

The Forms and Uses of Undergraduate Student Game Design Logs

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Design logs provide a way for designers to articulate their goals, track their progress, and record decisions. College students in an introductory game design course were assigned to keep design logs during a multi-week, community-engaged tabletop game design project. The research team analyzed the students' design logs and the designer's statements of their final projects in order to understand how students engaged with these writing practices and what impact these had on their work. The design logs varied significantly from each other and from the recommendations. The form of the logs can be described along three dimensions: multimodality, composition style, and document structure. We identified seven categories of use, only four of which came from the provided recommendations. Despite their idiosyncrasies, the logs and reflections demonstrate that students learned to follow a rigorous, iterative design process.

Introduction

One of the challenges of game design is keeping track of design decisions and direction. Approaches include comprehensive “design bibles,” team wikis, and one-page design documents. The size of the team and scope of the project are contributing factors in choosing the best approach. Having design documentation can improve communication across team members, reduce confusion by recording decisions and their rationale, and prevent wasting time and resources on re-work. Students of game design likewise need to learn to record their activity and their progress, especially once they start working on larger team projects.

To this end, we introduced our students in an introductory game design course to Dan Cook's game design log format (Cook, 2011). In his blog post, Cook describes design logs as a tool for recording decisions and building shared vision. He recommends keeping the design log as a shared document on Google Drive so that the document can grow and the whole team can access it. The first entry in the log is to be a description of the game concept. Then, for each successive prototype, new entries are added at the top of the log; these describe the evaluation of the prototype, notes from playtesting, next steps, and so on. By keeping the document in reverse-chronological order, the newest entry—describing the latest decisions—is always on top. Cook provides an example in his article, and he also acknowledges that the format is flexible: a different format could work as long as it can answer the question, “How do we improve the current game?”

Design Logs were integrated into a sophomore-level course, “Introduction to Game Design,” offered through the Computer Science Department at Ball State University in Fall 2021. The course's only prerequisite is the university's required freshman-level research composition course. Most of the coursework deals with analog games such as card

games, board games, and role-playing games. The following learning objectives are specified by the departmental syllabus.

1. Identify and evaluate the impact of the following on game design: formal and dramatic elements; mechanics and dynamics; positive and negative feedback loops.
2. Design an original game following an iterative approach using high- and low-fidelity prototyping.
3. Formally playtest a game, including documenting and presenting the results.

Although the course is open to all majors, the students were primarily Computer Science majors, for whom the course counted as a directed elective. In Fall 2021, eleven students successfully completed the course, meaning that they submitted at least one required component of the final project; ten of these were Computer Science majors and one was an English major.

The course grading scheme evaluated students according to their participation in the process. For example, students received course participation points for giving and commenting on presentations. This kind of labor-based grading, where students are graded based on whether they kept their time commitments rather than outputs (Inoue, 2019), was designed to encourage creative risk-taking. Students could focus on learning the process of game design without the expectation that their results be excellent.

The semester was split into two units. In the first half of the semester, students learned fundamental theories of game design. The primary reference material was Schreiber (2009), with supplemental material drawn from Burgun (2015), Bateman and Boon (2005), Koster (2012),

and Klopfer et al. (2009), as well as optional supplemental readings. The second half of the semester was devoted to a final project. During the first week of the final project, students pitched two different game design ideas. Each pitch included a formal presentation as well as a game concept document in the format recommended by Ryan (1999). After receiving feedback from the instructor and their peers, each student committed to one of the designs (theirs or a classmate's) to pursue for the remaining weeks of the semester. The seven subsequent weeks were spent in active development, during which time each student was to maintain a design log. The final week of the semester was used for final presentations and delivery. Interested readers are welcome to review the entire course plan, which is available online under a Creative Commons Attribution Share-Alike license at <https://www.cs.bsu.edu/~pvgestwicki/courses/cs215Fa21>.

This course represented community-engaged scholarship with Minnetrista, a museum and cultural center nearby campus in Muncie, Indiana. Minnetrista is "the home of the Ball jar," the location where the Ball family lived, operated their business, and developed their food preservation recipes. The museum served as the community partner and content expert for the class, and their staff visited the class several times during the semester. A visit early in the semester helped students understand the museum and the collaboration. Museum staff also provided feedback on project pitches and served as the primary audience for students' final presentations. Students were also given access to the museum's Institutional Interpretive Framework, a ten-page, internal document that explains the mission, vision, and values of the organization. This framework also explains the museum's themes, their philosophy of visitor experience, and specific details about core and supporting stories. The students' final project was to create an original game based on one of the museum's stories. Many students were attracted to the theme of food preservation, while others explored entrepreneurship, farming, the history of the Ball family, and Bob Ross, whose original Muncie studio for *Joy of Painting* is now part of the museum.

