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Gamification in Web Development Education: How Game Mechanics Enhance Engagement and Skill Acquisition

by

Herald Ago

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Under the supervision of Professor Andrea Valente

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Abstract

This thesis explores how gamification affects the motivation, engagement, and skill development of beginners in web development. The research is built around four guiding questions. First, how does traditional teaching influence students' motivation and their perception of learning outcomes. Second, what effect do specific gamification elements have on intrinsic motivation. Third, how helpful do learners find these features in practice. And finally, can gamification support the application of theoretical knowledge in real coding tasks.

To investigate these questions, a mixed-methods approach was used. Twenty-four master's students in IT-related programs responded to an anonymous questionnaire. They shared their experiences with conventional education and gave their opinions on common gamification features. The survey also helped identify motivational difficulties and learning expectations before the gamified intervention began.

Next, four participants were selected for a focused experiment. They first completed a coding task to evaluate their existing skills acquired through traditional education. After that, they worked independently through a four-week gamified course using FreeCodeCamp. Once the course was completed, they repeated the same task. This allowed for a direct comparison of their performance before and after the intervention. Finally, individual interviews were held to understand their experience more deeply, including aspects like motivation, enjoyment, and overall engagement.

The results showed that features such as instant feedback, visual progress tracking, and gradually increasing task difficulty helped learners code more efficiently, reduce mistakes, and feel more motivated. Survey responses also indicated that the gamified format felt more interactive and useful than traditional instruction. This research contributes to the existing literature by identifying which game-like elements are most effective for beginners in web development. It also provides concrete suggestions for educators and course designers who want to build more engaging and motivation-friendly learning environments in technical education.

1. Introduction

1.1 Context

Web development is one major skill among different industries in the current technology-driven world. It is no longer exclusive to software developers; figures such as digital marketing, business analysis, UX/UI design, and content management experts now more and more need coding abilities. The demand for dynamic web pages, mobile applications, and internet automation tools has necessitated quality coding courses with a great sense of urgency.

The fast evolution of technology is beginning to create new challenges in education. Traditional teaching methods are under increasing challenge from the need to engage a generation that is now fully digitalised and expects interactive and dynamic learning experiences. Unfortunately, traditional coding instruction has not kept pace with the evolving needs of today's students, leading to increased dropout rates in online coding courses and university programs.

In response, educators and researchers have started to embrace gamification, a practice that incorporates elements of game design in learning contexts, to enhance student motivation, engagement and learning outcomes.

Learning programming languages such as HTML and CSS, however, is notoriously difficult for novice students. Unlike conventional subjects with a linear learning process, learning to code requires integrating theoretical knowledge, logical reasoning, and practical application. This complexity can be difficult for new students to handle. The majority of students struggle to memorize syntax, proofread errors, and structure code, leading to demotivation and frustration (Luarn et al., 2023; Garcia-Iruela & Hijón-Neira, 2020). Conventional pedagogy on learning programming centers on memorization through rote and theory of instruction, which it becomes difficult for the students to transition from theory to practice.

1.2 Problem Statement

Though gamification is increasingly being applied in educational environments, its use in coding education for beginners is not yet well explored. Although several studies have demonstrated the effectiveness of gamification in areas such as corporate training, medical school and language acquisition, its possible influence on technical fields such as web development has yet to be studied.

Traditional pedagogical practices such as lectures, paper assignments, and passive reading of textbooks are typically insufficient for the next-generation learners who enjoy active, experience-based learning (Pradana et al., 2023; Kasahara et al., 2019). New web developers are likely to fail when required to apply theoretical principles in real-world scenarios. Gamification can be a novel solution in such situations by offering systematic, goal-oriented learning experiences that bridge the gap between theory and practice.

Despite the optimistic findings in most of the studies, there are still some knowledge gaps regarding gamification's impact in technical education. Although a good amount of research has already proven that gamification can enhance motivation and engagement, little evidence exists about which game elements are most effective at enhancing learning outcomes, especially for novice learners in web design and web development. Conventional teaching practices struggle to cross that bridge between theory and practice, and most new learners find themselves unprepared and demoralized.

Moreover, although numerous studies have explored gamification in overall learning environments as well as code correctness-based courses in programming specifically, fewer have been specifically aimed at its use in the creative and technical realms of web development. This deficiency highlights the need for a focused study into how certain gamification elements, through their incorporation into a structured e-learning environment, can support and enhance novice web design learning experiences.

In the last ten years, research has shed light on the potential of gamification in learning. Initial research by Deterding et al. (2011) established the foundation by defining gamification as "the use of game design elements in non-game contexts," and following literature has

documented its potential to revolutionize learning spaces. In software programming education, for instance, competitive elements such as leaderboards based on code quality metrics (e.g., cyclomatic complexity) have been shown to promote higher-quality code while maintaining the core purpose of solving the problem (Kasahara et al., 2019). Similarly, gamified web-based learning systems for web design have been shown to enhance learner engagement with the learning process becoming more interactive and enjoyable (Pradana et al., 2023).

This study aims to bridge the gap in current literature by exploring the influence of gamification on participation and learning skill among novice web developers, which could be an effective contribute to traditional teaching in technical education.

1.3 Research Questions

In response to identified gaps (see Chapter 3) in the literature review (particularly those related to the specificity, context-dependence, and measurement of gamification effects) this study aims to determine which gamification elements best enhance motivation, engagement, and learning performance among novice web developers. Although previous research shows that gamification can raise student motivation, there is little consensus on the impact of specific game features when applied to technical and creative learning environments.

To achieve this overall objective, the research is guided by the following key research question: “What gamification elements are most effective in boosting motivation, engagement, and learning achievement for web design and web development beginners?”

To tackle this general question in depth, the study is structured around a series of particular sub-questions:

- RQ1: How does traditional university pedagogy influence the motivation of beginner learners and shape their perceptions of learning outcomes?

This question seeks to analyze the effect of traditional teaching methods on both the motivational side and the perceived effectiveness of learning among beginners. By collecting questionnaire data from current and former students, research seeks to evaluate self-reported levels of intrinsic and extrinsic motivation along with students' evaluations of how well traditional pedagogy facilitated their overall learning outcomes. This assessment will help to identify the strengths and limitations of the conventional approach, providing indications of its role in motivating students and influencing their academic success.

- RQ2: How do different gamification elements (e.g., points, badges, leaderboards, challenges, feedback) influence the intrinsic motivation of beginner learners?

In response to this question, the research seeks to qauntify and analyze the impact of individual elements. By investigating differences in intrinsic motivation, the study examines which elements appeal most to novice students and how these elements may motivate long-term participation in a nongame environment.

- RQ3: What are novice students' perceptions regarding the usefulness and effectiveness of these gamification elements in their learning process?

In addition to the measurement of motivational outcomes, it is also necessary to be aware of students' subjective experience. This question will yield qualitative data on students' views about each feature. Being aware of these views can assist in clarifying potential trade-offs, for example, when extrinsic rewards reduce intrinsic motivation.

- RQ4: How can the application of specific gamification elements be optimized to facilitate the transition of theoretical knowledge into applied skills in web development?

The goal, finally, is not only to increase motivation, but also to improve learning outcomes. This research aims to understand which combinations of gamification elements and contexts are most effective. This question might initially suggest that a long-term study is necessary to make a very good assessment, but my research is designed to capture significant, observable changes within a one-month period. The choice of this timing is due not only to logistical constraints, but also to the fact that previous research suggests that even relatively short,

intensive interventions can lead to measurable improvements in technical skills and learning attitudes (Kashara et. al., 2019 ; Pradana et. al, 2023).

In the present study i use a mixed-methods design to compare the effectiveness of learning web development through gamification-based platform and traditional pedagogy (e.g. university classes). Quantitative data will be collected via questionnaires, while qualitative data will be gathered through pre- and post-test evaluation and face-to-face interviews. This methodological approach facilitate to measure both quantifiable changes in performance and motivation, and a more detailed understanding of how students experience and internalise these changes.

The research is divided into two main phases. First, I collect data on their general views of traditional methods and their perceptions of gamification via an anonymous questionnaire. Next, I will test the website creation skills of four volunteers. The purpose of this phase is to understand students' general views of traditional pedagogy and their thoughts on gamification. Secondly, I want to examine how traditional education has affected the students' perceived skill levels and motivation.

After that, the participants will work through a guided web development module on freeCodeCamp, a website that is well-known for its practical approach to learning code. Post-intervention tests will then be conducted to assess their technical skill progression, perception and motivation. In addition, in-person interviews with the focus groups will provide valuable qualitative feedback on their learning experiences and how they perceive the transition from theoretical understanding to applied skills.

The combination of quantitative and qualitative methodologies will allow us to make a comprehensive evaluation of the effectiveness of the intervention. The combined data will provide empirical results and real-world perspectives on how to create more successful gamified learning environments in technical education.

1.4 Significance of the Study

This research aims to contribute to the literature on gamification in web development and web design learning by offering experiential information to educators, instructors, and game-based learning platform developers. Analyzing the most appropriate gamification features, this study seeks to:

- Enhance the motivation and engagement of novice web designers and web developers.
- Improve learning and skill acquisition with interactive learning methods.
- Provide concrete recommendations to educators for using gamification in coding instruction.
- Use empirical evidence to create effective gamification strategies for game-based coding sites and hopefully professors too.

In addition to its immediate contribution to coding education, this work is also in line with future trends in digital learning.. It can also inform the development of adaptive learning systems, AI-driven gamification and personalised web development education. This research is valuable for two reasons. Theoretically, it contributes to the literature on gamification by describing the role and impact of certain game elements on technical learning.Practically, its findings will directly support professors and instructional designers in developing e-learning systems and improved traditional classes that can enhance student performance, reduce dropout rates and teach the skills needed to engage with the new digital-generation of students.

1.4.1 Challenges in Gamified Web Development Education

While gamification has worked in other learning contexts (eg. Language learning), its implementation in web development education is challenged by some issues:

- Combining intrinsic and extrinsic motivation: Focusing too much on extrinsic rewards (e.g. badges or points) may cause students to prioritize achievement over depth of learning.
- Preventing cognitive overload: If gamification components are not implemented properly, they will cause distraction instead of increasing learning efficiency.
- Measuring effectiveness: Unlike traditional tests, gamification learning environments must have alternative performance metrics to measure skills gained separate from game performance.

With these problems and limitations in mind, this research will give useful guidelines on effective utilization of gamification within web development training.

1.5 Thesis Structure

This thesis has six main chapters, all of which contribute to creating a general image of gamification in web design education:

- Chapter 2 Theoretical Framework: This chapter presents the conceptual foundation. It reviews the main learning theories relating to gamification, such as Experiential Learning, Self-Determination, Flow and Constructivist theories, and explains the key gamification design models, including the frameworks of Werbach & Hunter and Deterding et al. Together, these theories and models provide an understanding of how and why game elements can support learning.

- Chapter 3 Literature Review: This chapter provides a general overview of research on gamification in education. Beginning with general studies of the effects of gamification on student motivation and learning, it then focuses on studies specific to coding and web development education. It summarises the findings and limitations of past research and identifies critical gaps and open questions that the current study aims to address.

- Chapter 4 Methodology: The methodology section explains why I opted for an anonymous questionnaire, a pre and post coding task and one-to-one interviews, highlighting their practical, ethical and analytical suitability, and justifying why other

methods such as ethnography, focus groups, usability tests or randomised trials were not appropriate for this short, small-scale study.

- Chapter 5 Research Design and Tests Running: This chapter describes how the study was conducted. It describes the participants, the data collection methods (which included an online questionnaire, practical coding tasks, interviews and analysis of student activity on the learning platform) and the approach to data analysis. The chapter also discusses ethical considerations and acknowledges the study's limitations.

- Chapter 6 Results and Discussion: This chapter presents and interprets the empirical findings. First, it reports the quantitative results of the surveys, which show novices' perceptions of traditional teaching and their responses to different game elements. Then it summarises key patterns from the hands-on coding project and the student interviews. Together, these results provide a general explanation of the effect of the gamified intervention on engagement, motivation and learning.

- Chapter 7 Conclusion: This final chapter interprets findings in the context of theoretical framework and literature review, makes comments regarding implications for education practice, and offers recommendations for future studies. It also refers to the study conducted here regarding its strengths and limitations and makes recommendations for future studies.

- Chapter 8 Aknowledgments: In the Acknowledgments, I thank all those who helped and supported me during my studies and the preparation of this thesis.

