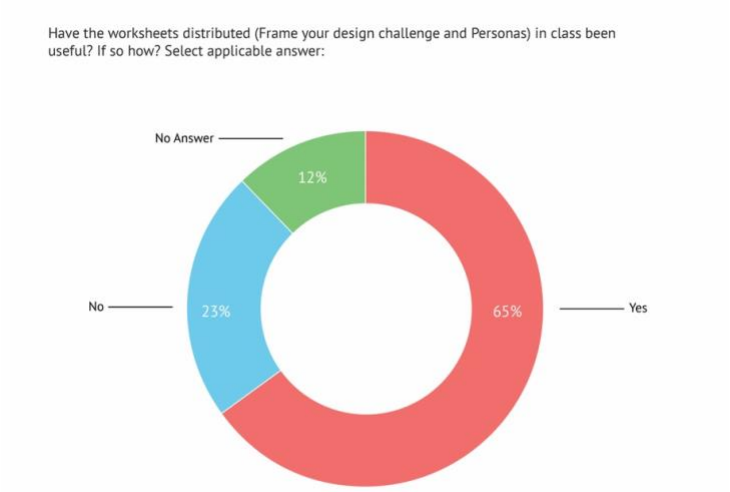

Figure 5 – Mid-Semester Data Collection of Worksheets

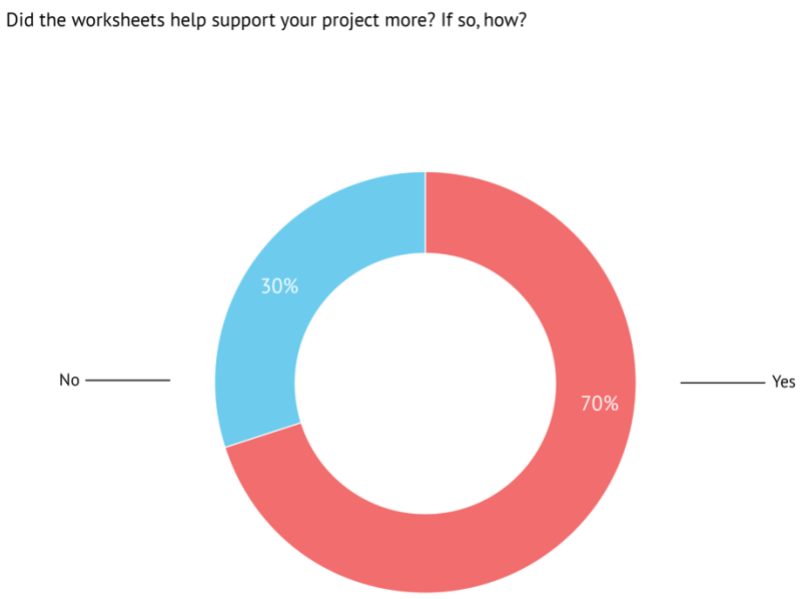

Figure 6 – Final Semester Data Collection of Worksheets

Quotes from students:

- “Yes, it helped us to better organize our thought process and to stay on track.”
- “Yes, they were helpful to have a tangible piece of process work.”

- “Yes, they were great resources to use and help guide our final projects.”
- “Not really, we mostly talked through and wrote our stuff on a shared doc, we didn't really need the paper.”

3. Group Discussions

Two of the projects were group based, and to encourage more collaboration among students and with the professor, the lecture was structured into a more interactive in-class group session. The professor divided the class into two different sections, and the professor and the researcher would talk to each group and answer any queries regarding the project. The students arrived for their chosen time slot with their groups and would use the class time to collaborate and work with their groups on the project. During this time, the professor and the graduate assistant would go to each group and answer any queries regarding the projects.

There is freedom to voice their opinion.

Being able to collaborate and break into groups was engaging and gave students time to review on what they learned in class and ask questions.

There are more opportunities to hear other students' perspectives and get to know them better. As a group, they effectively sort and divide tasks for the project. Students liked using in class time to work on the projects and thought it was an efficient way to use their time.