Students were given Cook's blog post as their primary guidance for how to write design logs. As per his advice, the logs were kept in Google Docs. Each student had their own log. These were accessible to the instructor but were not shared with the rest of the class.

The original project design asked the students to record their hourly commitment as part of the design log submission. This was done so that students would only have one item to submit each week even though the design log and hourly commitment tracking serve different purposes. However, it quickly became clear that students were confusing these two requirements. From the third week onward, the two tasks were separated: students now submitted their design log and a separate labor statement each week. This clar-

Table 1

Summary of Student Submissions

Student	Project	Design Log	Designer's Statement
A	✓	✓	✓
B	✓	✓	✓
C	✓	✓	
D	✓		✓
E	✓	✓	✓
F	✓	✓	
G	✓		
H	✓	✓	✓
I	✓	✓	✓
J	✓	✓	
K	✓	✓	✓

ified to the students that the design log was a living document about their creative project whereas the labor statement was just for bookkeeping. Even after this clarification, it became clear to the instructor that students were approaching these design logs in vastly different ways despite having been given identical requirements. This gave rise to the research questions addressed in this work: How do students in this introductory game design course use Game Design logs, and what does that mean for their creative efforts?

At the end of the project, students were to submit a designer's statement separately from the rest of their game materials. Students were given few constraints around the content of this designer's statement, although they were told that a good statement would explicitly address the role of blind and non-blind playtesting to the design process.

Eleven students submitted their final projects. Of these, nine maintained design logs and seven included designers' statements. Table 1 clarifies that, of those who completed the final project, three kept a design log but did not submit a designer's statement, one completed a designer's statement but did not keep a design log, and one student did neither.

Methods

Addressing our research question required deploying qualitative research methods. Our research team consisted of three faculty members from the Computer Science Department at Ball State University, and we followed principles described by Stake (2010) and Saldaña (2009). The game design course instructor was one member of the research team. This research protocol was reviewed by IRB and determined to be exempt from review.

The research team analyzed the nine design logs and seven designer's statements submitted by students. These were transcribed into a consistent format and divided into 1601 paragraph-separated units, comprising 30,366 words.

The designers' statements were similarly transcribed as 66 paragraph-separated units consisting of 1,586 words. The team kept analytic memos while studying the data. A total of 22 memos were taken comprising 6,474 words in total.

The games themselves represented a variety of genres including strategic card games, party games, dexterity games, and social deduction games. The quality and content of the games were not part of this analysis since we were focused on the design logs. The analytic memos occasionally referenced subjective evaluations of the games, but these were not central to our analysis.

The decision to focus on process-related artifacts rather than the games themselves was influenced in part by the course's labor-based grading policies. The students were instructed that game design benefits from good processes but that good processes cannot guarantee good outcomes. Since their process focused on iterative design and keeping a design log, so did our analysis focus on their discussion of design within the design log. This avoids problems of preference or bias that can arise in the evaluation of the games.

In our first reading of the students' design logs and statements, the research team separately coded paragraphs using descriptive and *in vivo* codes. Not all team members read every student submission, but every student submission was read and coded by at least one researcher. We separately developed a total of 192 codes, which includes 179 descriptive codes and 13 *in vivo* codes. After discussing our findings, we converged on 19 second-phase codes, and these are discussed below in our findings. Following the coding of the data, reading of analytic memos, and discussion of our experiences, we distilled our initial set of 192 codes into 19 second-phase codes. These were validated by re-coding a subset of the data.

Findings: The Content of Design Logs

The second-phase codes were grouped into seven categories. These codes describe the content of design logs, telling us what students wrote about. Six of these categories have multiple codes, and these categories are *theory*, *class*, *research*, *design*, *museum*, and *emotion*. The singleton category was *my future*. The complete list of second-phase codes is given in Table 2, and each is explained below.

Under *theory*, we describe students' use of game design theories that were discussed in the class. We used two different codes here, one for explicit references and one for implicit references. The former was useful when students made a clear connection, for example to Bartle types (Bartle, 1996) or the MDA framework (Hunicke et al., 2004). The latter was for cases where there was an implication of a theoretic connection without explicitly naming the relevant theory.

