A Longitudinal Look Into Student Video Game Designs

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ABSTRACT

Teaching video game design is challenging due to its plural and interdisciplinary nature, lack of theoretical and methodological consensus, and idiosyncratic dependence in its iterative process and practice. We analyze the game design documents (GDDs) generated over several years by teams of students in university video game design and development subjects. Observations and samples suggest game implementations are guided by informal discussions and not by design practices discussed in class and included in the materials. The delivered GDDs have content patterns (favoring flowcharts, lists and tables) but not structural patterns in the schema, and they are not iterated with the same frequency as game prototypes. We conclude that students are tasked with a practical, iterative process requiring knowledge and experience they lack. They use GDDs for documentation, not design, leading to costly and redundant teacher monitoring. Teaching video game design should include flexible guidelines for structure, methodology, and content through practice.

Keywords

Video game design, teaching video games, video game subjects

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INTRODUCTION

Over the years we have been teaching how to create video games, we have noticed that students particularly struggle with the design process. Our initial qualitative observations suggested several possibilities, but we decided to analyze the student deliveries to try to better understand what the obstacles are. The following sections include a brief literature review focused on the problem we are observing, an analysis of the students' deliveries, and a discussion of the results.

Situating Game Design and the Game Creation Process in Game Studies

Rouse's book *Game Design: Theory & Practice* (2004) provides a concrete and succinct definition of game design as "...what determines the form of gameplay" or "In short, the game design determines every detail of how the gameplay will function." The very nature of video games means that the book must go in depth into gameplay, technology, storytelling, focuses, artificial intelligence, gameplay, documentation, level design, and playtesting amongst other topics. Even by the author's own summary, game designers include sketch concept and asset artists, scriptwriters, coding developers, level layout creators, and project managers. The provided scope of game design is wide, and therefore, it takes him hundreds of pages to cover all these topics, and arguably, the discourse is superficial in some specific areas (such as the most technical ones). These chapters do not provide strict guidance on how to implement these topics in a process. They are focused on analyzing the different nature and implications of a given dimension of video games. These topics are then explored via specific game analysis and designer interviews. Instead of concrete guidelines on how to design a video game, we get a rich tapestry of reflections and considerations that should go into gameplay, accompanied by examples that illustrate good practices and the experience of veterans of the industry. Admittedly, some specific areas provide rather specific guidelines, such as level design (this aspect of game design tends to be the most linear and explicit in the literature).

In the same vein Chris Crawford (2003), one of the field's pioneers, states how game design involves theories, guidelines, and abstract concepts rather than precise formulations, clear specifications, and straightforward rules. Arguing that design and development are distinct, he proceeds to provide his thoughts and experience in different aspects of game design, such as play, challenge, conflict, interactivity, creativity, and storytelling. Then, the second half of the book is used to review the author's past game designs to illustrate his ideas and practices.

These early works provide a personal perspective into game design that operates at multiple granular levels and that is based on the author's experience developing specific games. Two decades ago, the field of video game design was still being defined. The view that the field had not yet developed was quite widespread (Salen and Zimmerman 2004) even though video games had been around for more than two decades. The lack of consensus or unifying approaches in the field resulted in essential discrepancies in work structure and methodology. Ultimately, these early professional books focus on the object of the design process (the games) and give little consideration to certain essential aspects of the design activity, such as representing, moving and reflecting (Kuittinen and Holopainen 2009).

There are more recent works focused on the practical design of mechanics (Adams and Dormans 2012), the sensation of gameplay (Swink 2008), the presence of uncertainty (Costikyan 2013) or the emotions evoked by the game experience (Sylvester, 2013). Other such work includes an approach based on specific design challenges (Romero and Schrebier 2008), programming patterns (Nystrom 2014), player engagement and permanence (Lovell 2018), and the use of thematic observational "lenses" to pose questions (Schell 2008). As a contrast, some of the recent work describes video game design as a systematic and less mechanistic phenomenon (Sellers 2017; Zubek 2020). Furthermore, coordinated and constant iteration between design and development is recommended (Fullerton et al. 2008; Rogers 2014; Salen and Zimmerman 2004). These works provide a collection of concerns, methodologies and analysis frames, often through specific game examples and interviews. However, we have found them either focused on specific game genres (missing a more generalist approach) or presenting a methodology we had problems following or implementing, again, because of the narrowness or inability to adapt to the games our students were trying to create in our lectures.