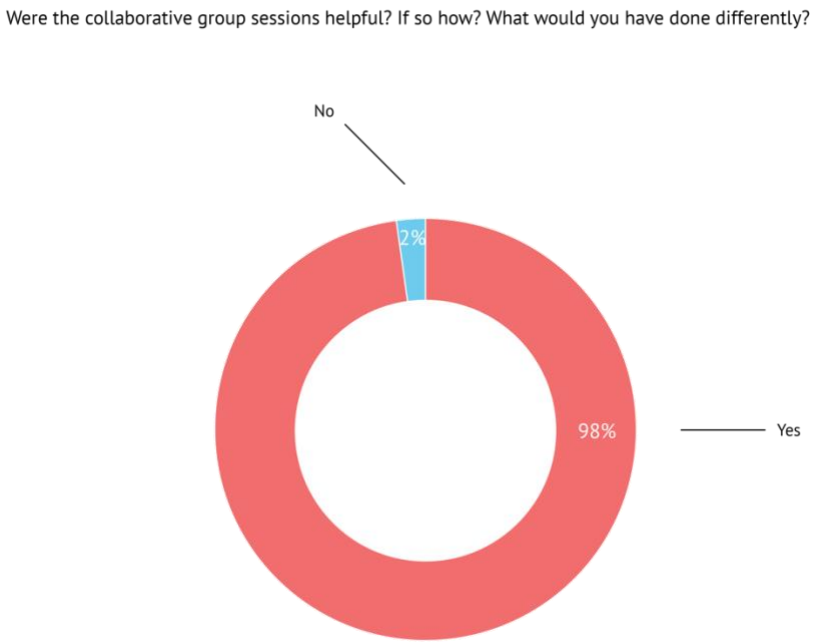

Figure 7 – Data Collection of Collaborative Group Discussion

Direct quotes from students:

- “Collaborative group sessions are helpful, especially because there are a few different majors in this class--in the real world we will be working in interdisciplinary teams and this was a good practice run. Working in a team is an essential skill, and in other classes we don't often get the opportunity to do so.”
- “Yes very helpful. It was nice to be able to bounce ideas off group members and receive feedback as well.”
- “Yes they were! That way we didn't have to use more time outside of class to catch up in our already busy schedules.
- “I think it helped me to understand better the assignments and what needed to be done. It also allowed me to talk to my peers and have a different perspective of ideas.”

4. **Interactive Mapping**

This was an online visual tool created for students to help them visually understand and identify the “problem scope” of their project. This is an example of gamification as it encourages more interactivity and a visualization for the students. Allowing students to “click” and identify on a

map where the problem or opportunity area was visible helped build more participation amongst students and encourage more group discussions.

5. **Card Sorting**

During the collaborative group session, students were provided with Post-it notes as a tool to organize and synthesize interviews and identify problem areas of the project. This activity helped provide structure to the student's work, enhanced interactivity and collaboration, and provided a safe space to fail among students. Learning comes from failure and it is important to create this kind of environment where students can achieve this. Students were coming up to the professor and the researcher in other class sessions and asking for more Post-it notes, even when this activity was not required. They were eager to keep using Post-it notes.

6. **Process Mapping**

Research indicates that students like to visually see their learning progress (Moss & Brookhart, 2009), and it helps build motivation for them. In the context of the course, a journey map was created for the students where every class they would "click" on which stage of the project they were on.

Every student had access to this map and was able to see others' progress as well. In all, there were five stages of the project, and to encourage competition amongst students two challenges were introduced:

1. Collecting the most surveys
2. Performing the most paper prototypes rounds

This was a group project consisting of three to five students in each group. The group that won the challenges received a $25 gift card to Roh's Street Café. These challenges were related to the final project, in which students were asked to apply the user-centered design methodologies and build and evaluate a paper prototype. The steps consisted of defining the problem, conducting user research, designing the paper prototype, evaluating the paper prototype, and finally sharing the results.

The journey map was viewed as a leaderboard where students were able to see each group's progress and this motivated them to keep going. It was a tool that encouraged conversation between students, the professor, and the researcher. The challenges were also a success, as they helped increase students' excitement for the project, their willingness to participate,

and increased their work towards completing the project. Students enjoyed having to build a prototype that they performed user research on, and tjos opened a new perspective into how the design process works. They understood the value of the feedback from surveys, and this encouraged them to implement it and made them be more creative with their prototypes. A small number of students mentioned that the challenges were not as exciting and did not motivate them, but they did provide a clearer idea about developing the paper prototype.