The *class* category was for students' references to the learning environment. This category included four specific codes. *Grades and deadlines* dealt with course policies such

Table 2

Second-Phase Codes

Category	Specifier
theory	explicit
theory	implicit
class	grades and deadlines
class	activities and participation
class	to instructor
class	time commitment
research	other games
research	ideas
design	identify
design	ideate
design	build
design	test
design	evaluate
design	completing a loop
museum	explicit
museum	possible
emotion	course causality
emotion	external causality
future	my future

as grades, deadlines, and assignments. *Activities and participation* covered in-class activities such as playtesting, presentations, and the end-of-semester showcase. The *to instructor* code was used for the rare cases where the student wrote something in the design log specifically addressed to the instructor. *Time commitment* was used for students' referencing the time they spent on the class. Some students continued to count and report hours spent in their design logs even after the labor statement requirement was properly extracted from it; others made more passing or general references about how much time they felt they were putting into the project.

The *research* category covered cases where students wrote about finding ideas and inspiration from other sources. Two different codes were used depending on the nature of the source. *Other games* was used to describe cases where a student referenced other games, including board games and video games. We found students wrote about other games both as a point of reference ("Tried playing the game with the point system of *Bohnanza*...") and as something to investigate for future work ("Check out *Brave's Hand*."). The *ideas* code was used for cases where students researched concepts or non-game related works that they could bring into their projects ("Spent more time looking up [some minor] facts about the plants that I'm working on...").

The *design* category was the most robust one that we identified. The students read the introduction to design in Schreiber (2009). It includes a four-phase prototyping model consisting of design, implement, playtest, and eval-

uate steps. Schreiber contrasts it against the non-iterative waterfall model (Royce, 1970) and compares it favorably to the scientific method. However, despite the members of our research team coming from different backgrounds with respect to design theory, we prefer a different conceptualization of *design*: that design itself is an iterative process whose quality can be determined by appropriate fitness functions. For most games, fitness can be measured by a combination of theory and empirical playtesting evidence. When dealing with community-engaged games, fitness also requires consideration of the partner's needs.

Our team recognized in the students' writings evidence of five stages of design. We would serialize these as *identify*, *ideate*, *build*, *test*, and *evaluate*, although they do not always show up in that order in the logs. We coded as *identify* those cases where students name specific problems in their games; this often coincides with writing about action items for future work. *Ideate* described those cases where students wrote various ideas that they could integrate into their games; these were frequently, though not always, rooted in previously identified design problems. The *build* code was used for many kinds of statements that dealt with creating the prototype, including articulating rules, shopping for materials, developing components, and making decisions. Every student wrote about their playtesting results, and we coded these as *test*. It is not surprising that much of the design logs were dedicated to testing, given its importance to game design and the fact that students were graded in part based on regularity and quality of playtesting. We coded students' interpretations of testing results as *evaluate*; this always followed a reference to testing, and it frequently was succeeded by identification of design problems or ideation of new or revised rules.

Students' flow from evaluation to identification represents a completion of the iterative design process. A sixth code within the *design* category was identified to describe cases where students seemed to have done this: *completing a loop*. However, in practice, we found that students rarely referenced the loop itself: the completion of a game design iteration was not recorded in the design log, though it is clear that these loops occurred. We will return to this theme in the discussion section.

The *museum* category was used for references to the museum, the partner for the project. Students had been encouraged to incorporate the values and themes into their projects, although no course credit hinged on their inclusion. In practice, reference to the museum came up very rarely. As with the *theory* category, we divided this category into codes to describe *explicit* reference to the museum, its staff, or its themes, and *possible* references that were implied from the context of the project and course.

The final category we identified was *emotion*, where students talked about both positive and negative emotions. We

divided this into two codes. *Course causality* were those emotions related to course participation and activity, including joy at successes and frustration at challenges. *External causality* was used to code statements of emotion that seemed separate from this particular course; the most common example of this was references to stressors from other courses that, in the students' articulation, were taking away time and attention from this project.

The final code, which did not fit neatly into the other categories, was *my future*. We used this code for the rare statements where students connect their experience to their educational or career goals. For example, this describes the claim made in Student B's designer's statement: "I want to design games because for me, it is a calling."

Findings: The Form of Design Logs

Type

We identified three dimensions for classifying the design logs: multimodality, composition style, and document structure. They are explained in more detail below and summarized in Table 3. As that table indicates, most logs maintained the same form throughout the semester, although two students changed the form of the log while working on the project.

The simplest classification was whether the logs were multimodal or not. This is a simple Boolean classification: three of the students incorporated images into their design logs, and the rest did not. The images included photographic documentation of interesting playtesting experiences, board and component diagrams, and reference images for components that could be incorporated into the design.

The second classification is based on the composition of text within the design logs. Some documents used short, informal entries, which we reference as the *brief* type. These were sometimes composed of sentences but were often fragments. Other documents were primarily composed of prose paragraphs, which we reference as the *paragraph* type. All but one design logs fell clearly into one of these two categories; the remaining design log from Student K switches between these in what appears a haphazard way. Documents in the brief form contained more technical errors than those in paragraph form, Types of errors include spelling errors, grammar errors, and referencing games by the wrong names, such as a student who wrote research notes about "Hero's Legacy" when the commercial game under analysis was *Hero Generations* (Brodie, 2015).