The field of game studies has been producing an extensive academic literature from approaches where design is a central element: ludological theory, about the ludic structures of the video game (Frasca 2003); the theory of procedural rhetoric (Bogost 2007); approaches from the theory of emotions (Isbister 2016) and models of textual analysis of the video game that incorporate various definitions and theoretical articulations on elements of video game design. Given the academic nature of these works, they are often focused on either the final games or the users, and do not account for the process of creation (Kultima 2018). This can be observed in some of the works that seek to categorize video games studies, where the creation process is framed as context or interplay between user and game (Mäyrä 2008; Björk 2008).

Lately, there has been a rise in studies that look into the actual process of video game design, situating game design within the border field of design disciplines. These include a deep dive proposing game design praxicology (Kultima 2018), a methodological bridge between creativity studies and game design research (Chiapello 2022), or between higher education institutions and the game industry (Godin et al. 2020). There is also a push to delve into the game creation process and industry, with significant works that explore game production (Sotamaa and Švelch 2021) and a realistic analysis of how video game developers work (Keogh 2023), or even into the many tensions resulting of teaching video game development in higher education (Keogh & Hardwick 2024). We believe that this latest wave that investigates the process of video game creation and design will be useful and instrumental in articulating the teaching of video game design and development.

The Challenge of Teaching Game Design

Our Video Game Subjects

For the past decade, we have taught video game design and development in different courses. All of them involve the creation of a video game in teams and are taught to students of engineering degrees, including computer science, data analysis and biomedical sciences in the case of Universitat Pompeu Fabra (UPF) and video games in the Universidad Complutense de Madrid (UCM). The courses include theoretical lectures and practical labs. An important common feature is that all the

subjects involve the design and development of a video game. We theorize that many of the problems we describe would not be present in subjects where the students just work on the design of a video game but are not required to implement it.

We first describe UPF's Narrative and Video Games (NaiVi) subject. The theoretical block of the subject focuses on the theory of the design of rules, game mechanics and forms of gameplay as an expressive medium, including semiotics of video games and procedural rhetoric (Bogost 2007; Flanagan 2014; Pérez Latorre 2012). Also, in accordance with the title of the subject, this design theory is connected with narrative issues, adopting a ludonarrative approach: how the design of rules, game mechanics and gameplay forms can be devised and improved, throughout a design process, with the aim of representing/expressing (better) a certain character, the fictional world that surrounds him/her, certain narrative situations. About ludonarrative video game design, see also: Navarro-Remesal (2016) and Planells (2015). The topic is exemplified through diverse cases, some of them mainstream narrative video games (e.g., the importance of the incorporation of adding stealth mechanics for a renewed representation and interactive "incarnation" of Batman, in the Batman saga: Arkham by Rocksteady Studios). The theoretical segment also includes indie video games, where "classic" mechanics are modified or resignified to build atypical narrative experiences in the mainstream. Some examples include *Papers, Please* (Pope 2013), *Celeste* (Maddy Makes Games 2018) and *Dys4ia (*Anthropy 2012).

In the practical block, students are arranged in groups of three to four, and adapt a movie, comic, novel or short story from a list. The teachers discuss the initial approach with each group and whether it is being adopted correctly to communicate the central idea of the original media. The group then moves on to develop the GDD and a prototype for their game in parallel. The methodology involves periodic reviews with feedback of the incremental deliveries of the GDD and the functional prototype.

As for the structure of the GDD, they are given the following schema, with freedom to choose the sections they deem necessary to describe their video game. All the sections and tools included are explained and exemplified during the lectures of the subject.

Introduction

- Concept
  - Distinctive traits
  - Genre and references
- Narrative
  - Synopsis
  - Theme and tone
  - Genre and tropes
  - Characters and narratological actants
  - Acts and plot structure
- Gameplay
  - Core mechanics tied to the concept

Functional Design

- Mechanics and rules
- Control and Interface design
  Game Flow/Loop design
- World Elements, properties, and behavior
- Ludo-narrative development
  Gameplay unit design

Development Plan

- Technical approach
- Cost breakdown
- Timeline planning

Table 1: Suggested content for the mandatory sections of UPF's GDDs.

Regarding the proposed design tools, the following are included:

- Flowcharts and sequences
- Graphs
- Trees
- Lists, ontologies and taxonomies
- Tables
- Maps
- Storyboards
- Wireframes
- Sketches and illustrations
- Moodboards

Table 2: Proposed design tools for UPF's GDDs.