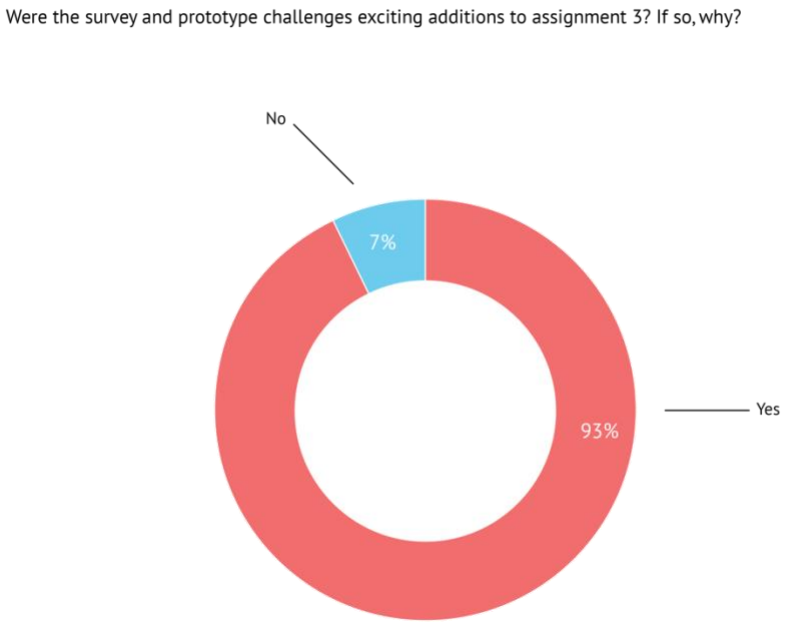

Figure – Data Collection of Collaborative Process Mapping

Direct quotes from students:

- “Yes, they are used in design process in the real world when I talked to professionals and they were surprised by how closely they were related to their design process.”

- “Yes, I think it was a good way to end the semester. It was very hands on and collaborative.”
- “Yes...this made us more willing to complete the assignments and made sure we set aside time to research ahead of time.”
- “Yes! It was fun to not only brainstorm an idea, but actually visualize it in a tangible fashion and see how it works.”
- “Yes. I enjoyed the research for assignment 3 and looking at the results for our survey. It definitely added to the experience in assignment 3.”
- “Yes, because they made the assignment feel more "real." We also received lots of great data from these challenges.”
- “They didn't really motivate my team in particular as we just wanted to get an adequate amount of responses to help us be as productive as possible, but maybe they could have helped motivate the less interested groups to have something to work for.”
- “They helped with the project itself when it came to researching and gathering information, but I wouldn't say they were super exciting to

do. They just gave insight as to how to get good researched information for the types of projects we were doing."

7. Think Aloud Protocol

The Think Aloud Protocol activity consisted of the professor and the researcher demonstrating "Screen Time" to the students on iPhones. The purpose was to show how the user (the professor), interacted with Screen Time when the interviewer (the researcher) was asking questions. This activity was presented in context to Project 3, where students had to collect data on how users would react to a paper prototype design.

Think Aloud activities helped the students understand the overall project goal and helped them realize how users could potentially react to a product. Through the surveys collected, before experiencing the Think Aloud activities, students underestimated the value of observing and talking to the user of a service or product. The spoken feedback provided during the Think Aloud protocol helped students grasp the concept of usability testing.