The third classification was document structure, particularly how students used internal hierarchy. Some students composed their documents in a *linear* fashion while others used a *nested* fashion, deploying multiple levels of indentation. Nesting was commonly although not exclusively accomplished with bulleted lists, using Google Docs' nested

Table 3*Student Design Log Types*

Student	Brief Linear	Brief Nested	Paragraph Linear	Paragraph Nested	Modes
A			●		Text
B		●			Text
C		●			Text & Images
E				●	Text & Images
F	●				Text
H			●		Text & Images
I	○	○			Text
J		●			Text
K		○	○		Text

Note. Full project duration is shown with ●, and half project duration is shown with ○.

Table 4*Student Uses of Design Logs*

	A	B	C	E	F	H	I	J	K
Action items*	✓	✓	✓	✓	✓	✓	✓		
Activity log*	✓	✓	✓	✓	✓	✓	✓	✓	✓
Addressing the instructor					✓			✓	
Class notes		✓							
Decision log*	✓	✓	✓	✓			✓		✓
Defect tracking	✓	✓	✓	✓	✓	✓	✓		✓
Playtesting log*	✓	✓	✓	✓	✓	✓	✓	✓	✓
Research notes		✓	✓						✓
Stating rules								✓	

Note. An asterisk(*) indicates a use recommended by Cook (2011).

lists capability. Only Student I's document transitioned between linear and nested forms. In this case, the student followed a linear brief entry form for the first half of the project and a nested brief entry form for the second half.

Use

Our analysis of the students' design logs identified nine distinct uses for them, each of which is described below. Table 4 describes which uses are present in which logs. Four of these uses come directly from the recommendations given by Cook (2011), namely, tracking action items, activity, decisions, and playtesting results. Cook also gives clear guidance on the structure of the document, but only Student H's log manifested this structure; the others used *ad hoc* formats.

Action items

Most of the students clearly tracked what they wanted to do next. Some students explicitly marked these items as "To Do," "Prioritize," or, literally following Cook's recommendation, "Prioritized Next Steps." There were a variety of things tracked here, including personal directives to alter game mechanisms, address visual design flaws, and research particular examples. For example, Student H was frustrated with some physical components and wrote this note: "The weather cards need to be put into a digital format instead of on index cards." This led the student to design a hybrid game, combining a core dexterity mechanism with app-driven randomized events and goals. Some students included rationales with their action items, such as Student F, who wrote, "Prioritize: Print out more drawings so games can go on for longer."

The students never marked previously-identified action items as completed, nor did they write about past entries in the log in any metadiscursive way. That is, the logs never referred to themselves. We are left with no evidence regarding whether students read their own design logs. Similarly, we have no evidence about whether they worked from memory or used some other task-management system.

Activity logging

All of the students used the design log to track project-related activity. This is similar to Cook's recommendation of tracking "Tasks accomplished," although the usage we found in the student logs was more broad. That is, they did not just address accomplishments but effort more generally.

Activity often included reference to the hands-on work of creating game prototypes and testing them, such as Student H, who wrote, "Today, I was able to blind playtest with another group of players." This type of logging was often accompanied by findings, such as this example from Student J's log, "Tried different time lengths, its honestly best to just count to ten and let haste make chaos, that and a timer isn't needed which is nice."

Addressing the instructor

There were two cases where students used the design log to address something specifically to the instructor, who they knew would be reading the logs. Student E addressed the instructor directly in the second person, writing "I spent an hour when I got home after class thinking about the feedback you gave me on the puzzle game." Student J did not address the instructor as directly but rather posed a question that only the instructor could answer. They wrote of their time commitment, "At least 4 hours so a C-? (is that even a grade?)" This raises an important question for future work, namely, investigating whom students conceive to be the audience for their logs.

Decision logging

Most of the students kept track of the decisions they made and their rationales as they made changes to their games. The type of decisions included choices about game mechanisms, visual design, production choices, playtesting configurations, and rules articulation.

The decisions logged by the students are often necessary but rather mundane work of game design. This is exemplified in Student I's log, which states, "Each player now has a 'Basket' on the table where they store their fruit. This allows other players to see what fruits each other have." In this cooperative card game, players collected fruit cards and didn't have a place to put them nor a way to see what other players had. We see in this quotation that the problem is solved with a simple metaphorical basket.