2. Theoretical Framework

This chapter provides the conceptual basis for researching the effect of gamification in web development training, focusing on novice learners. It integrates findings from two main fields: learning theories that explain motivation, interest and how competence is built, and gamification frameworks that describe how game mechanics should be applied in non-game contexts. Together, these perspectives offer a robust theoretical basis for this research and will contribute further empirical studies.

2.1 Learning theories

Another key reason for using gamification in education is its ability to engage students' intrinsic motivational drivers and encourage them to work. Various established learning theories helped me to provide an explanation as to why incorporating game elements into educational practice will be more effective. Four such theories are described here and are particularly relevant to web development education.

2.1.1 Experiential Learning Theory

Experiential Learning Theory (ELT), which was constructed by Kolb (1984), proposes that learning is a cycle of four phases: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Learning, as proposed by this model, is accomplished by experiencing actual real-life problems and tasks directly, reflecting on the experience, generalizing, and trying out the ideas in new situations.

As an example, let us consider a class in web development where the student is assigned to design a basic webpage with HTML and CSS. Through this concrete experience, the student is confronted with real-world problems, such as layout problems or syntax errors, that need to

be fixed right away. Considering these types of problems and trying out different solutions helps students to understand the "how" and the "why" behind design choices.

Gamification strengthens the cycle by applying game mechanics that facilitate progressive improvement. When a learner fixes a bug and receives prompt feedback in the form of a progress bar or badge, the experience cycle is confirmed once again. These mechanisms transform the process of debugging into a smooth, interactive experience that leads to a deeper understanding and better memorisation.

However, it is important to remember that not all experiential learning is equal. Poorly designed gamified experiences can fail to provide helpful feedback and may confuse learners about basic concepts. Therefore, it is a significant challenge to ensure that gamified elements enhance the experiential learning cycle.

I personally find Experiential Learning Theory particularly useful because it emphasizes the importance of learning through real experience, reflection, and experimentation. In my research, I utilize a gamified interface where students learn with real coding problems. The theory supports the fact that learning by doing, or hands-on practice, plays a crucial role in learning to code. However, I also know that even though Experiential Learning Theory accounts for the process of real-world application and reflection, it doesn't cover some of the motivational factors (e.g., rewards, competition) specifically relevant to gamification. It is because I blend it with other theories in order to account for both the process of learning as well as motivational factors.

2.1.2 Self-Determination Theory

Self-Determination Theory (SDT) by Deci and Ryan (2020) focuses on the role of intrinsic motivation in effective learning. According to SDT, three basic psychological needs must be met for maximum motivation: autonomy, competence, and relatedness.In the classroom, if students feel that they are in control of what they are doing (autonomy), are assured that they can do it (competence), and have supportive interpersonal relationships (relatedness), they are likely to become completely and durably engaged with the material.

Gamification address these needs more explicitly. For example, giving learners the autonomy to choose coding exercises from a selection of options, or customising the learning environment, allows them to feel more in control. Similarly, frequent positive feedback in the form of points or badges helps learners to maintain a sense of competence. Discussion forums, peer challenges, and group collaboration promote a sense of connection, even though they differ a lot from real-life classes and courses. These factors are especially important in web development courses, which require a combination of creative and technical skills and necessitate long-term support.

However, there are risks associated with relying too heavily on external incentives. If students focus only on earning badges or moving up a leaderboard, they lose sight of the intrinsic value of learning. Therefore, it is essential to achieve a balance between internal and external motivations. We will discuss this topic further when we consider gamification models.

Self-Determination Theory (SDT) is relevant to my research since it addresses the intrinsic motivation of students as a function of their need for autonomy, competence, and relatedness. SDT provides us with a solid foundation for understanding intrinsic motivation, but does not offer explicit strategies for incorporating gamification. For this reason, while I use SDT to explain why students will be intrinsically motivated, I also consider other theoretical frameworks to address the extrinsic motivators introduced by gamification.

2.1.3 Flow Theory

Flow Theory, formulated by Csikszentmihalyi (1990), is a psychological condition of being completely involved and immersed in doing something. The condition is described as being completely focused, losing self-awareness, and feeling joy that can strengthen productivity and creativity. Flow occurs when there is ideal matching between challenge and learner's ability level (e.g., too low challenge level leads to boredom, and too high leads to frustration).

In a gamified web-based development setting, flow can be induced by providing tasks that become progressively more difficult as the learner's skills enhance. For instance, a coding site can provide a set of challenges that begin from low-level HTML tasks and proceed to

progressively more difficult CSS challenges. The incorporation of time constraints or dynamic feedback mechanisms maintains learners' focus and can push them into flow. This ongoing adjustment of challenges and skills maintains learners' engagement.

However, inducing a state of flow in a learning context takes planning. Incompetent task challenge to student ability matching can readily ruin the flow state by causing the task to be too easy or hard.

Flow Theory taught me that students are able to achieve a state of total absorption, in which their abilities precisely correspond to the degree of challenge they are encountering. In my project, I plan to use Flow Theory as a model for comparing effectiveness of traditional lecture and gamification at bringing about this ideal condition. In particular, I experiment with whether classroom settings that make use of gamification more effectively assist students in arriving at a state of increased engagement compared to traditional lectures.

Last but not least, I would like to explore if instant, constant feedback (an element of gamification) would be more engaging than occasional feedback one would receive in class lectures.By measuring items such as levels of concentration, time perception and general enjoyment, I can determine which method more reliably induces a state of flow. Ultimately, this study will enable me to establish whether gamified learning environments offer a measurable advantage over more conventional teaching methodologies when it comes to producing absorbed learning experiences.

2.1.4 Constructivist Learning Theory

According to Constructivist Learning Theory, as developed by Piaget (1952) and Vygotsky (1978), students actively construct their own knowledge through experience rather than passively absorbing information. This theory emphasises the importance of social interaction, context and experiential problem solving in the learning process.

Web development is by nature a constructivist process. Rather than passively learning and memorizing code syntax, students build projects, debug and learn through error. Gamified

learning environments facilitate this constructive knowledge building through cooperation and experimentation. For instance, environments that permit students to publish code, receive feedback from peers and collaborate on projects foster a sense of community. Here, students can observe different approaches to problem-solving, discuss alternative solutions, and develop a richer understanding of web development concepts together.

In addition, the adaptability of gamification allows instructors to create learning activities that are learner-centered for students' unique needs and interests. If students are permitted to choose projects or personalize challenges, they are more likely to listen to the content in a meaningful way. However, the success of this approach depends on the quality of interactions and challenge provided, which requires thoughtful instructional design.

Constructivist Learning Theory it is important for me because it is concerned with how students build their own knowledge through interaction and collaboration. I see a marked lack in most gamified online environments, in that the social aspect inherent to face-to-face classroom learning does not exist. In my investigation, I would like to explore how this lack of social component might affect the learning outcome, and whether integrating collaborative elements would positively affect the overall learning process.

I propose that social interaction be deliberately integrated into online gamified environments. For instance, mechanisms such as discussion boards, collaborative tasks, and peer evaluation systems can be employed to simulate the collaborative setting of traditional pedagogy.

Within Chapter 5, I seek to discuss how important real social interaction is to my interviewees and measure their sentiments regarding the effectiveness of such interaction in a learning setting. This will involve collecting qualitative and quantitative information on whether students perceive increased social elements in online, gamified environments to have a tangible impact on their engagement and comprehension. My ultimate goal is to ascertain whether including social interaction can bridge the gap between the advantages of collaborative learning in traditional settings and the benefits of gamification's adaptive, interactive elements.

2.1.5 Summary

In brief, I consider Experiential Learning, Self-Determination, Flow, and Constructivist Learning Theories as mutually complementary components of my theoretical model. Each of the theories has unique insights to offer regarding different aspects of learning and motivation for my research purposes. By blending these perspectives together, I intend to build an integrated framework in order to explore how gamification elements influence the motivation and learning performance of web development students.

2.2 Gamification Models and Frameworks

Whereas learning theories explain why gamification is effective, gamification frameworks and models provide practical insights into how to go about using it. This section gives a brief overview of three commonly known frameworks especially beneficial in gamifying web development courses.

2.2.1 Werbach & Hunter's Six Steps of Gamification

Werbach and Hunter (2012) offer a practical model dividing gamification into six straightforward steps. The model has been broadly adopted due to its simplicity, actionability, and direct applicability to learning systems.

- Define Objectives: Establish specific and measurable learning objectives. For a web development course, objectives might be to improve coding speed, build debugging skill, or encourage peer-to-peer collaboration.
- Define Target Behaviors: Identify specific behaviors that the gamification features must encourage, such as ongoing problem-solving, adherence to coding best practices, or peer review.

- Define Players: Identify the characteristics and needs of your students. Since the audience is beginners, gamification must be friendly and assistive in nature and not competitive.
- Design Activity Cycles: Create a series of interrelated challenges and feedback loops allowing students to build incremental steps toward the final result. Every cycle should offer opportunities for students to reflect on performance and repeatedly revise.
- Don't Forget the Fun: Ensure learning is enjoyable. Adding narrative dimensions or real-life problem contexts makes routine activities exhilarating.
- Use Appropriate Tools: Pick fitting gamification tools such as points, badges, leaderboards, and progress markers that complement the learning objectives and targeted behaviors.

The methodical process not only supports the development of successful gamification designs, but also offers a foundation for assessing their effect on learning outcomes.

2.2.2 Deterding et al.'s Gameful Design

Deterding et al. (2011) offer a different perspective with the "gameful design" approach with a particular focus on using game elements to foster intrinsic motivation. Gameful design is distinct from typical game design in that, instead of superficial rewards, meaning and interest are prioritized.

Some of the most significant gameful design principles include:

- Intrinsic Motivators: Designing challenges that naturally induce curiosity and the desire for mastery, rather than relying on extrinsic motivators like points or badges.
- Adaptive Feedback: Providing learners with real-time, adaptive feedback that tells them about their progress and where they need to improve. Adaptive feedback makes sure students are neither overwhelmed nor under-challenged.
- Player Autonomy: Allowing learners to make choices about their learning path, which supports self-directed learning and aligns with the principles of Self-Determination Theory.

This framework is especially valuable in technical education, where the ultimate goal is to instill a genuine passion for learning rather than a mere pursuit of rewards.

2.2.3 Marczewski's Player Type Framework

Marczewski's (2017) Player Type Framework categorizes learners based on their motivational profiles, providing a way to determine how different gamification elements may engage diverse groups. According to this framework, learners typically fall into one or more of the following types:

- Achievers: Driven by specified challenges and tangible rewards, achievers are motivated by measurable improvement and badges.
- Explorers: Explorers are motivated by curiosity, and they enjoy open-ended exercises that allow room for creativity and discovery.
- Socializers: They value interaction and collaboration.
- Killers: Innate competitors, killers are motivated through the potential to dominate other people (for example on leaderboards).

2.3 Their importance for my research

Gamification models and frameworks guide me in setting up both the quantitative and qualitative parts of my research on gamified learning in web development education.

For example, Werbach and Hunter's model helps me define clear learning objectives and target behaviors. With these steps, I can establish specific performance metrics, including coding time or debugging ability, and then track improvement via pre and post intervention tests. A well-crafted questionnaire will also capture students' views on the clarity of these goals and how helpful they find continuous feedback.

Deterding et al.'s approach focuses on things like, adaptive feedback, and giving learners choices. With this model, I can create simple metrics for assessing how motivating and engaging students find. Further, interviews and tests will provide me with a clearer idea as to whether or not these design principles deliver a more enjoyable, more satisfying learning experience.

Marczewski's Player Type Framework helps me divide learners, when and if needed, into groups based on what motivates them such as achievers, explorers, or socializers. I can analyze my survey data to see if certain groups benefit more from specific gamification elements. Also, in interviews, I explore how different types of learners feel about the mix of competition and teamwork in an online environment.

In short, these models let me clearly set the variables I need to measure and help me design the interview questions and surveys. This makes it easier for me to evaluate both the actual performance changes and the personal experiences of learners in the gamified learning context.

2.4 Final discussion

Combining learning theory and gamification models shows how teaching methods and practical design work together. On the one hand, theories like Experiential Learning, Self-Determination, Flow, and Constructivism provide a theoretical foundation for why game-based learning designs can generate higher engagement and better learning outcomes. They all emphasize active participation, good feedback, learner autonomy, and social interaction, all of which are essential for learning hard technical skills.