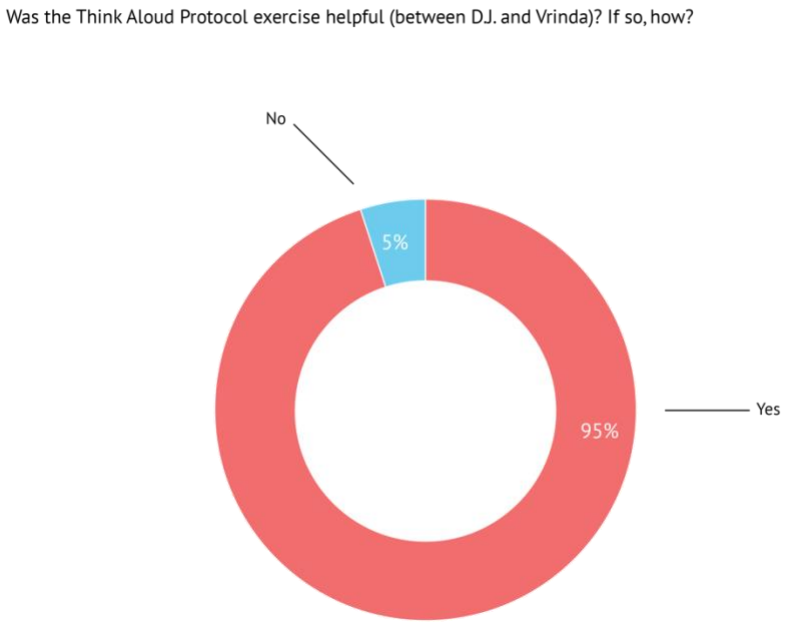

Figure 9 – Data Collection of Think Aloud Protocol

Direct quotes from students:

- “Yes, it helped me fully grasp the concept.”
- “I think this was a helpful exercise because it helps the whole TAP idea make more sense when using a prototype.”

- “I believe it was helpful because you saw how the user interacted with their product and what they were thinking and you could see the problems.”
- “Yes, showed us the right way to utilize something many of us already do (I like to think out loud) and that showed how to use it as a protocol.”
- “I didn't understand it in relation to the TAP definition at first but it made more sense when I was reviewing the presentations on my own.:
- “I think it was helpful to learn about, and would be good to use however we did not use it.”

8. **Kahoot vs Top Hat**

For the final exam, two exams were prepared on two different digital platforms: Kahoot and Top Hat. Top Hat is a digital platform used by professors to present interactive lectures in the classroom. It consists of tools such as taking attendance, asking questions in real time and provoking class discussions. Kahoot is a novel learning experience where you can host live competitions for students. First, the students split into teams and

logged onto the Kahoot platform on their smart devices. The Kahoot questions would be projected onto a screen in the lecture hall, and students would answer on their devices. Students were given 60 seconds per question. After every question was answered, a leaderboard would pop up showing where each team stands. With Top Hat, students individually answered each question on their smart devices.

Students preferred Kahoot compared to Top Hat as it encouraged healthy competition, collaboration, engaged the users instantly, and was a fun activity. Kahoot also adds a more interactive user interface compared to Top Hat. Students wished Kahoot was used more in their other classes, as adding game elements makes the class more engaging.

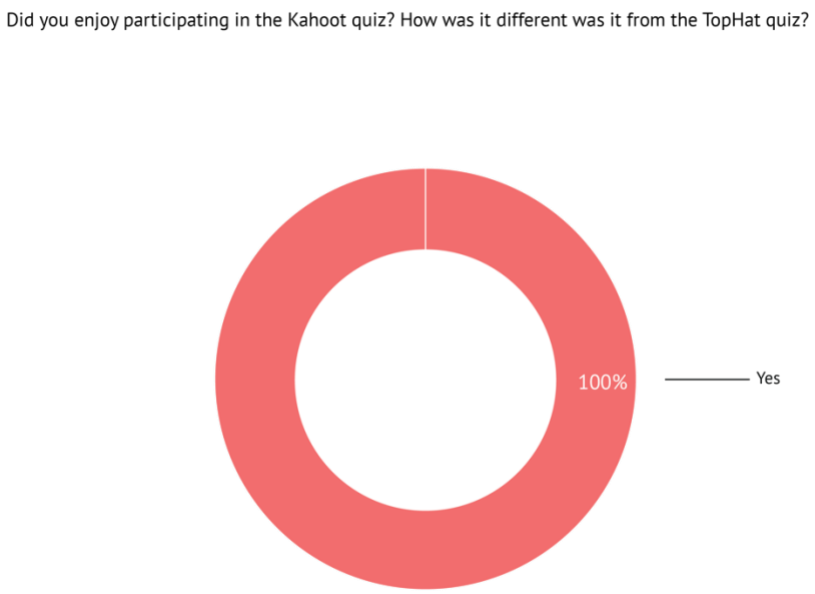

Figure 10 – Data Collection of Kahoot

Direct quotes from students:

- “Yes! Kahoot is way more fun/interactive and works better (with connection). Fun to see how people answer with Kahoot.”
- “Yes, it was awesome, it made me enjoy class more.”
- “Yes....it was more competitive and fun.”