The subjects from Universidad Complutense de Madrid (UCM) include: Video Game Programming in Interpreted Languages, from the Degree in Video Game Development (2nd year, first semester), in which groups of 4 students make an HTML5 video game with Phaser; Projects 2, from the Degree in Video Game Development (2nd year, 2nd semester), in which groups of 10 students make a complete video game, from scratch with C++ and SDL; and Video Game Development with Web Technologies, a third and fourth year elective for engineers in Computer Science degrees, in which groups of 4 students also make a video game in Phaser. These subjects, which cover the last 7 years and include more than 50 projects, involve the design and development of a game prototype. However, unlike NaiVi in UPF, they are focused on video game creation and implementation and not on narrative.

The Game Design Document as a Focalizing Tool

One of the main ideas on which there is some consensus is the usefulness of a central design document, or game design document (GDD). The GDD has been used in our lectures as a tool for the teams to focalize their design work. It typically serves as a link between the design process and the development process. It is also a fundamental communication tool when working in teams of several people.

However, and as a consequence of the lack of disciplinary convergence previously mentioned, it does not have a standardized structure (Rouse 2004; Rogers 2014). GDDs are ad hoc and are derived from experience and iterative process within the framework of a particular project. A game designer can draw on all the previously mentioned material, but will ultimately have to develop its own GDD model that reflects and communicates to their development team the required project design. As an additional complication, the GDD will also need to be updated, constantly changing to reflect changing conditions due to factors such as preliminary implementation results, technological limitations, or other changes during the development of the game (Salen 2004; Cormio et al. 2024). It is worth noting that some authors are critical of the GDD, especially if it becomes long and convoluted, and recommend sticking to a shorter format no longer than one or two pages (Ryan 1999; Kelly 2011).

Difficulties Teaching Design in Our Lectures

The included literature review presents several limitations when applied to the teaching of game design in a university setting. The early seminal professional books cited, such as Rouse (2004) and Crawford (2003), provide broad theoretical frameworks, reflections, and practical insights into various aspects of game design. However, these sources often focus on specific games, theoretical underpinnings, or isolated aspects of design, leaving a gap in cohesive, adaptable methodologies for teaching game design to students. The generalized nature of these resources means they lack the specificity required to address the unique challenges faced by novice designers in a structured academic environment. For example, while they may outline best practices in gameplay mechanics (Adams & Dormans 2012) or help in conveying emotions (Isbister 2016), they do not provide step-by-step guidance tailored to the diverse types of games our students aim to create, nor do they sufficiently address the iterative, interdisciplinary nature of video game development or design.

While some frameworks such as thematic lenses (Schell 2008) or mechanics-focused methodologies (Adams and Dormans 2012) offer valuable insights, they can be difficult for students to directly apply to their projects without significant adaptation. Furthermore, game design praxicology (Kultima 2018) and game production studies (Sotamaa and Švelch 2021) suggest the game design process is deeply contextual and influenced by myriad factors, including team dynamics, project goals, and technical limitations. In accordance with this idea, students require more targeted guidance that aligns with their specific game ideas and development goals. This mismatch between the literature (often too general or focused on specific game types) and the specificity needed in the classroom (producing ideas that are not necessarily derivative) often results in students struggling to bridge the gap on their own. As a consequence, they develop their own methodologies and approaches, but given the short span of a subject and the long nature of game design, they might not get the opportunity to iterate or refine them.

A significant challenge for students learning game design and then implementing their creations is the steep technical learning curve associated with mastering game development tools. While over the last decades, game engines such as Unity, Godot or Unreal Engine have leveraged the cost of implementing games or prototypes, the learning curve is nevertheless steep. Most of our students come from engineering or

computer science backgrounds and have minimal experience with the creative and artistic aspects of game design. However, instead of trying to acquire the skills they are missing, their focus often shifts toward the technical implementation of their games rather than the foundational design principles. This division of attention can result in design being relegated to a secondary skill, perceived as less critical than technical proficiency. Despite the need for coordinated iteration between design and development emphasized by Fullerton (2008) and Salen and Zimmerman (2004), students often lack the time or resources to fully embrace this iterative process. Furthermore, students frequently fail to recognize the importance of thorough design work before implementing their games. We believe this often leads to a design process guided by informal discussions between team members and technical breakthroughs. In other words, instead of embracing design theory, students focus on mastering game development technology and create the game as they go, only informally discussing key decisions. Once they are satisfied with the results, they document their creation and deliver it as their game design.