Sometimes, the decisions were combined with interesting design problems and the students used the log to explore their own design ideas. The quotation below comes from Student B, who was working on a party game with multiple game modes. Two of the game modes are called "gladiator" and "monarch," and these metaphors undergird the rules for each mode. In the quotation below, we see how a student commits to the theme.

Should I have a timer for this, or maybe just the whole voting phase? This would lend itself more to the Monarch style mentioned in previous entries, rather than gladiator. If I'm sticking with the theme this makes sense, because gladiators wouldn't really get to talk after they perform. The monarch however could even direct the discussion, allowing only certain chosen players to speak (maybe the two with the best options).

The decisions were sometimes, but rarely, rooted in theories that were studied in the class. Student C wrote, "With this version, the Card Tree will be harder and harder to grow. What might start out as a puzzle turns into a game with what you could write to stop the other players." Their use of "puzzle" and "game" here are implicit references to Burgun's taxonomy of interactive forms (Burgun, 2015), which sees a "puzzle" as having a clear solution while a "game" incorporates endogenously meaningful ambiguous decision-making.

We also see these decisions occasionally rooted in other research experience. Student K designed a card game about competitive gardening. *Bohnanza* (Rosenberg, 1997) was recommended to the student early in the semester, and we can see in the log how playing this game drove them to make decisions about their project:

Tried playing the game with the point system of *Bohnanza*, found it to add another layer of risk to the game. Now it's the risk of losing your investment rather than just straight points. I think

that the point generation of *Bohnanza* is a worthwhile addition. I found that the updated composting mechanism took a weight off my shoulders when it came to keep the plants alive. While there were times where I still had difficulties on deciding if drawing from the Action deck was more worth it than composting from hand, composting ultimately won out more often than not.

Three students did not exhibit decision logging in their documents. These three described rules or changes but without addressing why the changes were made. There is an implication in these three logs that the decisions were made for a purpose, but we presume that the purpose was internal to the student: it was not made manifest in the log.

Defect tracking

All but one of the students used their design logs to keep track of problems they were facing in their game. The kinds of project problems addressed included systems, rules articulations, and component problems. Students also tracked problems with related class activities, such as notes about difficulties with in-class presentations.

Some of these entries were quite terse, such as Student F's entry, "Ran into the issue that not all people were enjoying the new concept." Others provide a bit more context about what exactly went wrong, such as in Student H's statement, "Lightning rules were not clear, players were confused what was meant by destroying the last place flower." In some cases, students wrote even more details about particular game situations that they encountered in testing, such as when Student K wrote:

I played a Winter Season card to freeze the game state for 2 turns, since my plants were rather low on life, only to be thwarted when I drew into an instant play which dealt damage to all my plants. I either need to adjust some of the healing cards or play with a more expanded action deck to encourage other avenues of play.

Interested readers may notice the use of terminology from *Magic: The Gathering* (Garfield, 1993) here, which we might consider an implicit game research reference as well.

The most interesting of these entries was from Student E, who, in this entry, deals not only with the present problems with the game but also points to directions for future self-improvement: "Despite the time and effort that I spend redesigning the tokens with visual elements I haven't been able to create a design that people I've shown or I like or find effective. Perhaps I need to spend some time studying visual communication/design for this kind of thing in the future."

Class notes

Student B used the design log to keep class notes. This was the only example of this phenomenon within our data. The student kept two kinds of class notes in the design log: observations about classmates' projects and notes from the instructor's presentations. When writing about classmates' projects, Student B was very clear about observed strengths and weaknesses and took particular note of suggestions that were made. For example, Student B writes about a classmate's project:

There are some issues with the analog design of the game, but some of this stems from his ideas on managing the pieces. I think if they continue that it might lead to issues further down, when they try to make a more polished version, or do more serious playtesting, as people outside of class might not take it as well.

In another entry, this student describes a problem observed in a different classmate's project, "Awkward shuffling of pieces to move to the next phase, did not lend well to rapid iterative play testing, but that's more a personal opinion I guess." The prototype Student B describes here involved manipulating over a dozen tiny dice on a grid with paper tokens placed atop or under them. Any seasoned designer would agree that Student B was technically right about this quality of the prototype. However, the student hedges the criticism by claiming it is "a personal opinion," and yet then goes on to equivocate with a trailing "I guess." It seems that the student knows that they are right about this evaluation, but it is less clear why they hedge their feedback. Note that, at this point in the semester, the students' evaluations of classmates' work was *ad hoc*. The EOTA model for feedback (Hammer & Cook, 2019) was introduced later, but it does not show up in our data.

Playtesting Notes

All of the students included playtesting notes in their design logs. This is a clear and explicit recommendation from Cook, and it was likewise a clear and explicit requirement for grading in the course policies: to get a high grade on the project required students to do various forms of playtesting.