- “Yes, it was so much more engaging than the top hat quizzes and enforces healthy competition.”
- “Kahoot was a lot of fun and it definitely helped review for the exam. It gave the class the ability to interact with each other and made the subject matter seem less academic than it would have been in a TopHat quiz.”
- “Yes, I like it because it made it more fun and easier to stay engaged.”
- “Yes, because there's some kind of interaction with other people. The competition aspect of it actually makes it entirely more fun than tophat questions.”
- “I really enjoyed the Kahoot quiz! We used it in high school and I found it to be really easy learn and retain the information at hand.”

CHAPTER 6. DISCUSSION

In the user-centered design class, the gamified tools tested by the researcher suggested that it was a more effective way to engage students. Based on the data collected, positive to mixed feedback was received from the students. It is important to create an environment where students are included in the teaching and learning process. They want to be involved and feel comfortable to voice their opinions in the classroom. It can be suggested that gamification is an essential part of improving the education system, especially in the lecture environment.

Applying gamification in an undergraduate lecture environment can be challenging and takes time to implement. The professor should be provided with a gamification toolkit which has guidelines on how and when to effectively use gamified tools. The researcher has designed a toolkit which can be used by professors. A toolkit could be simple as a card set with learning activities that could be integrated into the curriculum quickly and customized based on the course objects and learning outcomes.Since gamification is new and emerging, professors are still unclear on how to

implement this system and need guidance. As much as gamification is about improving students' learning experience, it is important to consider the professor's perspective and knowledge of the theory since learning is a two-way communication.

The activities studied in this research were created through a translation of the course's intended learning outcomes into practical and meaningful experiences that involved multiple modes of engagement. For example, interactive mapping was developed by adding a visualization of a park's map to help students identify opportunities to maximize accessibility in and around a local park. Although students had been to the park, it was not until they saw the park's visual layout in its totality in the classroom that they could comprehend the many different ways in which other students conceptualized accessibility. The resulting group-sourced ideas were diverse and creative, expanding students' scope of possible solutions for increasing accessibility in the park.

CHAPTER 7. CONCLUSION

After conducting this case study, it can be concluded that gamification is an effective approach to increase learning retention, participation, and enjoyment. Learning retention was achieved in various ways through the gamified activities such as Top Hat interactive questions, worksheets, the Think Aloud Protocol, and Kahoot. As the surveys and group interviews were conducted, students said that using these gamified activities helped reinforce what they were learning. Although the data collected suggests student engagement increased, more research is needed to provide a clearer picture of how and when engagement occurs in the gamified activities and if the engagement varies by subject matter, depth of students' previous knowledge, or other factors.

Participation can be measured by external factors such as studying the products students create and observing their interactions with peers.

Students expressed enjoyment from using Kahoot, doing

worksheets, and engaging in collaborative group discussion. However, enjoyment is subjective and is challenging to measure. More research is needed that incorporates students' self-assessment narratives about their experience of the activities.

For future research opportunities, exploring students' behavior and emotions would be helpful to further understand the students' experience in the classroom. It would also be helpful to look students coming from different socio-economic backgrounds and their exposure to the emerging teaching methodologies.

In this particular case study, gamified activities also supported the students' sense of community and teamwork. For example, when comparing the grades from fall 2018 and fall 2019, it was quite clear that the gamified tools, when implemented, helped to not only enhance the classroom experience but also show improvement in overall grades. Based on these results from the user-centered design course, the researcher will be applying this knowledge and will test the gamified tools in two other design lecture courses for spring 2020 at the same institution.

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APPENDIX A

IRB Forms on next page.