Teamwork in video game design is inherently challenging, particularly given the interdisciplinary nature of the subject. In our courses, student teams typically consist of three to four members, each with varying skill sets and levels of experience. This structure reflects the collaborative nature of the game industry but also introduces significant difficulties in coordination, communication, and role allocation. The engineering backgrounds of students further compound these challenges, as they may lack exposure to the creative and artistic aspects of the design process. While some literature on industry practices (Sotamaa and Švelch 2021) provides valuable insights into real-world team dynamics, it does not adequately address the unique challenges of student teams, where members are simultaneously learning technical skills, design principles, and teamwork strategies. Balancing these demands can be overwhelming and often leads to friction or inefficiencies within teams.

Evaluating student game prototypes and designs presents another significant challenge. Unlike traditional assignments that can be graded using standardized rubrics, game design projects require teachers to invest considerable time and effort in supervising and assessing the iterative process. The creative and iterative nature of game development necessitates constant feedback and intervention to ensure the project remains on track. This process is resource-intensive, requiring teachers to engage deeply with each team's progress, provide tailored guidance, and evaluate both the final product and the underlying design rationale. The lack of clear, standardized methodologies for assessing game design further complicates this task, often resulting in subjective or inconsistent evaluations. Additionally, the need for specialized equipment, software licenses, and physical or digital playtesting spaces adds to the logistical and financial demands of teaching game design. One key informal observation in the lab session is that design aspects that are not present in the GDDs, are often discussed informally. This leads us to believe that the interactions between each team, either through oral or other channels (such as instant messaging or remote conferences), are key in their design processes, but never made explicit.

Formal Observations

In this section, we present some evidence that reinforces some of the previous claims and introduces other relevant insights.

Manual Annotation of GDDs

We've manually annotated student-delivered GDDs to analyze and document their contents and structure, created by students in the *Narrative and Video Games* (NaiVi) course at UPF. The analysis aims to identify patterns in how students structure their GDDs, the types of design elements they emphasize, and how they use the GDD to document their game development process. The GDDs are also examined to understand how they reflect the students' engagement with design theory and how they integrate iterative development in their process.

The sample consists of 40 GDDs from groups of 3–4 students enrolled in the NaiVi course at UPF. These GDDs are selected from the final submissions of students, which also include a functional game prototype and are submitted as part of the course's assessment. Each GDD is analyzed separately for the following elements:

- **Design Elements**: The following specific content of the GDD is categorized and quantified: lists, tables, screenshots, sprites, wireframes, storyboards, mood boards, flowcharts, lists, tables, diagrams, taxonomies, structured descriptions.

- **Document Structure**: The organization and layout of the GDD are analyzed based on the mandatory sections of the GDD. These include game concept, functional design, and development plan, as well as any additional sections that students may have included from the suggested sections.

- **Iteration Tracking**: Whether students have used the GDD to document iterative design changes, including updates made during the development of the prototype.

Using the annotation data, a quantitative analysis is conducted to identify trends and patterns. The following metrics are extracted and analyzed:

- **Design Element Frequency**: A count of each type of design element used (e.g., frequency of visual elements like sprites and screenshots).

- **Document Length and Structure**: The length of the three mandatory sections (game concept, functional design, development plan) is measured by counting words.

- **Pre- vs. Post-Prototype Documentation**: An analysis of whether students introduce design elements into the GDD during pre-prototype planning (e.g., game concept and mechanics) or during post-prototype documentation (e.g., screenshots, final assets).

Additionally, the following qualitative data is gathered:

- **Design Element Function**: Whether the design element was used to describe the physical game world (e.g., characters, levels), the rules (e.g., variables, states), narrative content (e.g., plot progression charts, dialogs) or gameplay (e.g., mechanics, player actions).

It should be noted that this study is based on the final submissions of students, and as such, the GDDs may not reflect the entirety of the design process. Furthermore, since GDDs are created by student teams with varying levels of experience and expertise, there may be inconsistencies in how the GDD is utilized across different projects. The study also focuses solely on documentation and does not include direct observations of team meetings or informal discussions that may influence the design process. It also omits the prototype from the analysis.