The playtesting notes themselves are expressed idiosyncratically. They appear important to the designers but are frequently expressed as fragmentary ideas. All but one student used text alone to record their playtesting results. Student H's incorporation of images helped us to recognize how much more clear and expressive multimodal composition can be for recording playtesting data. This student designed a dexterity game in which players throw weighted bags across the playing field. Their log included two photographs of interesting play situations. One of these was from the classroom,

where, during a presentation, a classmate who was testing the game successfully made an unlikely shot. The caption, "Cool throw that came of today's playtest," shows that it was recorded in a spirit of pride and wonder. Earlier in the log, there is a similar photograph taken in an apartment, where a bag hangs precariously from a curtain rod. It is captioned, "Something cool that happened that I want to remember." In another place, the log includes a photograph of a particular playtesting configuration.

Research notes

Three students used their design logs as a repository for course-related research notes. As mentioned in the discussion of coding, research included both reference to other games as well as ideas related to the game's theme or metaphor. Student K, mentioned earlier for including explicit reference to *Bohnanza* in the design log, also included research notes about the game:

Went back and reread the rules of *Bohnanza* and watched a brief video for further explanation on rules (specifically why clearing 1 bean fields is bad). Restricting point values based on the number of beans planted, for [my game] it'd be any other plant, on the same field is worth considering.

Stating rules

Student J used the design log to document the complete rules of their game. This student's log only had three entries: one for the first week, one for the second week, and one immediately before the deadline. This student struggled with attendance and its concomitant participation. In fact, their final entry begins with a parenthetical disclaimer that is likely addressing the instructor: "I am aware my thought process is a bit chaos, but I tried to make it understandable." Following this is an entry in brief nested form that seems to try to collect four weeks of intermittent effort into one recollection. This log appears to have been written about the same time as the final project submission, which also presents the rules of the game. Curiously, they appear to have been independently composed; no text was copied from one to the other despite their having ostensibly the same content. In addition to the rules articulation, the design log contains questions and acknowledges ambiguities around the theme of the game.

Discussion

Writing and the design process

The design logs make it clear that most students engaged in multiple loops through the design cycle, although we found it impossible to clearly delineate where a cycle started and ended in the logs. Students emphasized different parts of

the process at different times, although we noticed that students did more ideation early in the semester and more testing and problem-identification later in the semester. In some cases, the design process led to significant changes to the game design. This exemplar of this is Student I, who began with a competitive game and transitioned it into a cooperative one, keeping the theme and many gameplay systems.

Writing the logs appears to have been helpful to students' design process even though we do not have clear data regarding exactly how students read the logs. The fact that the logs were submitted for weekly graded review certainly provided motivation for students to keep making progress. This seems to be the case even though the logs were graded based on labor rather than quality. Furthermore, we recognize that students were actively learning about the design process by writing about it, even if they never read their own notes.

This brings us to a discussion of the second research question: what do design logs mean for students' creative efforts? Students clearly incorporated five stages of design, but the research team was unable to find clear cycles because the logs jumped unpredictably between the phases. If this is how students write about their design, then it is probably also how they approach their design. Keep in mind as well that the codes we used were our descriptions: none of the students wrote about phases of design. This raises an important pedagogic hypothesis, that student's designs may be further improved by holding them accountable to a more rigorous following of a formal design process.

The games themselves were not formally evaluated as part of this study, but casual review reveals that they vary significantly in quality. There are clear differences in clarity of presentation, organization of materials, alignment with course learning objectives, and fitness for use by the community partner. We note an apparent correlation, that the higher quality games had higher quality logs, and that lowest quality games had poor or missing logs. Exploring this connection is an area of future work.

Much of game design is manifest in written artifacts such as design logs and text-based components, and so it is worth addressing the inconsistent writing habits of contemporary undergraduates. Few students in this class demonstrate efficacious note-making habits, and students everywhere seem to make poor choices about how to take notes (Morehead et al., 2019). This is a challenge for higher education, where students should be preparing to be lifelong learners. Students are not taking notes, which means they are not learning to learn as well as they could (Kiewra, 2002; Wu & Xie, 2018), or they are taking notes in ineffective ways (Mueller & Openheimer, 2014). The students themselves appear unaware that their note-making habits are poorly formed. This discussion highlights the pedagogic benefit of deploying design logs in university game design courses. They help students learn an authentic practice for improving knowledge work

through rigorous writing. They are unlikely to automatically transfer this experience to other contexts, but such transfer could be supported by future instructors.