University of
CINCINNATI
Institutional Review Board
IRB Registration #: 00000180 FWA #: 000003152

EXEMPT DETERMINATION

October 8, 2019

Vrinda Trivedi
DAAP SOD Students
trivedvd@mail.uc.edu

Dear Vrinda Trivedi:

On 10/8/2019, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title:	Gamification in an undergraduate lecture classroom
Investigator:	Vrinda Trivedi
IRB ID:	2019-1069
Funding:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• Surveys and Interviews Procedure and Questions, Category: Data Collection Tools; • Vittoria Daiello CV, Category: Other; • Template Protocol SBR, Category: IRB Protocol; • Information Sheet, Category: Consent Form; • Recruitment Method, Category: Recruitment Materials;
Review Type:	Exempt
Review Category:	(1) Educational settings (2)(i) Tests, surveys, interviews, or observation (non-identifiable) (3)(i)(A) Benign behavioral interventions (non-identifiable)

On 10/8/2019 the IRB reviewed the above submission and determined that this protocol meets the criteria for exemption from IRB review in accordance with 45 CFR 46.104.

The IRB has determined the following consent requirements:

- The IRB has waived the requirement to obtain DOCUMENTATION of informed consent for all adult participants.

PI Notification
Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a new request to the IRB for a determination.

Note: The exemptions at 45 CFR 46.101(b) do not apply to research involving prisoners, fetuses, pregnant women, or human in vitro fertilization, Subparts B and C. The exemption at 45 CFR 46.101(b)(2), for research involving survey or interview procedures or observation of public behavior, does not apply to research with children, Subpart D, except for research involving observations of public behavior when the investigator(s) do not participate in the activities being observed.

Thank you for your cooperation during the review process.

APPENDIX B

User Centered Design Syllabus: Course Description

User Centered Design: This course provides an interdisciplinary overview of the design philosophies and processes placing the user at the center of design. The purpose is for students to learn how to analyze and anticipate user behaviors while also identifying their needs. Subjects covered include empathic design, participatory design universal/inclusive design, and human factors. Methods explored include user ethnographic and observational studies, task analysis, task and user scenarios, card sorting, paper prototyping, interviewing, surveys, and usability testing. This course, open to all students, is essential for School of Design students.

Prerequisite: DSGN 1070 Sources of Modern Design or by instructor permission.

Course Format is a growth oriented and active learning course that requires students recognizable participation. For this course, there are three sections.

Each section will meet once a week on Tuesdays (Sections 001, 002 + 003) for the duration of 2.5 hours, 6:00–8:50 pm.

Class sessions will involve *active learning* exercises, quizzes, exams, lectures, guest presentations, written assignments and student team projects.

Learning Objectives

- Sort, categorize, associate, and understand supplied data,
- Select appropriate user-based research methods relevant to different tasks,
- Plan and Conduct selected user-testing method appropriate to the specific problem,
- Demonstrate empathy with users through development of an apt user profile,
- Integrate user needs into design concepts, and
- Communicate findings in the form of design performance criteria

Other Learning Objectives:

- Define and recognize the design and the discipline's purpose. *What is design? What it is not.*
- Recognize design's social role, responsibilities and audience/user expectations.
- Understand and be able to apply UCD philosophy, methods and testing.
- Become familiar with UCD terminology and proper communication
- Recognize and demonstrate UCDs important ROI benefits
- Gain familiarity and knowledge of the various UCD testing methods and protocol: *Examples: task inventory, content audit, card sorting, participatory design, persona development, surveys, interviews, behavior observation, focus groups, comprehension testing, to name a few.*
- Uphold UCD professional responsibilities and basic tenets of ethical and professional conduct when designing for people. *When conducting user testing, designers are able to evaluate the risks and benefits of their actions on all stakeholders and ensure these actions meet highest ethical professional standards.*

Student Requirements

Attendance: Attendance in this class is mandatory. Attendance will be taken at the beginning of each class session or thereafter. For this course, the Top Hat application will be used serve as your instructor's record of attendance.