GDD Manual Annotation Results

According to Figure 1, sprites and screenshots are more frequent than flowcharts and lists, while tables, maps and interface elements are in last position. Figure 2 compares the use of visual elements before the prototype implementation (such as diagrams or plans) with those after (mainly screenshots and sprites). The GDD is mainly illustrated with screenshots of either the running prototype or rendered game assets, and presents comparatively few diagrams or visual design elements that were created prior to the prototype implementation.

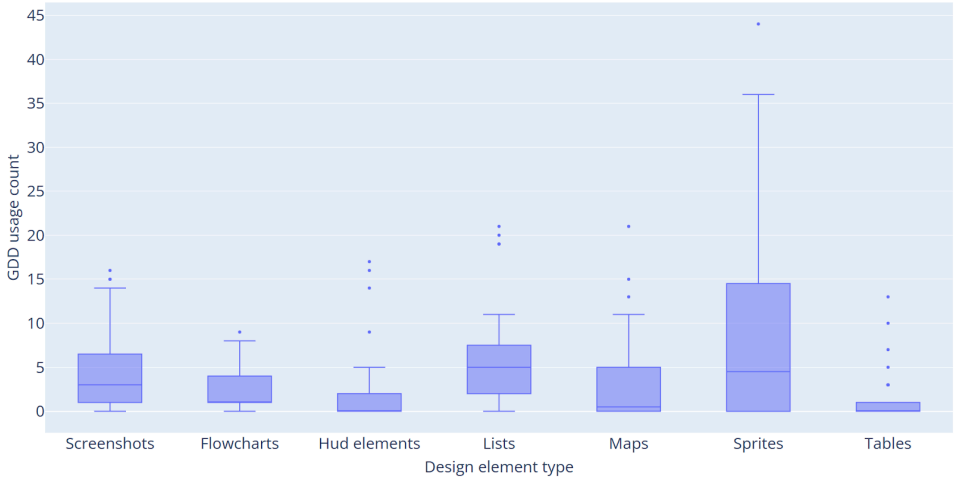

Figure 1: Design element usage count in UPF's GDDs.

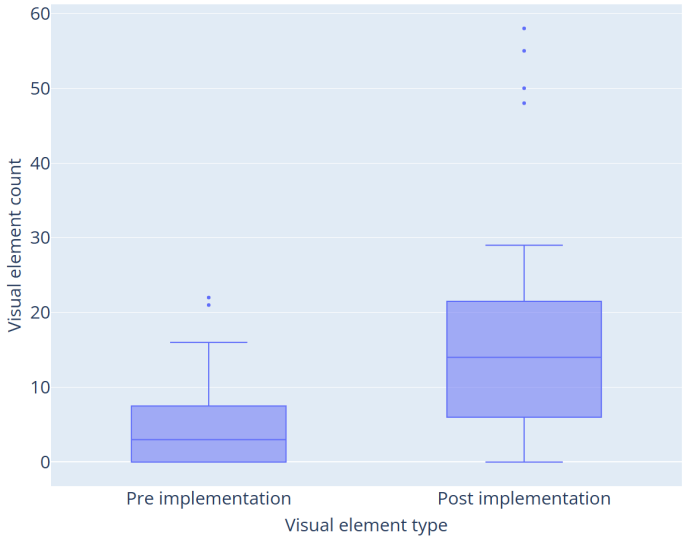

Figure 2: Use of visual elements pre- and post-implementation count in UPF's GDDs.

	Screenshots	Flowcharts	Hud elements	Lists	Maps	Sprites	Tables
GDD count	40	40	40	40	40	40	40
mean	4.52	2.25	2.12	5.95	3.12	8.62	1.45
std	4.70	2.35	4.3	5.44	4.82	10.48	2.82

Table 3: Descriptive statistics design element usage count in UPF's GDDs.

	Pre-implementation	Post-implementation
GDD count	40	40
mean	5.1	16.12
std	5.89	14.48

Table 4: Descriptive statistics for the use of visual elements pre- and post-implementation count in UPF's GDDs.

In Figure 3 we can see that most elements are used to show or explain the game world, such as objects, characters or places. This leaves the logic of operation, narrative or progression aspects in the story or actions and game mechanics with little presence. The existence and layout of content is being documented, but its operation and meaning less so. Since the prototypes are functional and contain mechanics, these aspects are probably developed informally through other channels.