On the other hand, models such as Werbach & Hunter's Six Steps, Deterding et al.'s Gameful Design, and Marczewski's Player Type Framework offer concrete guidelines for operationalizing these principles. For example, while Self-Determination Theory underscores the necessity of supporting learner autonomy, gameful design provides actionable strategies (such as offering customizable learning paths and adaptive challenges) to achieve this goal.

Also, the emphasis of Flow Theory on the appropriate balance between challenge and skill is best attained by the systematic activity cycles proposed by Werbach & Hunter.

Furthermore, the diversity of learner profiles, as highlighted by Marczewski's framework, reinforces the need for a flexible approach to gamification in education. By tailoring game elements to address the unique motivations of different player types, educators can create a more personalized learning environment that not only engages but also nurtures long-term skill development.

In sum, the combination of this theories illustrates that successful gamification of web development learning depends on a two-sided strategy: having knowledge of the underlying psychological and pedagogical mechanisms, and applying design methods responsive to the different needs of inexperienced learners. This perspective is the basis for the structure of this thesis, guiding both methodological strategy and interpretation of empirical findings in subsequent chapters.

3. Literature review

The chapter has a detailed and extensive literature review of gamification in education, including its application in programming and web development training for novice learners. The review is organized into several sections, beginning with an overview of gamification in education, then a general discussion of studies examining its overall impacts on student motivation, engagement, and performance.

The review goes on to examine coding instruction and web development specifically and how gamified learning can be designed to address the specific requirements of novice learners in these areas. The extensive literature review not only illustrates the state of the art of research on gamification but also delineates general gaps and problems warranting the emphasis of the current study on optimizing game mechanics for technical content learning.

3.1 Introduction to Gamification in Education

Gamification is the application of game design mechanics such as points, rewards, leaderboards, challenges, and immediate feedback within non-game contexts. This concept, which initially emerged during the early 2000s and then found favor with scholars like Deterding et al. (2011), has been applied in a vast number of industries from business to health and education. In education, gamification has been taken up as an innovative way of transforming old, often passive, teaching approaches into engaging, interactive experiences that access both intrinsic and extrinsic motivation.

Essentially, gamification is based on the premise that learning must be as engaging as play. By introducing game-like features typical of games, including reward for correct response without effort, tracking progress, and competitive or cooperative challenges, educators aim to take advantage of the natural human inclination towards play. Besides creating a more immersive learning experience, this helps keep students focused in the long run.

In web development education, gamification is particularly required. Web development is a discipline that requires technical skills and creative problem-solving skills. Traditional methods of teaching, especially theoretical study and memorization, might not be sufficient to offer the practical experience required to learn coding and design. Gamification offers a way to bridge this gap by offering a platform where theory and practice meet in the form of interactive exercises that mimic actual work. Students who have been brought up with interactive digital media are especially likely to appreciate such approaches, matching their learning expectations of immediacy, interactivity, and customization.

In addition, the digital revolution has also made a significant impact on education content delivery and consumption. With digitalization, students have grown to expect learning experiences that are interactive, flexible, and personalized. Gamification is easily able to accommodate these expectations, with its dynamic challenge and adaptive feedback capable of modifying its difficulty level in accordance with the student's level of skills. Such flexibility is particularly useful for technical areas of study, with technology rapidly changing and requiring ongoing updates in learning.

3.2 Gamification in Educational Contexts

There has been significant research that has examined the impact of gamification on learning accomplishments in different learning settings. Most studies suggest that if game elements are incorporated into learning tasks carefully, they can induce significant student motivational, engagement, and learning increases. For instance, Luarn, Chen, and Chiu (2023) in 'The Influence of Gamification Elements in Educational Environments' demonstrated how aspects such as perceived collaboration, competition, and positive feedback are significant in promoting intrinsic motivation to learn. These studies have applied various approaches from experimental studies, case studies, surveys, to meta-analyses in investigating the various impacts of gamification.

One of the key findings in all general research is the necessity of instant feedback. Multiple studies have substantiated that immediate, dynamic feedback (e.g. points awarded, leaderboard refreshed, hints etc.) can significantly heighten the sense of accomplishment

among learners. For instance, in studies that have taken into account how gamification affects class participation, it was found that students who were provided feedback in real-time were more likely to change their approaches to learning and persist with challenging assignments. This finding gives support to the hypothesis that gamification, together with rewarding correct responses, encourages sustained loops of skill acquisition and reflection.

While at the same time an overabundance of extrinsic motivators can take away from the intrinsic pleasure of learning. As students are so focused on receiving rewards, they will forget intrinsic value of the material. This is a conflict and has led researchers to give an harmonious balance that subtly adds extrinsic motivation without displacing intrinsic motivation. Garcia-Iruela and Hijón-Neira (2020) found that although short-term immediate feedback mechanisms work well, avowed dependence on extrinsic rewards has the consequence of reducing intrinsic motivation over time.

Further, the research work carried out by Mohd Hishamuddin Abdul Rahman et al. (2018) as well as the research work carried out by Bozdag and Van Den Hoven (2015) also emphasized the importance of context. Success in gamified interventions appears to vary significantly depending on the subject, learners' background and age, and features of the gamified system at hand. For example, gamification has proved effective in language acquisition and mathematics, whereas the argument for more technical or creative subjects might include a different kind of design strategy. This context-dependence would mean that the findings of general research do not necessarily apply directly to specialist contexts like web development but must be properly translated.

3.3 Gamification in Web Development and Programming Education

Compared to the overall gamification literature, research in programming education and web development is more differentiated about its benefits and drawbacks. Programming is, by its very nature, an iterative process of learning not only theoretical concepts but applying them in real-world, often trial-and-error, environments. And therefore web development education encompasses both technical skills in coding as well as creative skills in designing and user-experience. Computer programming education is different from other educational

areas. Computer programmers get annoyed with the intangibility of programming, i.e., something goes wrong and the entire program will not execute. In an attempt to counter such challenges, there are some research studies that have investigated the application of gamification to enhance the joy of coding and encourage iterative learning. For example, the paper "Applying Gamification to Encourage Students to Write Quality Code in Programming Exercises" (Kashara et al., 2019) explores whether the use of competition mechanics (e.g., leaderboards based on cyclomatic complexity) can get students to improve their code quality. The study demonstrates that even though the number of coding problems solved could be the same, code quality is greatly improved with a gamified environment. Students learn to become more truthful, striving not to create unnecessary complexity in their code and refining their coding habits.

This study, and numerous others in the field, demonstrates the requirement for feedback loops. As students receive immediate, quantifiable feedback on the correctness of their coding, they are in a better position to examine their mistakes and attempt various attempts. This method of multiple learning is core in computer programming instruction, where success relies upon trial, mistake, and continuous refinement.

3.3.1 Gamification in Web Development Education

Web development training merges technical and creative competence. Learners are required to master coding and design concepts, user interface design, and aesthetics. The dual nature of web development presents certain distinct opportunities and challenges for the implementation of gamification.

One example of how gamification can be specifically designed to address the particular demands of web development is the research "Development of Gamification-Based E-Learning on Web Design Topic" (Fajar Pradana et al., 2023). In the research, an e-learning platform was created especially for studying HTML and CSS. The platform incorporated various game mechanics like points, experience bars, badges, interactive quizzes, and progress bars. These sorts of functionalities were intended to encourage students to program as much as to utilize the artistic elements of web design. As an example, there existed

challenges for students to try out various layouts, color combinations, and design patterns, and thus developing both technical skill and aesthetic judgment.

The study also reported high levels of student satisfaction and engagement, suggesting that gamification can transform the hard process of web development learning into an interactive and enjoyable experience. The platform facilitated personalized learning paths, allowing learners to select projects that matched their interests and skill levels In addition, the visual feedback in terms of progression and instant feedback allowed students to track their progress, an element which is critical in sustaining motivation in the long term.

In addition, the visual feedback in terms of progression and instant feedback allowed students to track their progress, an element which is critical in sustaining motivation in the long term. The other essential element featured in the literature is the integration of social interaction and collaboration in web development teaching. In contrast to conventional programming classes where students tend to work in isolation, web development is made more robust in collaborative learning settings where students are able to exchange ideas, provide one another with critiques of their designs, and resolve design problems together. Gamified communities that include social features like peer review and discussion forums can build support and community. This kind of socializing not only improves learning results but also reflects the cooperative nature of the professional web development field.

3.4 Research Gaps and Critical Analysis Identified

The literature in this chapter demonstrates the benefits of gamification for motivation, participation and learning performance in various learning environments. Furthermore, the review identified some research gaps issues that directly impact the direction of this study. Below is an overview of the gaps and their implications that are most relevant to my research:

Gap	Description	Implication
1. Gamification Elements	Lack of analysis of individual elements.	Study effectiveness of specific gamification elements.
2. Context-Dependent Efficacy	Gamification's success varies by context.	Adapt gamification to web development needs.
3. Intrinsic vs. Extrinsic	Overuse of extrinsic rewards may hurt intrinsic motivation.	Balance intrinsic and extrinsic motivators.
4. Learning Outcome Measurement	Traditional assessment tools are insufficient.	Develop better assessment measures.
5. Long-Term Impact	Short-term effects may not be sustainable.	Focus on short-term effects, not long-term sustainability.
6. Social Interaction	Lack of collaboration and social elements.	Integrate social interaction in gamified environments.

Table 1. The table describes the gaps and explain theirs implication.

The subsequent subsections discuss these gaps in more detail.

3.4.1 Specificity of Gamification Elements

One of the most important ideas in the literature is that gamification works, but most studies look at gamification as a whole and do not look at the different parts. Research like that by Askehave and Ellerup (2005) shows that digital genres are difficult to fit into traditional frameworks. This means we need to look at each part of gamification on its own in different

situations. But right now, we don't have enough evidence to say for sure which of these things work best in the specific environment of teaching web development. Students in this field must be able to understand both the technical, coding-centric side of programming and the creative, design-centric side of design. Literature has not yet decided if competitive mechanisms like leaderboards are better than collaborative structures like peer review, or if a combination of the two is better than each on its own. This means we need a strong design that uses both quantitative and qualitative methods. We need to compare how well the players do with how they feel about the different gaming elements.

3.4.2 Context-Dependent Efficacy of Gamification

A second key gap identified in the literature concerns the significant impact of context on the effectiveness of gamification. Although aggregate research shows that gamified interventions are highly successful in subjects such as language learning and mathematics, it is not possible to apply these results to areas such as web development and programming.

As Bozdag and Van Den Hoven (2015) have demonstrated, gamification's success is strongly context-dependent and therefore underscores the need for closely tailored interventions in such complex areas as web development. Technical problems and design demands characteristic of web development mean that it must be approached through a tailored gamification solution. For instance, the course on computer programming can employ leaderboards in order to encourage minimization of errors and optimization of code, whereas the course on web design would need to come up with something that could assess creativity and taste.

3.4.3 Balancing Intrinsic and Extrinsic Motivation

The interplay between intrinsic and extrinsic motivation is one of the central topics of debate within gamification research.

Many studies have shown that, when students become too preoccupied with attaining external markers of achievement, they lose sight of the inner aspects of learning. Baker and

Potts (2013) contribute to such a phenomenon by describing how excessive dependence on external rewards can detract from the intrinsic value of learning.

This is particularly relevant in technical instruction, where the ultimate aim is to develop a deep understanding of coding practices and design patterns. For novice web developers who are in the early stages of developing technical competence and creative confidence, it is crucial that gamified systems foster intrinsic motivation rather than merely rewarding shallow success.

3.4.4 Measurement of Learning Outcomes

Another major challenge is measuring learning outcomes in gamified environments. Traditional measurement tools (e.g. tests, quizzes or the quantity of problems solved) may fail to capture the multidimensional benefits of gamification. In technical training, particularly in subjects such as web programming, students must acquire not only factual knowledge, but also practical skills and creativity abilitiesMuch of what is currently known relies on short-term measures of performance (e.g. coding test scores or task completion rates) which do not show longer-term retention, theoretical knowledge applied to practical problems, or creative design processes. As Bateman, Delin and Henschel (2007) have illustrated, then, conventional evaluation techniques are not suited to measuring the multi-faceted benefits of gamification, and more integrated and holistic assessment tools have to be developed.
Therefore, it is imperative to develop alternative, integrated assessment measures that can capture both quantitative and qualitative learning. These new measures must capture both short-term impact and long-term value in terms of sustaining skills, generating creativity, and maintaining learner engagement.