The art of defect-tracking

Almost all of the participating students have a background in Computer Science, and professional software developers spend significant time and effort in documenting, tracking, and addressing defects. However, defect tracking is not a formal part of these students' curriculum. Students who have engaged in team projects would have likely encountered some kind of formal defect-tracking system such as GitHub Issues or Jira, particularly students who have completed capstone projects. The specific systems used to track defects would either be idiosyncratic to the instructor or *ad hoc* to the students rather than systematically formalized in the curriculum. It was therefore not a surprise that we did not find any patterns in students' articulation of defects. There was no observable difference in how students articulated or tracked defects depending on their major, class level, or background.

This finding points us to an opportunity to include more structure in the course about how playtesting results can be tracked and addressed. Authors such as Gary (2018) and Lemarchand (2021) provide techniques with different levels of rigor. Studying these techniques may be of particular use to Computer Science students, as the skills should transfer between game design and software design.

The Environment of Higher Education

The assignments in the first half of the semester required that students complete the readings and activities. That is, a student could not have completed the submitted work at all if they did not at least glance at the assigned reading or, potentially, have someone else explain it to them. The final project had a different structure, where assigned readings and reference materials were provided to the students to help them succeed in their multi-week design efforts. It appears that without having these tied to specific submitted work, students simply chose to skip them.

The first and most important case deals with the museum's interpretive framework that was described in the introduction. The document was distributed via Canvas, the university's course management system, by being mentioned in an announcement and placed in the top module of the course's site. It was also briefly discussed in class. However, students made no reference to this framework for the duration of the semester, not in design logs, conversations, the games themselves, nor final presentations. This supports our hypothesis that it was neither read nor used by the students.

A similar case occurred around teaching students how to give presentations and playtest their prototypes. Students were assigned to watch a video about how to teach board games (Smith, 2020), although as with the interpretive

framework document, there were no immediate submissions, deadlines, or activities that directly referenced the video. A class discussion weeks later made it clear that only one student had watched the video.

Cook's explanation of design logs makes it clear that the logs are for the team, not for a manager or other stakeholder. Yet, since the students apparently did not refer back to their own design logs, and some of the students address the instructor directly, we are left uncertain who students consider to be the audience for this artifact. Although most logs appear to be written as per Cook's recommendation, we have to face the implicit structural assumptions of higher education: students know that if they turn a thing in, it will likely be read by the instructor, who is not "on the team." Furthermore, having the logs submitted as graded work—even with labor-based grading—runs the risk of reducing students' intrinsic motivation (Deci et al., 2001). Future work could explore the distinctions between how a student and a non-student approach this kind of composition.

The museum's adoption of design logs

Finally, we note an interesting and unexpected benefit of this research project on our community partner. During the subsequent semester, many students from this class enrolled in a game production studio course. This course was taught by the same instructor, and in this course, an original video game was created in collaboration with the same community partner. This student-driven studio struggled with miscommunication and confusion around design decisions, and the mentor suggested they use Cook's design logs. The logs—following Cook's format—were adopted with great success.

Our primary partner at the museum had access to the shared drive of student material. Out of curiosity, he opened the "Design Log" document to see what it contained. On seeing that it was essentially a log of decisions, he realized that he could use a similar format to help his own museum teams with some miscommunication and confusion. Several of his teams had recently grown due to museum expansion, and their previous methods of tracking decisions were not scaling to larger teams. He adopted essentially the same format for museum exhibit and experience design decisions as the students had learned to use for tracking their own game design decisions.

Conclusions

Students used the design log to support a good, iterative design process despite having approached the logs in idiosyncratic ways. Students' design logs varied significantly from each other, and only one student followed the recommended structure. Despite variation in multimodality, composition style, and document structure, almost all the design logs give evidence to students' having followed a standard

design process: identifying problems, coming up with potential solutions, building prototypes, testing prototypes, and interpreting those results. Future work could explore the implications of particular formats on project quality.

Incorporating design logs into an undergraduate class yielded several benefits, not the least of which was keeping students engaged during a multi-week project. The most clear design logs were those in which students wrote clean prose and made prudent use of images; future student designers can be encouraged to compose this kind of design log. Students' designs may be further improved by holding them accountable to explicitly referencing their stages in the design process and, for community-engaged projects, the relationship between their work and the community partner.

A labor-based grading approach may benefit from being coupled with other objective rubrics or specifications. Labor-based grading of the logs meant that students could approach this writing however they were comfortable. This reinforced some themes of the class: that creativity requires risk, and that while there is no guaranteed method for creating a great game, a good process is more likely to produce a good result. On the other hand, a novice designer may inadvertently choose a design log form that is unhelpful due to their lack of experience, particularly given students' propensity to choose inefficient methods of note-making. Furthermore, the design logs contain very few references to the theories and vocabulary studied in the first half of the semester, and this points to a potential weakness of the labor-based grading approach. That is, a student may learn a concept from a reading for the purpose of completing an assignment but quickly lose that understanding due to a lack of structured reinforcement.