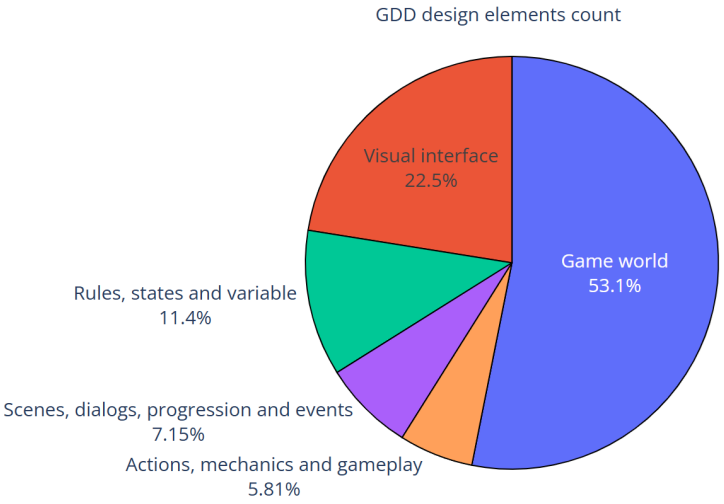

Figure 3: Design element count by type in UPF's GDDs.

	Game world elements	Actions, mechanics and gameplay elements	Rules, states and variable elements	Scenes, dialogs, progression and events elements	Visual interface elements
GDD count	40	40	40	40	40
mean	15.77	1.72	3.4	2.12	6.67
std	12.56	1.72	3.84	2.45	7.1

Table 5: Descriptive statistics for design element count by type in UPF's GDDs.

Regarding the schema found in the GDDs, we found no recurring patterns besides some structural impositions from our instructions. These include the need to separate the game concept, its functional design and the development plan. Despite the students' significant exposure to software project development (including the popular Agile project management approaches in the mandatory curriculum), only 19 out of the 40 annotated GDDs include any indication of iteration, neither in design nor development. We actively encourage them to do so in the labs and give better grades to GDDs that include this information. The length of these sections is presented in Figure 4.

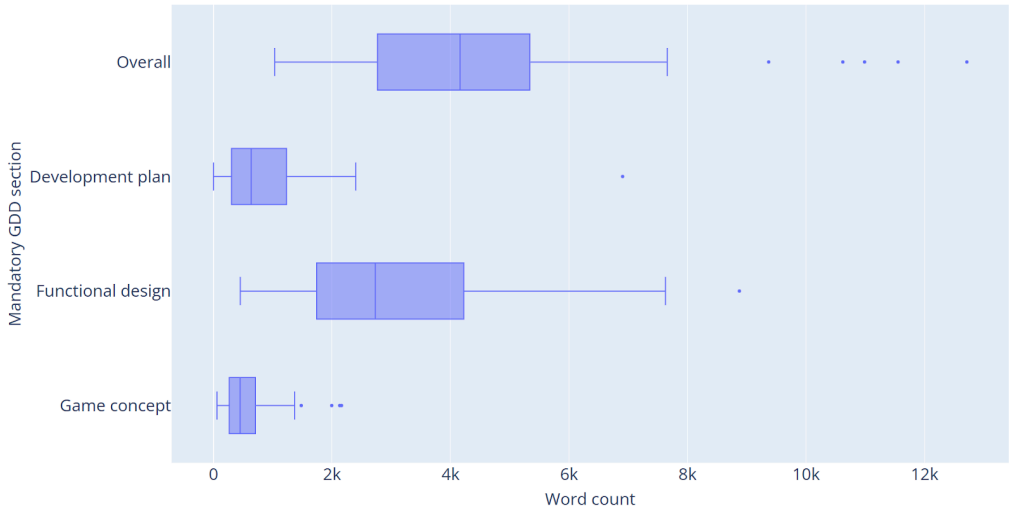

Figure 4: Length of the three mandatory sections in UPF's GDDs.

	Game concept	Functional design	Development plan	Overall
GDD count	40	40	40	40
mean	634.02	3153.525	955.27	4742.82
std	541.19	1989.11	1138.99	2840.53

Table 6: Statistics for the three mandatory sections in UPF's GDDs.

Temporal Analysis of GDD contributions

The temporal analysis of project contributions focuses on tracking the frequency and timing of updates made to both the Game Design Document (GDD) and the game prototype across the duration of the course. Using a version control system that records 224.229 changes across 50 student projects, we analyze the time intervals between updates to each component. Changes are categorized as either modifications to the GDD or adjustments to the prototype code. These updates are normalized to account for the length of the semester, allowing us to compare the relative frequency of updates to the GDD versus the game prototype. This analysis aims to reveal patterns in how students prioritize and allocate time to documentation versus development during the iterative game design process.