3.4.5 Long-term Impacts of Gamification

Many studies show that gamification can initially boost student engagement, but this effect often wears off once the 'game' element is no longer new. If challenges are not updated regularly (e.g. by varying the difficulty or incorporating new types of feedback), students may

become bored and revert to their previous habits. Bozdag and Van Den Hoven (2015) emphasise that maintaining high motivation requires constant adjustments to the system, and Khaleel et al. (2016) stress the importance of iterative feedback loops to prevent engagement from waning. In an ever-evolving field such as web design, it is therefore critical to design gamified solutions that adapt over time, and to conduct longitudinal studies to confirm whether the initial benefits endure.

3.4.6 Combining Social Interaction and Collaboration

One under-explored area is how to integrate social collaboration into gamified learning environments. While most gamification focuses on individual achievement or competition, teamwork can be an even stronger motivator, particularly in web development where projects rely on collaborative problem-solving and feedback. Bresciani and Eppler (2013) found that team challenges and peer review can greatly enhance collaborative learning and knowledge construction in technical subjects. In a web development context, features such as group coding tasks, discussion forums and structured peer feedback enhance individual skills and build a supportive learning community. However, clear guidelines on how to design and implement these social elements within a gamified framework are still lacking. Further research should investigate which collaborative mechanics best complement game features to boost motivation and learning outcomes.

3.5 Summary, Implications and Conlusion

This literature review confirms that gamification has great potential to improve learning outcomes like motivation, engagement, and performance. However, in web development education it will only be effective if several key issues are addressed. For example, the literature suggests we must:

- Identify which game elements work best for both technical coding and creative design skills.

- Tailor gamification strategies to the dual nature of web development (since coding and design have different demands).
- Balance extrinsic rewards and intrinsic motivation to keep learners truly interested (over-relying on points or badges can backfire).
- Develop evaluation methods that capture both short-term progress and long-term learning outcomes.
- Plan for sustainability by continuously updating the gamified system to maintain engagement.
- Incorporate social and collaborative features (like team challenges and peer review) to boost both individual and group learning.

These insights set a clear roadmap for my study. Instead of optimizing gamification in general, I will focus on individual elements and their relation to learning outcomes for novice web developers. This approach aligns with findings that specific game elements can independently stimulate intrinsic motivation (e.g. Deterding et al., 2011), so each element deserves careful examination.

I plan to use a mixed-methods approach: quantitative performance data (like coding scores) will show measurable impacts, while qualitative feedback (from surveys and interviews) will capture students' experiences and views. Together, these methods will give a fuller picture of how each element contributes to learning and motivation.

The research shows that, overall, gamification can boost engagement and performance, but it also has its limitations. Many studies agree that features like immediate feedback, challenges, and rewards improve outcomes, but they also warn that too much focus on extrinsic incentives (points, badges, leaderboards) can undermine intrinsic interest (García-Iruela & Hijón-Neira, 2020). Bozdag and van den Hoven (2015) emphasize that success depends heavily on context, meaning gamified designs must be tailored to the specific needs of web development students. For example, in programming courses, competitive elements like code-based leaderboards have been shown to improve code quality. In web design classes, creative and collaborative challenges help develop both technical and artistic skills. Together, these findings suggest a hybrid approach combining technical performance tasks with creative, team-based activities. The literature also notes that without regular updates

the initial motivational boost will fade (Khaleel et al., 2016), so a gamified system must be kept fresh to remain effective.

Finally, the review highlights gaps that this study will address. For instance, Baker and Potts (2013) note that little research has analyzed which game elements suit beginners in technical fields. We also still lack good strategies for balancing extrinsic and intrinsic motivators, and for measuring both immediate successes and long-term learning gains. Addressing these gaps is the aim of my study, which seeks to optimize game mechanics in technical education and offer evidence-based recommendations for course design. By tackling these challenges, my research will deepen our understanding and provide practical guidance for instructors and designers.

In summary, this chapter provides a solid foundation for the current study. It shows that while gamification can improve learning outcomes, success in web development education requires careful design, evaluation, and iteration. The insights drawn here directly inform the objectives and methodology of my research. By addressing the issues identified in this review, the study aims to create a gamified learning experience that is engaging, effective, and sustainable for novice web developers.

4. Methodology

Greenberg and Buxton (2008) emphasise that ”the choice of evaluation methodology must be appropriate for the specific problem or research question being addressed”.

In line with the focus of my study on the impact of a gamified learning intervention on student motivation and engagement, i employed three complementary methods and avoided others, as explained below.

- Anonymous Questionnaire: A survey was used to collect standardised, quantifiable data on students' general views, motivational attitudes and engagement. The questionnaire was anonymous to encourage candid feedback, as research shows that respondents are more likely to provide truthful information in anonymous conditions.

- Pre/Post Coding Performance Task: I included a pre-and-post intervention coding task to evaluate firstly students’ preparation from traditional pedagogy. And finally to measure how a gamification-based could improve students’ skills and motivation. I asked each participant to build the same survey form twice, once before the gamified intervention and once after. By comparing each individual’s own results, I could directly measure improvements in speed and accuracy. This simple and straightforward design is practical for a master’s thesis, since it avoids the logistical and ethical challenges of forming separate control and experimental groups. At the same time, it delivers clear, participant-level evidence of learning gains linked to the gamified module.

- In-Person Interviews: Finally, individual interviews provided valuable qualitative insights into the impact of gamified elements on student engagement. Interviews enable a more in-depth exploration of personal experiences and clarification of survey results. When the goal is to understand users' experiences as a whole, interviews are

more suitable method than usability tests. This method provided detailed explanations of student motivations that could not be revealed by quantitative data alone.

Rejection of Other Methods: Although other research approaches were considered, they ultimately did not suit this study. For example, ethnography requires spending weeks or months closely observing participants, which was impossible given the short, few-week intervention. Focus groups can discourage honest feedback when participants are speaking in front of their peers, so I opted for private interviews to encourage openness. Traditional usability testing aims to identify interface issues, but I was interested in how students felt and performed rather than in platforms' design problems. Conducting a randomised controlled experiment would have required dividing a small group of volunteers into two balanced subgroups (one with gamification and one without) which was not practical in this context. In contrast, the anonymous questionnaire, the pre-post coding task and the one-to-one interviews provided timely, ethical and directly relevant insights into both learning gains and personal experiences with the gamified module.

Therefore, the three methods selected were the best fit for the research objectives, with Chapter 5 detailing their implementation and providing deeper explanation for every single choice.

5. Research Design and Tests running

5.1 Research Design

When I first started planning this thesis, I came up against a challenge that many education researchers will be familiar with: it is impossible to use a single method to effectively capture both measurable improvements in learner performance and the complex, subjective experiences behind those improvements. I wasn't just trying to find out whether gamification worked in some basic sense, I wanted to understand how it worked, and why. Does gamification actually help someone code more efficiently, or does it just make the learning process feel more enjoyable? Do visual feedback mechanisms like progress bars or certificates enhance retention, or do they just create a sense of momentum without impacting deep learning?

Reading John Creswell's work on mixed-methods research provided me with a framework that helped me to make sense of this complexity. He explains that using both quantitative and qualitative methods in parallel and then combining them provides a richer and more reliable picture of learning outcomes than any single method could deliver on its own (Creswell, 2012). Surveys, performance data and timed tasks tell us what has changed, while interviews and open feedback tell us why. Together, these methods allow for a more complete understanding of the learning process.

Based on this approach, I designed the study using a convergent mixed-methods design. This involved collecting three types of data simultaneously, each of which played a different role in helping me to explore the impact of gamification on novice web developers and designers. The three methods used (survey, experimental task and interview) were then interpreted together to reveal patterns, contrasts and meaningful insights.

- **Anonymous Online Survey**

The first phase of the study involved the distribution of a fully anonymous (Appendix A) online questionnaire to a sample of 24 students. All participants are novice web developers or designers (as initally targeted) enrolled in international, English-taught IT-related programs in Denmark. I designed this part of the study not to measure change over time, but rather to capture a clear snapshot of learner perceptions at a specific moment, before exposure to any gamified instruction.

Anonymity was a deliberate and essential choice. Research by Krosnick and Presser (2010) demonstrates that anonymous surveys reduce social-desirability bias and encourage more truthful responses, especially when questions deal with self-assessment, motivation, or feelings of failure or frustration. In order to protect privacy further, I also chose not to collect demographic data such as age, academic background, or nationality.

The purpose of the survey was to explore how beginners perceived different elements often associated with gamification, such as:

- progress tracking (e.g.points and levels)
- performance tracking (e.g. leaderboards)
- achievement system (eg. badges)
- feedback (e.g hint)

Additionally, I made no changes to the phrasing or structure of the questionnaire from its pilot version. Following the recommendations of Krosnick & Presser (2010) and Schober, Suessbrick, and Conrad (2018), I aimed to preserve maximum clarity and consistency. Even minor alterations in wording, scale format, or instructions can lead to differences in how respondents interpret and answer survey items. By maintaining the original formulation, I ensured that any observed patterns were due to participants' genuine perceptions rather than inconsistencies in instrument design.

- **Hands-On Pre–Post Performance Task**

  To investigate whether these gamified elements had any actual effect on learning, I implemented a small experimental strand with four volunteers drawn from the same population. The goal here was analysing how each participant responded to a short gamified course in a controlled, measurable way.

  First, each participant was asked to complete FreeCodeCamp's *"Build a Survey Form"* project over the course of a single weekend. This task served as a pre-test: it gave me a sense of how quickly and accurately each student could complete a basic HTML/CSS project based solely on knowledge they had gained through conventional, university-based instruction.

  After the pre-test, participants were introduced to FreeCodeCamp's full Responsive Web Design module. This four-week course includes many features commonly associated with gamification:

  - frequent, short quiz-style checkpoints with instant feedback
  - a visual progress bar showing percentage completion
  - a final certificate awarded upon successful course completion

  While FreeCodeCamp doesn't use competitive leaderboards, it still offers a structured, feedback-rich, and goal-oriented path. The platform's design allows learners to build small wins, visualize their own progression, and feel a clear sense of direction and completion.

  After completing the module, participants were asked to repeat the *Survey Form* project under identical conditions. Again, they timed their work and noted mistakes or obstacles. This post-test allowed for a simple comparison of:

  - task completion time
  - task accuracy
  - motivation and enjoyment

By comparing pre- and post-test data for the same individual, I was able to measure within-subject learning gains. This method aligns with Braddock's (2019) recommendations for educational studies in small, naturalistic settings where random assignment is impractical but individual progression can still be tracked meaningfully.

- **Interviews**

  Immediately following the post-test, I conducted interviews with each of the four participants. These interviews allowed me to explore learners' experiences on a personal level, asking how the gamified structure affected their motivationnand learning behaviors.

  I followed Rabiee's (2004) note-based approach to interviewing, opting not to record audio. This choice was made to encourage openness and reduce the pressure often associated with being recorded. Each conversation was informal in tone but guided by a set of open-ended questions tied closely to the survey themes and the research questions laid out in Chapter 1.

  I reintroduced some of the questions from the survey. This gave me an opportunity to compare and discuss participants' responses. In some cases, their perspectives remained consistent. In others, they changed what they had originally expressed. This divergence itself became valuable data, it helped me understand how learners' experiences evolved once they were immersed in the gamified course.

- **Analysis of Data**

  Once all three strands of data were collected, I moved into the analysis phase. My goal here was not just to analyze each dataset in isolation, but to examine how they complemented one another.

I began with the survey data, identifying patterns in how learners perceived different gamified features. This allowed me to spot which elements were seen as useful or unnecessary. Next, I reviewed each participant's performance data, comparing their pre- and post-task times and outputs to determine whether measurable improvement had occurred. Finally, I examined my interview notes for recurring themes or expressions.

All the methods used were based on well-known academic research. Creswell's model of combining different types of data was the foundation for this. Krosnick and Presser's work helped to design the survey so that it was clear and fair. Schober et al. (2018) showed how important it is to make sure questions are always asked in the same way. Braddock suggested a way to judge the success of teaching methods without picking the methods at random. Finally, Rabiee's interview model helped create a way of talking that was relaxed but still very organised, so that we could get detailed feedback.

5.2 Participants and sampling

This study has a very focused target: individuals who had self-identified as novice web designers or web developers and were enrolled in international, IT-related Master's degree programs in Denmark. The population was narrowed to this group to have an insight into how gamified learning environments affect first-time learners, in particular their motivation, learning experience, and performance. The intention was not to make generalisations about a broader group of learners, but rather to examine how certain game-like features work for beginners starting out in web development.