- Students absent for more than the equivalent of a week (3 classes if the class meets twice a week. **2 classes if the class meets once a week**) will have the final course grade lowered by one full letter grade (for example, a B+ grade would becomes a C+).
- Each additional absence will receive another full letter grade lowering (for example, C+ becomes a D+).
- Students absent for a scheduled assignment submission, quiz or exam will receive a failing grade for that assignment/event. Unless special arrangements have been made with your section instructor, no late work will be accepted. Approved quiz/exam make-ups will be given only up to 1 week after date of the missed quiz or exam.

Special Needs Policy: If you have any special needs related to your participation in this course, including visual impairment, hearing impairment, physical impairment, communication disorder, and/or kind of learning disability that may influence your performance in this course, it is important to meet with the instructor to arrange for reasonable provisions to ensure an equitable opportunity to meet all the requirements of this course. At the discretion of instructor, some accommodations may require prior approval by Disability Services.

Plagiarism

The UC Student Code of Conduct defines plagiarism as—

- Submitting another's published or unpublished work, in whole, in part, or in paraphrase, as one's own without fully and properly crediting the author with footnotes, citations or bibliographic reference.
- Submitting as one's own, original work, material obtained from an individual or agency without reference to the person or agency as the source of the material.

- Submitting as one's own, original work, material that has been produced through unacknowledged collaboration with others without release in writing from collaborators.

Penalties for Plagarism: See student Code of Conduct prodcedures.

Laptop + Technology Classroom Use Policy

Although having a laptop or smart device in class opens up new learning possibilities for students and instructors alike, sometimes their usage can also become inappropriate, irresponsible, distracting, and simply disrespectful, not only to the instructor, guest presenters, but your classmates. During the scheduled class period, your computer and other technical devices, whether the school's or personally owned, are to be used for that course's lectures, note taking, assignments and team activities when inside the classroom ONLY.

Acceptable Usage: includes taking notes, following along with the instructor on software demonstrations, whole class activities, working on assigned in-class exercises/projects, and discussions that do require laptop usage.

Inappropriate Usage: includes instant messaging, e-mailing, surfing the Internet, playing games, chatting, writing papers, doing homework (for other courses), etc. during class time. Also, do not display any material on computer screens that may distract or offend classmates and instructor. When classroom activities require sound, please use headphones and do so at an appropriate volume level.

Monitoring: : For the first or second inappropriate usage, instructor will politely request observance of the technology policy. Continued inappropriate usage thereafter will be noted and will lead to reducing your final course grade by at least 1/3 letter grade for each infraction. Use your laptop and smart devices appropriately and responsibly.

So, during our scheduled class session remember… please turn off cell/smart phones, instant messaging and use your laptop appropriately and responsibly.

Evaluation + Grading

Evaluation will be based on careful consideration of criteria and performance that includes:

- Critical Thinking
- Knowledge Integration
- Depth of Investigation
- Concept Development
- Visual Skill
- Manual + Technical Skills
- Effective communication
- Class + Team Participation
- Meeting Deadlines
- Professionalism

All evaluations will be assigned a letter grade between an A to an F. Please refer to University grading scale found at: http://www.uc.edu/registrar/faculty_resources/grading_scales.html

Incompletes (“I” grades): This type of grade is granted only by the instructor’s discretion, with a signed Request for Incomplete Grade form (available in the

College office). It will only be granted due to extreme or unforeseen circumstances (medical or family emergency, judicial obligation, etc.). Grade "I" will recorded as an "F" after a year, unless the grade is changed by the instructor (with successful completion of uncompleted assignment within a time given by the instructor).

Top Hat Application

Top Hat is required for this course.

Please purchase a subscription and join the course before class on August 27.

Sign up at: https://tophat.com/sign-up/

The join code is **750815**

Class Topics

- **Defining Design + User-Centered Design** (UCD)
    - Determining Good Design/Designer

- What is Usability?
- Where Does it Fit In the process?
- What is Utility?
- Iterative Process + UCD Testing
- UCD is about People—not designers

- **History Overview**
  - Ancient Greece
  - Vitruvius
  - Industrial Revolution
  - World Wars I + II: The Military Impact
  - German Werkbund
  - Gestalt Psychology
  - Moholy-Nagy + Bauhaus
  - Henry Dreyfus
  - Victor Papanek
  - Abraham Maslow: Hierarchy of Needs
  - Donald Norman
  - Jesse James Garret