Writing design logs helped students through the metacognitive steps required for effective design. However, we don't have clear evidence about how exactly students combined the design logs into the rest of their planning and personal organization. Future work could explore the question of how students read and reflect on design logs, to expand on the work in this paper on how students write design logs. This relates to the point that students seldom wrote about their game's appropriateness for the museum. Requiring such writing as assigned coursework would guarantee that students would think about it.

The environment of higher education was an important factor in this work. We observe that some students use design logs for class-related purposes in a way that a non-student designer would never use, such as writing notes to the instructor or justifying time spent. Students also appeared to ignore critical resources when no grade was attached to them. Our results are therefore clearly coupled with our academic environment. Studying the work of novice designers outside of academia could help us better understand how reflective writing practices benefit game design projects.

Future work should more rigorously investigate the rela-

tionship of game quality to students' writing habits. Quantifying or classifying the differences between games would provide an important complement to our findings about how students write and use design logs. Studying how design logs are used in industry would also allow us to compare the patterns of professional and student use.

References

- Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit muds [<https://mud.co.uk/richard/hcds.htm>].
- Bateman, C., & Boon, R. (2005). *21st century game design*. Cengage Learning.
- Brodie, S. (2015). *Hero Generations* [Video game].
- Burgun, K. (2015). *Clockwork game design*. Routledge.
- Cook, D. (2011). Game design logs [<https://lostgarden.home.blog/2011/05/03/game-design-logs/>].
- Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research*, 71(1), 1–27. Retrieved June 3, 2022, from <http://www.jstor.org/stable/3516064>
- Garfield, R. (1993). *Magic: The Gathering* [Card game].
- Gary, J. (2018). *Think like a game designer*. Aviva Publishing.
- Hammer, J., & Cook, A. (2019). EOTA: A method for improving peer feedback in the game design classroom. In R. Ratan, B. Winn, & E. Lapensée (Eds.), *Proceedings of Meaningful Play 2018* (pp. 75–86). ETC Press.
- Hunicke, R., Leblanc, M., & Zubek, R. (2004). Mda: A formal approach to game design and game research. *AAAI Workshop - Technical Report, 1*.
- Inoue, A. B. (2019). *Labor-based grading contracts: Building equity and inclusion in the compassionate writing classroom*. University Press of Colorado.
- Kiewra, K. A. (2002). How classroom teachers can help students learn and teach them how to learn. *Theory Into Practice*, 41(2), 71–80.
- Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving learning games forward: Obstacles, opportunities, & openness* (tech. rep.). The Education Arcade, MIT. http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf
- Koster, R. (2012). Narrative is not a game mechanic [<https://www.raphkoster.com/2012/01/20/narrative-is-not-a-game-mechanic/>].
- Lemarchand, R. (2021). *A playful production process*. MIT Press.
- Morehead, K., Dunlosky, J., Rawson, K. A., Blasiman, R., & Hollis, R. B. (2019). Note-taking habits of 21st century college students: Implications for student learning, memory, and achievement. *Memory*, 27(6), 807–819. <https://doi.org/10.1080/09658211.2019.1569694>
- Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: Advantages of long-hand over laptop note taking. *Psychological Science*, 25(6), 1159–1168. Retrieved April 28, 2022, from <http://www.jstor.org/stable/24543504>
- Rosenberg, U. (1997). *Bohnanza* [Card game].
- Royce, W. W. (1970). Managing the Development of Large Software Systems: Concepts and Techniques. *Proceedings of IEEE WESCON*.
- Ryan, T. (1999). The anatomy of a design document, part 1: Documentation guidelines for the game concept and proposal [<https://www.gamedeveloper.com/design/the-anatomy-of-a-design-document-part-1-documentation-guidelines-for-the-game-concept-and-proposal>].
- Saldaña, J. (2009). *The coding manual for qualitative researchers*. Sage.
- Schreiber, I. (2009). Game design concepts [<https://gamedesignconcepts.wordpress.com/>].
- Smith, Q. (2020). How to teach board games like a pro [<https://youtu.be/P5fjDaFuft8>]. *Shut Up & Sit Down*.
- Stake, R. E. (2010). *Qualitative research: Studying how things work*. The Guilford Press.
- Wu, J.-Y., & Xie, C. (2018). Using time pressure and note-taking to prevent digital distraction behavior and enhance online search performance: Perspectives from the load theory of attention and cognitive control. *Computers in Human Behavior*, 88, 244–254. <https://doi.org/https://doi.org/10.1016/j.chb.2018.07.008>