Choosing to study novice learners is justified by research in the field of gamification. As Hamari, Koivisto, and Sarsa (2014) argue, gamified systems are especially effective for beginners, who benefit more from systematic motivation and feedback than expert learners. Beginners are faced with uncertainty, low confidence, and lack of familiarity with technical tools and are thus more receptive to such aids as progress tracking, immediate feedback, and systems of rewards. Gamification here can be a significant element in helping learners

transition from passive knowledge to active practice. Furthermore, Deci and Ryan's (2020) self-determination theory highlights the importance of competence, autonomy, and relatedness in evoking intrinsic motivation, factors that are particularly relevant for students in the early stages of skill acquisition.

Participants were recruited through informal contact like private messages and emails. Even though the sample would consist of participants from across the globe, countries, and different levels of education, I had deliberately chosen not to collect demographic data such as age, gender, or nationality. This was for anonymity of participants and maintaining responses on learners' experience and not individual background characteristics. As Krosnick and Presser (2010) note, omitting unnecessary demographic items can contribute to improved data quality by reducing participant discomfort and any potential indirect identification, especially in small academic settings.

24 students completed the anonymous web-based survey, which was distributed at the start of the study. Although the outreach was to a larger population, only these 24 were complete and analyzable.

Of these, a smaller subsample of four volunteers was then purposively selected to be employed in the experimental portion of the study. This included the pre-test, the four-week gamified learning experience with FreeCodeCamp, the post-test, and interview follow-up. Selection of these participants was based on a purposive sampling technique. In line with Patton (2002), purposive sampling can be used in research where the aim is to get deep, rich insights from participants who are specifically relevant to the research questions. Here, the volunteers were chosen on three self-evident conditions: they presented themselves as beginners, they were new to FreeCodeCamp beforehand, and they were willing to invest the time required for self-study and follow-up tasks.

The small-group design allowed for deep exploration of each participant's unique learning journey and experiences. Participants not only provided performance data drawn from pre- and post-tests, but also individual interview accounts. This approach was at the heart of the

study's convergent mixed-methods design, which aimed to integrate performance, perception, and lived experience.

Voluntary participation in survey and experimental conditions was obtained. No monetary or academic rewards were given. All of the participants were informed of the purpose of the study, their right to withdraw at any time, and the confidentiality of their responses. In the interviewing process, Rabiee's (2004) note-taking technique was applied, avoiding tape recording as a means of constructing a less structured and relaxed setting. This facilitated members to communicate more freely and reflect more openly about their experience, which was crucial to gaining insight into how the elements of gamified learning were received and interpreted.

By combining a broad, anonymous survey with a focused, qualitative subsample for in-depth analysis, this sampling approach balanced thematic diversity with detailed understanding. This approach provided a solid foundation of knowledge regarding how gamification is perceived at the outset of learning and its impact on real-world development when practised over time within an autonomous, interactive coding system.

5.3 Instruments and tools

Three main instruments were employed in this research: an anonymous web survey made with Google Form, a coding practice exercise provided on FreeCodeCamp.org, and a series of interviews conducted after the learning process. These tools were chosen to support the three main components of the research design (perception, performance, and personal experience) and the mixed-methods approach that guided the research.

The first tool was the anonymous online questionnaire with the purpose of exploring how students perceived the various aspects of gamified learning environments and what they thought of conventional instruction. The survey instrument consisted of a series of Likert-scale and fixed-choice questions that wanted to measure intrinsic motivation, perceived utility of features as aids like progress bars and feedback mechanisms, and satisfaction with prior learning modes. All items were worded in accordance with the best practices of survey

research. Specifically, the recommendations of Krosnick and Presser (2010) regarding consistent question wording and neutral phrasing to avoid bias were taken into account. Second, I also used the recommendation of Schober, Suessbrick, and Conrad (2018) when creating easy-to-understand simple scales and preventing ambiguous or confusing questions. The survey was filled out anonymously with no demographic data taken, following the methodological decisions described in Section 5.2. The entire instrument can be found in Appendix A.

The second resource used was the 'Build a Survey Form' project on FreeCodeCamp.org. This coding-in-action task was used in the pre-test and post-test stages of the experimental phase. It involved teaching participants how to create a fully functional survey form using HTML and CSS. It is one of the final challenges for the Responsive Web Design module and is publicly accessible. It was selected because it is a typical beginner-level development exercise with clear requirements and an achievable scope; it is therefore suitable for measuring both skill acquisition and variation in learner confidence. In the pre-test, learners completed the exercise using only what they had learnt in traditional university lectures. After completing the FreeCodeCamp course, they completed the same exercise under the same restrictions for the post-test. All testers recorded their completion time and noted down any difficulties they encountered. Submissions were qualitatively examined for completeness and basic HTML/CSS styling.

FreeCodeCamp itself constituted an additional critical material environment upon which the intervention was performed. It delivers an online curriculum organized into modular lessons, with brief coding exercises and instant feedback released across. FreeCodeCamp features relevant to the current study included:

- A visible progress bar showing how much of the module was completed
- Instant feedback on each task, including visual feedback of success or failure
- A certificate awarded at the end upon successful completion of the entire module

Although FreeCodeCamp does not use leaderboards, competitive rankings, or points, it does incorporate basic elements of gamification as suggested by Deterding et al. (2011), including feedback, progression, and tangible achievement. The platform's interface is minimalist,

linear, and self-paced, which allowed participants to complete the module independently but still be subjected to continuous motivational stimuli.

The third and final instrument was a series of interviews with the four participants who had completed the entire experimental sequence. These interviews took place immediately after the post-test and were based on a set of open-ended questions relating to the learning experience, motivation, frustration and the perceived usefulness of specific gamified components. These questions built on the items from the first questionnaire, enabling me to compare reflective and anonymous responses. Participants were asked, for example, to describe how the progress bar affected their motivation and whether the last certificate affected how seriously they took the final quizzes.

In line with Rabiee (2004), the interviews were not recorded. Rather, I took detailed notes during each session, creating an informal environment in which participants could discuss their views freely. This was done not just to protect participants' comfort and privacy, but also to enable the exploratory nature of the qualitative strand. The interviews lasted approximately 20–30 minutes and provided rich insights into how learners personally engaged with the gamified elements of the course.

These three instruments were selected to represent different facets of the learning process: the questionnaire assessed overall motivation and attitude; the coding activity represented observable performance; and the interviews captured inner reflection and meaning-making. Together, they supported the triangulation of the entire dataset, making it possible to quantify not only whether gamification had an effect, but also how it was perceived, experienced and expressed.

5.4 Ethical considerations

This study was planned with adherence to ethical standards. At all stages, from the survey to the experimental tasks and the follow-up interviews, prime consideration was given to the privacy, consent and emotional comfort of the participants. The entire research process was

guided by the ethical principles of research discussed by Creswell (2012), who emphasises the importance of protecting participants comfort, ensuring voluntary participation, and being transparent about the purpose of the research.

To begin with, all participation in this research was voluntary. Participants were informed of the purpose of the research, the structure of activities involved, and their absolute right to withdraw at any stage without explanation. In the initial message of the survey, displayed through Google Forms and shared via email and Facebook chats, students were informed that by proceeding with the questionnaire, they were consenting that their answers could be used in an anonymous academic research project. This procedure was in accordance with Creswell's (2012) recommendation that informed consent can be effectively incorporated into online survey questionnaires provided that participants are properly and politely informed about how their responses will be used.

Confidentiality of the online survey was a top priority of the research design. No personally identifiable information (such as name, age, gender, nationality, or academic background) was collected (See Figure 1).

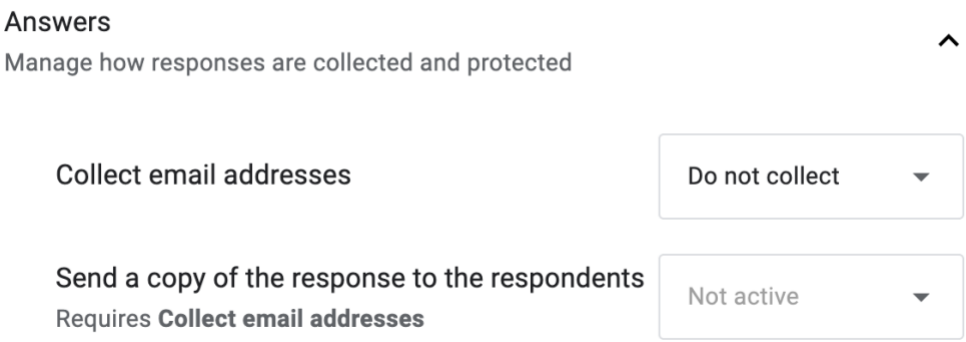

Figure 1. Screenshot of the Google Form settings that demonstrates anonymity

This was a deliberate ethical decision, in line with Krosnick and Presser's (2010) suggestion that anonymous surveys eliminate the potential for social bias and encourage more genuine responses. As the survey asked students about their motivation, confidence and learning difficulties, it was essential to ensure a secure and anonymous environment in order to obtain

valid and truthful data. Furthermore, as Krosnick and Presser point out, omitting unnecessary demographic questions helps respondents to focus on the content and goal of the study rather than on personal exposure.

Only four volunteers took part in the more extensive, hands-on component of the experimental part of the study. They were each informed of the procedures and time required, and they agreed to participate under the same voluntary conditions. Their names were not included in the thesis, and their performance records were anonymised. This process aligns with the ethical standards outlined by Braddock (2019) in his discussion of quasi-experimental designs in naturalistic settings, where achieving full anonymity may be difficult due to the small sample size. However, confidentiality and discretion remain essential.

In addition to preserving anonymity, this study favored minimally invasive data collection. No software monitoring, screen capture, or behavioral tracking tools were used. Completion times and difficulties were reported by participants themselves. The learning material, FreeCodeCamp, was open-access and freely available, with no login tracking by the researcher. This allowed participants to complete the exercises at their own pace, without observation or pressure.

The end-of-post-test interviews were conducted in a manner that encouraged open conversation while maintaining ethical awareness. In line with Rabiee's (2004) recommendations I took handwritten notes during the sessions to create an informal, low-pressure setting. This approach is also endorsed by Creswell (2012), particularly in situations where the researcher intends to alleviate participant anxiety and facilitate more candid discussion. The interviews involved open-ended questions that explored the participants' experiences, motivations and perceptions of gamification. Some questions were similar to those in the survey, enabling deeper elaboration while maintaining the anonymity of their earlier responses.

Fairness and clarity of questions were also primary ethical concerns throughout the study. According to Schober, Suessbrick and Conrad (2018), even minor alterations to the wording of questions or the structure of scales can have a significant impact on how participants

interpret and respond to items. Therefore, all survey and interview items were carefully reviewed to avoid ambiguity, double meanings or complex phrasing. The questionnaire remained identical to the version that had been pilot tested, ensuring consistency across data collection and analysis.

Finally, all data were handled with strict confidentiality. No raw responses were published or shared publicly; only anonymised, aggregated findings and quotations were presented in this thesis. No external party was granted access to any of the research material. All participants were treated with respect, and no psychological pressure, performance grading or ranking was applied during the study.

6. Results and Discussion

This chapter presents the findings from all three strands of data collection employed in this mixed-methods research design: (1) an anonymous online questionnaire (2) a pre-test/post-test performance task on FreeCodeCamp completed by a subsample of participants, and (3) final interviews. Each data strand serves a distinct role in addressing the overarching research questions and gaps in the literature that were previously discussed in Chapter 3.

The anonymous questionnaire, completed by 24 novice learners, provided an initial assessment of students' perceptions of traditional university teaching methods and their general views on gamification mechanics. The questionnaire was designed to address Research Questions 1, 2 and 3 directly, and to highlight several recurring limitations in existing scholarship. These include the need to analyse gamification in terms of its specific features (Gap 1), the complexity of intrinsic versus extrinsic motivational influences (Gap 3), the discrepancy between theory and practice in traditional education (Gap 4), and the lack of attention given to collaborative or social learning in gamified environments (Gap 6).

As Creswell (2012) suggests, collecting data from various complementary sources helps to develop a more thorough and balanced understanding of complex educational phenomena. The results of the questionnaire provide an initial insight into learners' motivational states and pedagogical preferences before they are introduced to any gamified context.

The second data set consisted of performance-based pre- and post-tests, in which four students completed the same coding assignment both before and after engaging with the gamified FreeCodeCamp module. This stage was designed to detect improvements in performance, efficiency or confidence following structured exposure to gamification-based learning tools. As Braddock (2019) notes, within-subject pre-post designs are particularly valuable in small-scale educational studies where randomisation is not feasible yet the researcher still aims to measure clear learning effects under realistic conditions.