- Alan Cooper
- ISO 9 2 4 1
- The Internet (www)
- 1984 Macintosh
- UX (User Experience)

- **Discovering People, Context, + Appropriate User Testing**
  - Understanding Users (People)
  - Cognitive Psychology
  - Information Design + Understanding
  - Instructional Design
  - Ethnography + Design Anthropology
  - Empathic Design
  - Personas (People Reminder)
  - Participatory Design
  - Storytelling
  - Heuristic Evaluation
  - UCD in Typography
  - Site Visitations

- Focus Groups
- Card Sorting
- Surveys + Questionnaires
- Comprehension Testing (Symbols + Graphic Systems)
- Task Analysis
- Eye Tracking
- Paper Prototyping
- Data Analysis
- Reporting Results
- UCD methods in the Classroom

Note: Students may find differences between the University catalogue description of this course and specific content presented by the instructor. Courses change as classroom experiences are gained and technology improves. Therefore, it is possible that actual content covered may be found to be modified from the course description and learning objectives listed.

APPENDIX C

Interview with Professor DJ Trishler.

How has this semester been different from the previous semesters you've taught? (this can include observations, grading, teaching methodologies)

- Typically, my energy decreases as the semester progresses. This year, my energy increased with each class.

- One of the biggest differences was interjecting quiz questions and discussions throughout the lecture to keep. I hadn't done that in the past because I was afraid the wifi bandwidth might be an issue. There were no issues though and I wish I had been doing it all along. I think this also helped keep students from watching Netflix or working on other things during class. They never knew when there would be a question on Top Hat to be ready for.

- We gave away incentives to during the third project by rewarding the teams with the best prototypes and most survey results. I think that engaged the students more in the assignment. My sense is that they didn't put off the work as much as prior classes because there were micro deadlines (with rewards) along the way. I've heard that in other classes too, where students want little milestones to reach rather than one big one at the end of the semester.

- I think the Code of Ethics was an interesting addition to the class. While I haven't read them all yet, I think that extra credit assignment, along with the content in class, caused the students to think of the greater implications of their work.

- We handed out worksheets to help the students kickstart their projects. There's so much open source content out there for the design process. I'm glad we at the very least showed the students that the information is out there if they want it, whether they used

the sheets, or not.

- I enjoyed demonstrating the Think Aloud exercise in front of the students. In hindsight, I would have done more of these types of exercises.

- Kahoot was totally new to me and I loved using it in class. My only regret is not learning about it sooner.

What was the impact of the class?

- Hard to say now. I always enjoy hearing students say that the class makes them think differently about design. One fashion designer said that they never thought of themselves as problem solvers until the class. That's pretty great. I also like reading the code of ethics that some of the students have written and I hope that they go back to them throughout their careers. Ultimately the impact of the class like this is long-term in that regard. How will they take what they've

learned and put it into practice?

What would you have liked to do more?

- More Kahoot, for sure! (less Tophat).

- More demonstrations.

- Guest speakers, especially from Fashion to meet the FD students' needs.

- More incentives (like the Rohs gift cards) in previous assignments.

- More worksheets.

- More discussion in class (it was fun to have ad hoc discussion during the final recap of the class). I'd also like to break the students up into smaller groups for discussion as well. That way

they can learn from each other's perspectives and then share back with the rest of the class.

What did you learn from this course?

- Tophat should go away. Forever.

- I still think lectures are not a great model for teaching, but there are ways to make it work.

- I like consuming content and therefore expect everybody else to do the same. That's unrealistic with gen z. They want to be content creators, I think. That means it's important for me to talk less and let the students talk more. They need an introduction to the content and then a chance to interact with it in their own unique ways. I think in that regard, I'd try to create many more micro assignments and perhaps get rid of grading (with the exception of the bigger assignments). Micro assignments could include using platforms like Tik Tok and Instagram for surveying and "getting close to the

users." Another thing they could do is make short, improvised, movies about what they just learned and share it with the rest of the class. Likewise, with so many students in the class, they could all partner with someone and practice interviewing skills and share what they learned on an Instagram story or short-medium post. This all probably falls under the question above, but it's also something I'm learning.