Temporal Analysis of GDD contribution results

Figure 5 displays the amount of time between updates to either the GDD or the game prototype. This analysis suggests game prototype iteration happens more frequently than the game design iteration.

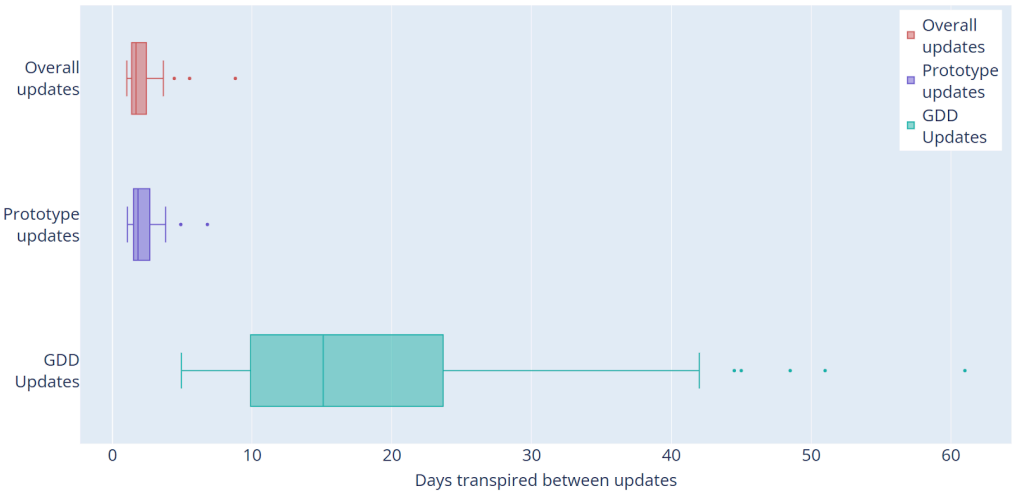

Figure 5: Average time between updates separated by section of the GDDs at UCM.

	Overall days between updates	GDD days between updates	Prototype days between updates
GDD count	50	50	50
mean	2.09	19.11	2.19
std	1.31	13.47	1.07

Table 7: Average time between updates of the GDDs at UCM descriptive statistics.

Discussion

Our findings on the use of Game Design Documents (GDDs) in video game design education align with several observations made in the literature, particularly regarding the challenges of bridging theory and practice in the context of developing video games. As outlined by some of the authors (Crawford 2003; Rouse 2004), the GDD is commonly seen as a tool to formalize the design process and communicate the vision of the game. However, our observations indicate that students in our courses tend to treat the GDD more as a final documentation tool, focusing primarily on the prototype rather than guiding the iterative design process. Students might focus on fullfiling the subject's mandatory requirements, prioritizing the final evaluation, and not really relying on it as a tool for design and development. This mirrors the concerns raised in the literature about the disconnect between theoretical frameworks for design and the practical realities of game development.

One of the key issues highlighted in our findings is the lack of documentation regarding design iterations. The iterative process is critical to game design (Fullerton et al. 2008; Salen and Zimmerman 2004), where continuous refinement and testing

inform the development of mechanics, narrative, and player experience. However, in our study, students rarely use the GDD to track these iterative changes, instead engaging in informal discussions in the lab sessions or through channels like Discord. Game developers often fail to recognize the importance of documenting the iterative design process (Keogh 2023), and it seems this extends to students too. Instead, their focus is on immediate technical execution, as they prioritize the prototype's development over reflective documentation.

The students' engineering background has them focus more on achieving the technical and functional aspects of the game prototype. Their efforts are more focused on achieving functionality than to iterate and explore mechanics and dynamics or to reinforce the narrative and communicative intent. This tendency echoes the criticisms raised in the literature about the gap between technical and creative aspects of game design. Some authors (Adams and Dormans 2012; Isbister 2016) emphasize the need for designers to understand the emotional and narrative implications of their game mechanics. However, our findings suggest that students are not yet fully equipped to appreciate or integrate these aspects into their design process. This results in GDDs that are heavily skewed toward the physical description of game worlds and characters, with less emphasis on the meaning or function of these elements within the game's broader narrative or mechanics.