The final analysis included interviews held with the four experimental participants at the conclusion of their learning experience. These interviews offered qualitative insights into how gamified elements such as progress tracking, quizzes, and certification were perceived on a

personal level, and whether participants believed those elements had a meaningful impact on their learning and motivation. The interviews were deliberately structured to reflect several of the key themes from the questionnaire. This provided an opportunity to compare the anonymous survey responses with the participants' spoken reflections, and to explore how their perceptions may have evolved during the study.

These three data sets provide a triangulated approach, showing not only whether gamification helps novice learners, but also how it works, why it is effective and when it might be ineffective. The chapter is organised as follows: Section 6.1 reports the results of the questionnaire, which cover overall motivation, satisfaction with traditional teaching, and reactions to specific gamification features. Section 6.2 presents the outcomes of the pre- and post-test coding. Section 6.3 discusses insights from the interviews. Sections 6.4 and 6.5 bring all the evidence together by linking each finding to the research questions, and by combining quantitative and qualitative data to reveal key themes and contradictions with the theoretical framework.

6.1 Questionnaire Results

The anonymous questionnaire provided a clear snapshot of how 24 novice web developers and designers felt about gamification and traditional pedagogy. As the researcher, I analyzed these responses personally, following a convergent mixed-methods approach that merges numbers and narratives for richer insight. I designed the survey with guidance from best practices (Creswell, 2012; Krosnick & Presser, 2010) so that each question was clear and targeted, allowing participants to answer honestly and in detail. In this section, I interpret the key findings in a narrative form, organized by the research questions RQ1, RQ2, RQ3. I also relate the results back to the main literature. Throughout this interpretation, I include specific survey question numbers in parentheses (e.g. Q1, Q2) to ground each insight in the data. For all the detailed answers look Appendix B.

6.1.1 Perceptions of Traditional Pedagogy and Motivation (RQ1)

RQ1 asked how traditional university pedagogy influences beginners' motivation and learning outcomes. To probe this, the survey first asked if participants felt their university education helped them develop practical coding skills (Q1). The responses were striking: 12 out of 24 answered *No*, only 7 said *Yes*, and the remaining 5 offered nuanced comments instead of a simple yes/no. One student wrote, *"Only to some extent. While theoretical concepts were taught well, practical coding skills required additional self-learning and hands-on practice outside the classroom."* This sentiment that theory was covered but real coding ability was not fully gained, was common. Another admitted, *"Yes, but [the skills] were not so specific and [were] used very few times after the first semester, so... I started to forget things."* These candid answers suggest that traditional classes alone often left students underprepared for *applying* their knowledge. In other words, many novices did not feel their university courses effectively bridged the gap between knowing and doing. This reinforces Gap 4, the well-documented disconnect between theory and practice in tech education: even students themselves recognize that theoretical instruction didn't easily translate into practical ability.

I also asked students to rate their satisfaction with the teaching methods in their university courses (Q2, on a 1–5 scale). The majority gave a middling 3 , with very few expressing strong satisfaction. In fact, none of the 24 respondents said they were "extremely satisfied" with traditional pedagogy; and one student even chose 1. This average rating of around 2.9 out of 5 suggests that conventional lectures and assignments did not inspire much enthusiasm. From a motivational standpoint, if learners aren't particularly satisfied, their intrinsic motivation in those classes may have been low. 3 students clearly appreciated the foundational knowledge from university, but many felt something important was missing in the traditional approach.

It is important to note that these frank responses were likely aided by the survey's anonymity and clarity. The careful wording of questions (following Krosnick & Presser's survey design guidelines) also meant participants understood what was being asked and could respond in depth. For example, rather than just checking "No" for Q1, several took the time to explain *why* it was "no" or "only partly yes." This nuance shows they were comfortable sharing honestly, which is crucial for interpreting motivation (Schober et al., 2018 emphasizes that question phrasing can invite detailed answers when done right).

Overall, the RQ1 findings paint a picture of novice developers who often feel that traditional university teaching fails in motivating them or preparing them to code. Many did not gain confidence in practical skills through lectures alone, echoing the traditional lectures leaves students demoralize when attempting to apply knowledge in practice. This directly ties into Gap 4: participants sense a gap between what they learned in class and what they can do in reality. In fact, when asked directly which learning method better supports their motivation and understanding (Q17), 22 out of 24 chose "Gamified" over "Traditional". Similarly, an overwhelming 21 students felt a gamified approach would better help them apply theory to real projects (Q18). Even for overall effectiveness in mastering web development (Q19), 20 students favored gamified learning. These responses show a strong perception among learners that traditional pedagogy is less engaging and less effective for them than a more interactive, gamified approach. In other words, before even experiencing my gamified intervention, most students believed that a new approach was needed.

6.1.2 Reactions to Specific Gamification Elements (RQ2)

RQ2 asked how different gamification elements influence the intrinsic motivation of beginner learners. To answer this, the survey included a series of questions isolating individual game-like features and asked students how they felt about each. By disaggregating the elements, I aimed to see which features students actually find motivating (addressing Gap 1 in the literature). The results indeed showed clear differences in how learners react to each element.

Progression Points and Levels: When asked *"How motivating do you find the system of points, levels, and streaks?"* (Q5), a large majority responded positively. 18 out of 24 students gave a rating of 4 or 5 (on a 5-point scale where 5 = extremely motivating) for the idea of progression points/levels. One student described earning points and badges *as "a dopamine rush – the brain thinks it has received something."* This comment illustrates how points and rewards can trigger a feeling of gratification that keeps learners engaged. At the same time, the same respondent cautioned that if they stop getting points, *"I feel very bad which can affect my learning experience."* This honest reflection shows both sides: points can boost motivation

when things are going well, but but demoralizing the moment this extrinsic motivation is missing. Still, overall, the points/levels system was viewed positively by most novices in my survey. Participants also indicated that points and levels are important for tracking progress (Q6: mean rating ~3.6/5, with over half rating 4 or 5). They like being able to see growth through these metrics. In open responses, some explicitly mentioned progress bars and level-based progression as useful because *"I can track my improvement."* This suggests that visualizing progress is inherently motivating for beginners, likely because it makes an abstract learning journey feel concrete and goal-oriented.

Streaks (Consistency): The idea of maintaining a streak (consecutive days of activity) was also appealing to many, though with slightly more mixed feelings. In Q7, which asked specifically about streaks, about 14 of 24 learners rated streaks as very or extremely motivating (4 or 5 out of 5). Another quarter were neutral , and a few (about 3 people) found streaks not very motivating (rating 1–2). So, most participants do enjoy streaks, but a small number do not care about them. Those who like streaks really emphasized *why* in their comments: a streak represents commitment, and once you build one, you "don't want to lose it." One student explained that after investing time to keep a daily streak, giving it up would feel like wasting that effort – *"at the end you spent so much time on that, so why give up now?"* (Q21 open response). Another mentioned using Duolingo as an example, saying *"starting to develop a streak is nice because then I'm motivated to not lose it… so I do it every day."* Streaks seem to tap into learners' pride: the longer the streak, the more they want to continue. It's an extrinsic number that ends up encouraging intrinsic behaviors like self-discipline. However, for a few students, streaks might induce pressure or simply not fit their learning style. On balance, streaks were seen as a positive motivator by most novices, helping increase consistency in learning. This is a valuable insight because consistency often leads to better skill retention, something traditional classes sometimes struggle to instill.

Leaderboards and Competition: In contrast to points and personal progress, leaderboards (competitive ranking) were not universally loved. Q8 asked how effective leaderboards or dashboards are for motivating continued learning, and the average response was neutral (mean ~3.0). In fact, 8 out of 24 rated leaderboards' motivational effect as low or not at all, whereas only about 7 people rated it high. Similarly, when asked if comparing their

performance to others on a leaderboard is motivating (Q9), the majority said it was not particularly motivating. This means many beginners don't find competition to be a strong motivator; some might even find it demotivating. One participant explicitly wrote that they value a *"scoreboard"* to see how they rank, but this was an outlier viewpoint. In fact, another student noted that seeing how I rank compared to others is enjoyable, but most did not mention leaderboards at all in their "most useful elements" comments. While competition can spur engagement for some, it can also create stress or feelings of inferiority for others. Participants' responses support this: about one-third did enjoy the competitive aspect but the rest were neutral or negative toward it. Notably, half said they rarely or never refer to any dashboard or leaderboard to track their progress (Q10 responses of 1 or 2). This indicates that many students focus more on their own learning than on constantly comparing scores or checking rankings. This directly speaks to Gap 1**.** I might have incorrectly assumed gamification as a whole was universally motivating, overlooking that competition can actually turn some beginners off. It also hints at a potential design implication: a gamified learning platform for novices might prioritize personal progress features over public ranking, or use competition in a careful, opt-in way.

Feedback and Guidance: Nearly all participants found immediate feedback and guided challenges to be highly motivating and helpful. When asked about feedback students responded extremely positively (Q11 had a mean of 4.2/5). In fact, half of the group gave feedback a full 5. Nobody said feedback was unhelpful. This was one of the strongest consensus points in the survey, learners crave feedback. They want to know how they're doing and how to improve in real-time. This makes sense: feedback is directly tied to learning quality, not just motivation. As one student put it, *"Immediate feedback – instant results helped me learn from mistakes right away."* That kind of comment shows that participants value gamified elements that double as learning support. Similarly, hints and guidance during challenges were well-received (Q12). Every single respondent rated hints at least moderately motivating, and most gave a 4 or 5. It appears that when learners face a challenge or task, having some guidance or tips along the way boosts their confidence and motivation to continue. This finding is consistent with the educational theory that providing learners with support as they solve problems can reduce frustration and maintain engagement.

The survey also asked if students feel that doing challenges helped them learn more effectively (Q13). Here too, the response was very positive: about 20 out of 24 agreed that challenges improved their learning, with 9 giving the strongest agreement. This tells us that it's not just the "game" rewards that matter; the learning activities themselves, when well-designed, motivate students. In their open comments, several participants mentioned quizzes or "challenges" as useful elements that kept them engaged and helped them learn by doing. One simply listed "Quizzes" as the most useful element, and another wrote that quests (questions/quizzes). This underscores that engagement comes from a combination of fun and meaningful learning.

Badges and Certificates: Gamification often includes achievement badges or completion certificates to recognize progress. Novices had mixed but mostly positive feelings about these extrinsic rewards. In Q14, which asked about the motivation from earning badges or rewards, about two-thirds of participants indicated badges are motivating. However, a few students were indifferent or even negative (one gave a 1). So while badges are generally liked, they don't excite everyone. One student explained that badges *"gave me a sense of achievement and made the learning feel rewarding."* This highlights the intrinsic benefit a badge can provide. Another student, though, viewed certificates very practically, saying they value *"Certifications because they can be relevant for my resume."* This is a more extrinsic take, seeing the badge/certificate as a credential for jobs. Both perspectives were present in the group. When asked how important certificates or rewards are for validating learning (Q15), the majority responded that they are fairly important. It seems students do like having proof of their achievements, but again it's not everyone's top priority. One interesting result came from Q16: *"Would you be more likely to continue learning if there were more badges or certifications to earn?"* Here, a majority said Yes in principle, but about 25% said No (rating 1 or 2). This divergence suggests that some learners are strongly driven by collecting rewards, while others would continue learning regardless of extra badges. This directly connects to the issue of intrinsic vs. extrinsic motivation (Gap 3). Literature warns that if students focus too much on extrinsic rewards like badges, their intrinsic interest might suffer over time. In my survey, we see both sides of that coin: many are motivated by these rewards (at least in the short term, they'd learn more if more badges are up for grabs), yet some are wary or simply not swayed by badges, implying their motivation comes from elsewhere. Notably, 16 out of

24 students later responded that gamified elements made learning feel *more enjoyable in itself* (intrinsic motivation), whereas only 8 felt it was *"mainly about the rewards"* (extrinsic) (Q20 results). This indicates that most of the participants view things like points, badges, and feedback as *enhancing the fun and engagement of learning*, rather than as the sole purpose for learning. They are using the game elements as a means to learn better (intrinsic goal), not just learning in order to get the game elements (extrinsic goal). However, one-third leaning towards "extrinsic" is still substantial, it means we must be careful in applying rewards so as not to undermine the genuine interest in the subject. I revisit this balance when discussing the open-ended feedback and literature gaps.

In summary, the RQ2 findings show that not all gamification features are equal in the eyes of novice learners. There was a clear pattern: elements that support personal progress and provide feedback were strongly appreciated and boosted motivation. In contrast, elements that enforce comparison or competition were the least motivating and even off-putting to many. Reward elements like badges and certificates fell in between, they are motivating for most students and can validate achievements, but they should be used with caution since a minority might not care for them or might over-focus on them. These nuances directly address Gap 1 by identifying which specific features learners find most effective. Additionally, the mixed reactions to badges and the split between intrinsic vs extrinsic perceptions tie into Gap 3: my data confirms that extrinsic motivators can be double-edged. They do motivate, but must be balanced to ensure the learning itself remains enjoyable and meaningful, not just a means to an end. It is heartening, though, that two-thirds of participants felt the gamified approach increases *intrinsic* enjoyment, implying that well-implemented gamification can *support* intrinsic motivation rather than undermine it. This finding offers a valuable contribution to Gap 3 in the literature, showing that beginner students can experience gamified learning as "more enjoyable" and not purely reward-driven.

6.1.3 Perceived Usefulness of Gamification for Learning (RQ3)

RQ3 asked about the students' perceptions of the usefulness and effectiveness of these gamification elements in their actual learning process. In other words, do learners think these

elements help them learn better, understand more, or achieve more, beyond just feeling motivated? The survey addressed this through both direct comparison questions (Q17–Q19) and an open-ended question (Q21) where participants explained which elements they found most useful and why. The results here were quite telling and very encouraging for gamified learning.

First, as mentioned earlier, when directly asked which method (traditional or gamified) better supports their motivation and understanding of web development (Q17), an overwhelming 22 out of 24 chose gamified. Only 2 students still favored traditional in that regard. It's a strong vote of confidence for the gamification approach. Similarly, the vast majority felt gamified learning better helps them transition from theory into real-world application (Q18: 21 said gamified, 3 said traditional) and that a gamified context is more effective for mastering web development skills (Q19: 20 said gamified, 4 traditional). Clearly, these novice developers believe that gamification can address some of the shortcomings they experienced in traditional education. This aligns with what I identified as Gap 4 (the disconnect between theory and practice): participants implicitly recognize that the right gamified elements might make it easier to apply what they learn. They see gamification not just as "more fun," but as a potentially more effective pedagogy. This is a crucial perception, because it suggests students are open to and even eager for innovative learning methods that could yield better outcomes. It also underscores a disconnect: traditional classes may not have given them this sense of efficacy, whereas they anticipate that gamified learning will. For instance, one student commented that combining well-structured content with a scoreboard can enhance learning, implying that when solid instructional content is delivered in a gamified format (with progress indicators), it might achieve the best of both worlds. Thus, in terms of perceived usefulness, gamification wins by a landslide in the survey.

The open-ended question (Q21) adds rich detail to these comparisons. I asked: *"Which gamification elements did you find most useful for your learning? (Please explain why?".* This allowed participants to freely express what helped them and to reflect on why those elements mattered. Analyzing these responses, I found several recurring themes:

- **Streaks and Consistency:** *Streaks* were the single most frequently mentioned element in the open responses. For example, one wrote that *"daily streaks keep me motivated,*

and even if I don't have much time, I'll learn something for 3-5 minutes daily, which makes the process more consistent." Another mentioned starting a streak with friends as a fun way to stay accountable, saying it motivates them so they *"don't feel like I'm failing them."* These comments show that students find streaks useful not just as a game, but as a tool for time management and peer support. By encouraging a little progress each day, streaks help prevent procrastination. In terms of learning usefulness, this is great for retention and practice, small daily learning is often more effective than sporadic large sessions. The social twist also indicates that streaks can incorporate a collaborative or competitive element in a positive way, partially mitigating Gap 6 about lack of collaboration. Indeed, 50% of respondents answered *Yes* to Q23, agreeing that many gamification platforms lack collaboration and social interaction. This split opinion on Q23 suggests that some learners are finding ways to include social interaction, while others feel the absence of it. The data highlights an opportunity: integrating collaborative elements into gamified learning could satisfy those who currently find the experience isolating, addressing Gap 6 directly.

- **Progress Tracking and Visual Feedback:** Many participants found progress visualization tools extremely useful. Mentions of *progress bars, levels, and points* were common. For instance, one student explicitly said *"Progress Bar – It helped me visualize how much I'd completed, which motivated me to keep going."* Others echoed that seeing progress gave them a sense of advancement and tracking. This is more than just feeling good, it helps learners plan and gauge their learning process, which is pedagogically useful. If a student sees they are, say, 50% through a module, they know how to allocate their time and can take pride in how far they've come. This aligns with the idea of self-regulated learning: visual progress can encourage learners to set goals and monitor their own progress. Several also noted *points and level-based elements* as useful, not purely for competition, but because it added a *"fun, competitive element that pushed me to improve"*.

- **Feedback and Challenges:** A significant number of comments highlighted immediate feedback, quizzes, and challenges as highly useful. One participant wrote that gamification elements *"kept me mentally engaged and encouraged me to reflect and improve continuously."* Another listed *"Immediate Feedback - instant results helped me learn from mistakes right away"*. The fact that these came up in the "useful for learning" question is important: it shows students recognize these features are not just fun, but actually help them learn better. Timely feedback closes the loop, students can correct misunderstandings on the spot. Challenging quizzes or tasks force active learning, which improves understanding and retention. This resonates with educational research that sees challenge (with support) as a driver of deeper learning. So from the student perspective, the usefulness of gamification lies largely in how it delivers instruction and feedback, not only in the extrinsic rewards. This underscores that a well-designed gamified course inherently combines learning activities with game mechanics. In our context, it appears that combination was largely successful in students' eyes: they felt they learned more effectively through interactive challenges and got more out of the content thanks to instant feedback and hints. This perception addresses Gap 4 in a positive way, these gamified elements might be the very things that help connect the theory they learn to actual practice, by constantly engaging them in practicing and adjusting (the core of applied learning).

- **Badges, Rewards, and Purpose:** Some participants also found badges, rewards, or certificates useful, often linking them to a sense of purpose or external validation. One student explained that *"Rewards and points give the feeling of having more purpose in learning."* For this student, knowing there's a reward at the end added motivation to keep pushing through the material. Another student simply noted *"certifications… can be relevant for my resume,"* indicating that for them the usefulness is very practical. While these are extrinsic factors, they should not be dismissed: if a digital course offers a certificate that can be put on LinkedIn, for example, students may take the course more seriously and stick with it, which in turn leads to more learning. The key is to align those rewards with meaningful learning outcomes. Participants

generally seemed to value these achievements; however, it's worth noting that in the open responses, badges and certificates were mentioned less frequently than streaks or feedback. This suggests that while rewards are appreciated, students didn't universally single them out as the most useful aspect. They tended to talk about the process (streaks, feedback, progress) more than the end rewards. This is a healthy sign that their focus is more on learning engagement than on just collecting badges. It also reflects the earlier intrinsic vs extrinsic split, many are internally driven even as they enjoy the external recognitions.

- **Social and Collaborative Aspects:** As noted, a few responses hinted at social learning benefits. One student valued the *"social aspect"* of *"building streaks with friends."* Another mentioned enjoying seeing how they rank among others (the scoreboard comment). These comments show that some learners do find a social dimension useful, either for friendly competition or mutual encouragement. However, because these were not dominant themes in the answers, it appears the current gamified experience was still largely a single-player one for most. This circles back to Gap 6: half of the class felt a lack of collaboration in gamified platforms (Q23 results). The open-ended feedback suggests that those who did involve others in their gamified learning found it beneficial. Meanwhile, those who didn't may have felt something was missing. This is a nuanced point: collaboration wasn't explicitly built into the pre-intervention platform they used (FreeCodeCamp, for example, doesn't have multi-user collaboration on exercises), so the ones who leveraged social motivation did so informally. Going forward, this insight is useful, adding features for collaboration or discussion could make gamified learning even more effective and satisfying, addressing that unmet need for the 50% who said "yes, lack of collaboration is an issue." The literature also notes that most gamification efforts so far under-emphasize social/community elements, so participants are reflecting that gap directly. Recognizing it here gives us a chance to consider social features in future designs or to encourage study groups alongside gamified modules.

Finally, the survey asked whether students would continue using gamified learning methods if they were part of a long-term course (Q22). The answer was nearly unanimous: 23 out of 24 said Yes, they would. This is a strong endorsement from the learners' perspective. Even after reflecting on all the pros and cons, all but one student wanted gamified methods to be integrated into longer courses such as university classes. From an educational point of view, this signals that students find value in these methods not just as a novelty but as a sustained approach. It also alleviates some concern about whether gamification's effects might be short-lived. At least in terms of perception, students are willing and even eager to stick with it over time.

To sum up RQ3, the participants clearly perceive gamified elements as useful tools for learning. They believe these elements improve their motivation, engagement, and even the effectiveness of learning itself. The most useful features, in their view, are those that keep them engaged daily, provide continuous feedback, and mark their progress in meaningful ways. This aligns with educational principles of effective learning, suggesting that well-implemented gamification can naturally embed those principles. The students' perspectives fill in several of the literature gaps we identified. By specifying which elements help them learn, they give us direction on what to include in future pedagogical designs. Their intrinsic enjoyment of the process alongside strategic use of rewards speaks to finding the right balance between intrinsic and extrinsic motivation, showing it's possible to have fun while still earning points and badges as a bonus, rather than letting the rewards become the sole focus. Their overwhelming support for gamification as a better learning method directly tackles the theory-practice gap, because they feel these methods helping them apply skills more effectively than lectures did. And their split opinion on collaboration highlights an area for improvement: integrating community features could further enhance the learning experience for those who feel something is missing socially.

6.2 Hands-On Performance Analysis: "Build a Survey Form" Project

Section 6.2 examines how four novice learners performed on a practical coding task before and after the gamified learning intervention. All four participants attempted FreeCodeCamp's

"Build a Survey Form" project as a pre-test (using only their prior knowledge from university classes) and again as a post-test after up to four weeks of gamified training. No software tracking tools or quantitative metrics were used; instead, performance improvements are described through reported experiences (e.g. task completion time, encountered HTML/CSS errors) and visible changes in the project outcomes. This approach addresses RQ4 by highlighting whether the gamified learning elements helped translate theoretical knowledge into applied web development skills, thereby providing real-world performance evidence to tackle the identified Gap 5. As detailed below, all participants demonstrated notable progress, more enjoyment, and more confident problem-solving, although the improvements varied for each individual.

6.2.1 Improved Task Completion Time and Efficiency

A clear pattern emerged: a reduction in task completion time from pre- to post-intervention. During the pre-test weekend, most participants found it difficult to complete the survey form within the established time. Several admitted to spending the entire weekend working on the project, with some features still missing by Sunday night. In contrast, after the gamified course, they were able to fully complete the same project much more quickly. Participants reported post-test completion times ranging from a single afternoon to about one day, roughly half the time they originally needed. For example, one participant (P1) shared, *"The first time it took me two full days and countless trial-and-error. This time I got it done in just a few hours on Saturday."*

All four learners finished the project well before the four-week deadline, reflecting the efficiency and enthusiasm generated by the gamified learning process. Interestingly, the participant who identified most with extrinsic motivators, such as earning a certificate, was among the fastest in the post-test saying "raced to the finish line *once they felt prepared*". Meanwhile, those driven more by intrinsic interest took a bit more time to polish their work, yet still *"felt way faster than before,"* as another participant (P2) noted. Despite individual pacing differences, the overall trend was that each student completed the survey form faster after the intervention, a testament to increased confidence and skill. This surge in efficiency aligns with their earlier expectations in Section 6.1 that a gamified approach would help them

work more productively; as P3 put it, *"I wasn't stuck Googling every little thing this time. I knew what to do and didn't waste hours."*