Moreover, the GDD is an evolving document that should reflect ongoing changes in both design and development (Schell 2014). However, our data indicates that students tend to view the GDD as a static tool, finalized once the game concept is established. This observation aligns with critiques of GDDs that caution against overly long or convoluted documents (Ryan 1999; Kelly 2011), as students tend to add excessive detail on superficial elements of the game world (such as characters and objects) without adapting the GDD to changes made during the development process. This disconnect suggests that students may not fully understand the flexible, evolving nature of the GDD, as highlighted in discussions of game production studies (Sotamaa and Švelch 2021), where the design should be iterated alongside the craft or development work to reflect the realities of the production cycle.

The frequent use of lists, tables, and flow diagrams in the GDDs is also reflective of the students' technical backgrounds. As noted in previous studies on game design praxicology (Kultima 2018), the design process is deeply contextual and influenced by a range of factors, including team dynamics and project goals. In our case, the students' familiarity with structured, technical tools likely leads them to prioritize these elements in their GDDs, as they are more comfortable with the organizational clarity that lists and diagrams provide. This aligns with some authors (Godin et al. 2020; Keogh and Hardwick 2024; Sotamaa and Švelch 2021) that sustain game design education often faces challenges in balancing creative freedom with technical constraints, especially for students coming from engineering or computer science backgrounds.

Finally, the gap between design theory and practical application observed in our study reinforces the need for a more cohesive, adaptable methodology for teaching game design. Game design is an expressive medium that requires a combination of technical and creative expertise. However, our findings suggest that students often fail to integrate these two aspects, as their primary focus is on the technical execution of the prototype. This issue echoes concerns raised in the literature about

the difficulties of teaching the interdisciplinary nature of game design, which requires a balance of design theory, technical skills, and creative expression.

Conclusions

Teaching game design in higher education is a complex endeavor, made more challenging by the limitations of the existing literature when used in a teaching environment, the need for tailored guidance, the technical and teamwork-related obstacles students face, and the resource-intensive nature of evaluation. Our findings reflect several of the challenges described in the literature on game design education, including the lack of documentation and iteration in the design process, the focus on technical aspects over narrative and communicative goals, and the preference for structured, technical tools over more abstract design concepts. There is a pressing need for pedagogical approaches that address the specific challenges of teaching game design. By integrating insights from literature with observations from our own teaching experiences, we aim to develop strategies that better support our students and enhance their learning outcomes.

To address the challenges observed in students' use of the Game Design Document (GDD), several solutions can be proposed. First, fostering a deeper understanding of the GDD as a dynamic, iterative design tool rather than a final evaluation document is essential. This can be achieved by emphasizing the importance of continuous documentation throughout the design process, with specific workshops focused on documenting design iterations, rules, narrative, and game mechanics. We propose student self-evaluation of GDDs and the evaluation of the GDD schema as potential solutions that we are going to test in our next course. Second, encouraging the integration of informal communication channels, such as Discord or team meetings, into the formal design process could help bridge the gap between oral discussions and documented decisions. This involves training students in organizing and structuring meetings, to make their internal communication more effective and focused on solving specific objectives and issues that might arise during the design and refinement stages. The mandatory methodology could implement structured checkpoints where students must formally document and reflect on their design discussions, ensuring these incremental insights are captured in the GDD. Additionally, balancing more creative and narrative-focused tools into the curriculum (that still need to be researched but should be informed by real game development success stories) with engineering-oriented design tools like flowcharts and tables, would help students appreciate the interdisciplinary nature of game design. Finally, instructors could provide more detailed guidance on balancing technical and narrative elements in the GDD, offering frameworks and templates that guide students in creating a more holistic document that captures not only the game's audiovisual elements but also its mechanics, narrative, and user experience.

There are some limitations to this study that we acknowledge. The sample was taken from students from engineering courses. This has many implications (some of which we already mentioned), such as their preference for design tools they’re already familiar with, or their familiarity with the game engine and other game development tools. Also, the qualitative analysis was mostly performed in UPF, and the bigger quantitative analysis was performed in UCM. Both universities are located in Spain. Generalizing our findings would require involving other studies, preferably better spread geographically and demographically richer. Also, as mentioned before, we

suspect that studies that focus on design theory and practice, and do not have students implement their designs, might not face the obstacles we document in this study. Finally, our teaching lessons and the provided materials, which already give some schema for a GDD and guidance, could be biasing the results significantly. A larger, more heterogeneous sample would test the validity of our claims better.

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