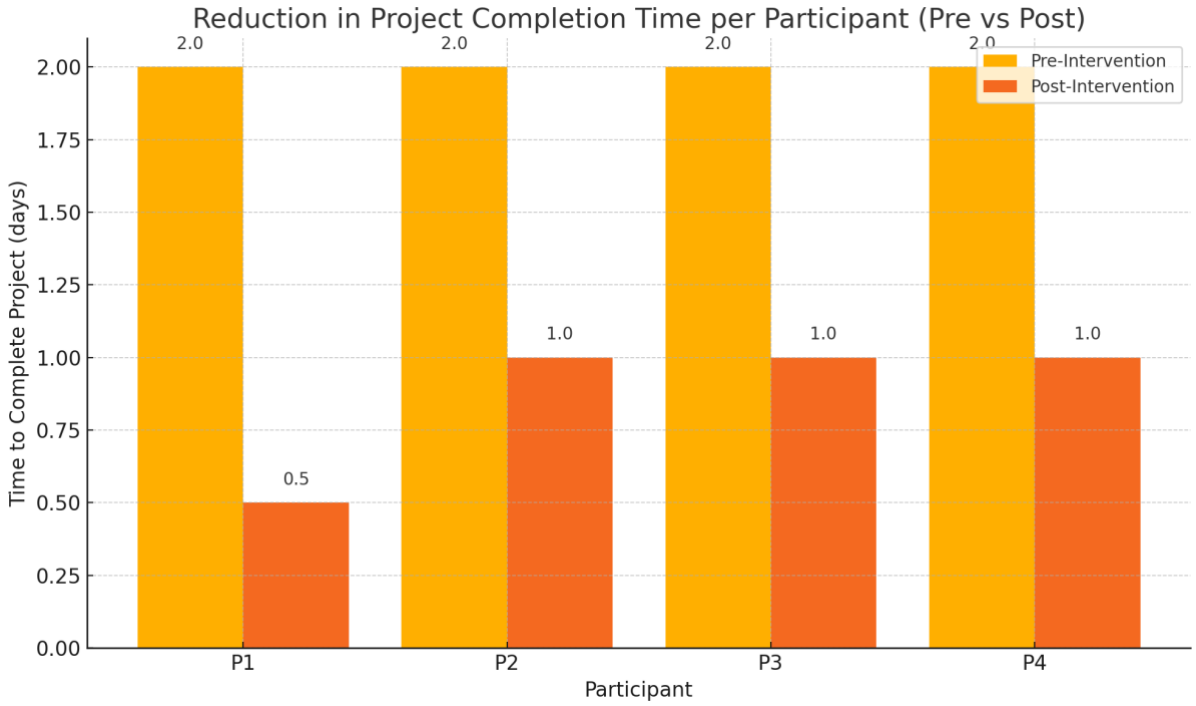

Figure 2. Chart shows the estimated time reduction for each participant when comparing the pre- and post-intervention attempts.

6.2.2 Fewer Errors and Better Debugging of HTML/CSS

Working quickly, participants improved the accuracy of their code and became better at handling errors. In the pre-intervention attempt, all novices encountered numerous HTML/CSS errors and struggled with basic syntax. For instance, one participant's pre-test form would not submit properly due to a simple structural mistake (they had placed input fields outside the <form> tags), and another left out the required attributes on mandatory questions, not realizing those were needed. Lapses in attention and errors in syntax were common in the initial submissions, which is consistent with their limited practical experience. By the post-test, these rookie mistakes had significantly decreased. All four final projects ran without major issues: the forms submitted correctly, and every required element was present and functional. Participants reported that when errors did occur, they could resolve them much more quickly on their own. *"Before, I didn't even know where to start when something*

broke," one learner (P4) explained, *"but after going through all those exercises, I could debug the form pretty much immediately."* The researcher's review of the code didn't contain error at the end.

An illustrative example of this progress is how participants handled HTML labels and inputs. In their first attempt, none of the participants linked form labels to their corresponding input fields. However, during the FreeCodeCamp curriculum, they learned about the importance of the for attribute on <label> tags. In the post-test, every participant correctly used labels to tag their text fields and options, improving both functionality and accessibility of their forms. Similarly, with CSS, participants demonstrated better command of selectors and styling rules. In the pre-test, one student tried to center a button by randomly adding CSS properties. After the intervention, the same student confidently used a proper CSS rule (text-align: center on the container) to achieve the desired layout.

6.2.3 Evolving Coding Approaches and Confidence

Beyond raw speed and accuracy, the approach to coding and problem-solving evolved noticeably from pre- to post-intervention. Early on, participants tended to code in an "*trial-and-error manner*". As one participant admitted, *"During the first attempt, I was basically copying snippets from the internet and hoping they would work."* A sense of uncertainty and low confidence characterised the pre-test efforts. Several features were left out or simplified because the learners were unsure how to complete them and were afraid of breaking their code.

After completing the gamified learning module, however, participants approached the project with far more strategy and confidence. All four noted that they had a clearer mental roadmap for building the form the second time. Many followed a step-by-step plan that mirrored the structure of the FreeCodeCamp curriculum. For example, P2 described how he first outlined the required form sections on paper (e.g. personal info, survey questions, submit button) before coding. The challenge-based progression of the gamified course led to a more methodical mindset, resulting in more organised code and a smoother development process.

Participants were no longer afraid to tackle the "hard parts" of the project: one individual who had omitted the dropdown menu in the pre-test (because she *"didn't know how to make one"*) confidently included it in the post-test after recalling a similar example from the lessons. *"The second time around I knew exactly how to do the dropdown, since I'd just practiced it,"* she said. Such comments illustrate a significant boost in self-efficacy. Instead of hesitating or avoiding complex requirements, learners felt empowered to implement them, trusting in the knowledge gained from the gamified exercises.

The coding style and organization further reflected this growing confidence. In the post-test submissions, participants' HTML/CSS code was generally better structured, they grouped related elements together, used consistent naming for classes and IDs, and even added brief comments in a couple of cases to delineate sections of the form. These behaviours were not observed during the chaotic pre-test coding sessions. This suggests that after four weeks of guided practice and feedback, the novices began to think more like developers planning a project, rather than students scrambling to complete an assignment. The personal confidence gained is perhaps best captured in one participant's enthusiastic post-test comment: *"I can't believe it, a month ago I was scared to touch CSS, and now I built a whole form and even made it look nice! I feel like I can actually do this on my own."* Such testimony highlights that the intervention taught not only technical skills, but also a more positive and proactive approach to problem solving.

6.2.4 Common Gains and Individual Differences in Outcomes

All four participants ultimately succeeded in building a functional survey form after the intervention, marking a clear improvement over their initial attempts. This common achievement was evidenced by each post-test project meeting all of FreeCodeCamp's user story requirements (something none of the pre-test projects fully did). In the qualitative review of the submissions, the researcher noted that every post-intervention form included the essential components (title, description, multiple question types, a submit button that actually worked, etc.), whereas in the pre-test at least two participants had left one or more of those components incomplete. In addition, the post-test forms were generally more

polished in appearance. Even without imposing any formal grading criteria, it was apparent that the overall quality of work had improved, the pages were more user-friendly and visually organized, showing that learners had translated their new knowledge into practice. One participant even went a step further to personalize the project, adding a custom color scheme and a background image to her form. She noted, *"I had extra time and felt confident to experiment with CSS, so I made the form prettier. That's something I would never have attempted in the first round."* While not required, this creative touch shows how greater competence can lead to more initiative and enthusiasm for the task.

Despite these shared successes, there were also individual differences in how each learner improved, shaped by their starting points and learning styles. Participant 1 (P1), who had a bit more of prior coding experience, was the only one to produce a mostly working form in the pre-test. P1's existing skills meant that the improvement in the post-test was less dramatic in terms of features added, he had already included most form elements initially, but it was evident in the refinement of their code and speed of completion. P1 finished the second attempt in a fraction of the time and cleaned up the messy parts of the first submission (for example, reorganizing the CSS rules and eliminating redundant code). On the other end, Participant 4 (P4) started with the weakest pre-test result: an incomplete form lacking several key inputs and with multiple broken elements. For P4, the gamified training had a transformative effect. By the post-test, P4 not only implemented all missing features (e.g. adding the dropdown and radio buttons that were absent before) but also did so correctly and independently. This participant expressed astonishment at their own progress, saying *"My first try was basically a skeleton, I didn't even know how to do half the stuff. Now I have a full form that actually works. It's a night-and-day difference."* P4's journey exemplifies how a motivated novice can catch up quickly when given structured, engaging practice.

Participants 2 and 3 (P2 and P3) fell between these extremes. Both had produced partially functional forms in the pre-test. For instance, P2 managed the HTML structure well but struggled with CSS styling, while P3 got the visual layout decent but missed some functionality. After the intervention, both fixed those gaps: P2 learned enough CSS to style the form neatly (he proudly pointed out that he centered all the elements and used a pleasant font, which he hadn't known how to do before), and P3 made sure to include all required

inputs and validation in the form (something he had skipped initially). Their post-test reflections echoed a mix of surprise and pride. P3 admitted, *"The first time, I left out certain parts because I just didn't know how to make them work. This time I didn't skip anything, and it actually all came together."* Likewise, P2 noted that working through the challenges gave him the perseverance to tackle styling problems: *"I remember how I gave up on making it look nice last month. After all those little exercises, I didn't give up. I kept tweaking until the form looked the way I wanted."* These comments illustrate that while each participant improved in different areas (based on their initial weaknesses), all improvements point to the influence of the gamified learning experience in bolstering both skill and persistence.

Importantly, even the participant who initially doubted that gamification would help in real-world application (one student had favored traditional learning in the questionnaire for transitioning theory to practice) experienced a positive shift. That individual acknowledged after the post-test that the hands-on, game-like exercises *"really did prepare me to build the project better than lectures alone,"* suggesting a personal reconsideration of gamified learning's value. In the end, all four learners shared the overlapping view that the project felt "easier" and "more doable" after the intervention, though each attributed that feeling to slightly different reasons, one highlighted the continuous feedback (*"the constant hints and corrections taught me a lot"*), another emphasized the motivational aspect (*"seeing my progress each day kept me going, which paid off when I sat down to code"*). This blend of perspectives reinforces that while gamified learning may impact individuals uniquely, the overall performance benefits were consistently observed.

Participant	Pre-Intervention (initial attempt)	Post-Intervention (after gamified course)
P1	~2 days to build an almost complete form (minor issues remained). Code was somewhat disorganized; a few structural/style errors present.	~0.5 days to finish the same form 100% correctly. Code was cleaned up and reorganized. No significant errors found.
P2	~2 days. HTML structure nearly complete, but very limited CSS styling; some CSS syntax mistakes; aesthetic details skipped.	~1 day. Well-structured and well-styled form: elements centered, pleasing font choice. Correct use of <label> and required attributes.
P3	~2 days. Decent visual layout, but key functionality (e.g. required inputs, validations) was missing. Some “difficult” parts skipped.	~1 day. Fully functional form with all required fields and validations implemented. Understood and implemented previously skipped features.
P4	~2 days not enough to complete the form. Initial project was incomplete: missing dropdowns, radio buttons, etc., several structural errors.	~1 day. Fully completed, working form. All previously missing features (dropdowns, radio buttons, etc.) added correctly. Dramatic improvement.

Table 2. The table summarizes each participant’s performance before and after the gamified intervention.

6.2.5 Linking Performance Gains to the Gamified Learning Experience

The hands-on results from the Survey Form project provide compelling, real-world evidence of gamification’s impact on novice developers’ performance. Across the board, participants demonstrated faster completion, higher accuracy, and greater confidence in applying their web development knowledge, directly addressing the practical skills gap (Gap 5) identified in the literature. These findings converge neatly with the self-reported data from Section 6.1: the elements that learners found motivating and useful (such as immediate feedback, progress tracking, and incremental challenges) likely contributed to the improvements seen here. For example, the immediate feedback loops in FreeCodeCamp’s lessons helped

participants internalize correct coding practices, which in turn led to fewer errors in the final project. Likewise, the sense of progression and accomplishment (visualized through the course's completion certificate and progress indicators) kept participants engaged enough to practice consistently, resulting in efficiency gains and more confidence when coding on their own. As one participant succinctly put it, *"I learned the basics in a fun way, and then I actually used them, it all clicked when I built the project again."*

In summary, the performance analysis reveals that the gamified learning intervention did more than just boost enjoymen, it measurably enhanced the learners' ability to translate theory into a working web project, even though the evidence is descriptive rather than numeric. By relying on self-observation and personal reports instead of strict metrics, this section captures improvements as experienced by the learners themselves. The common outcome was clear: after a few weeks of gamified practice, four novice coders who initially had trouble creating a simple survey form were able to build one successfully, each in their own style but all with better results than before. This tangible progress offers a real-world complement to the motivational gains discussed earlier, strengthening the argument that gamification can facilitate early-stage skill acquisition in web development. Section 6.3 will next delve into the qualitative feedback from participants, providing further insight into how specific game elements were perceived and how they might have driven the performance gains observed here.

6.3 Interview Findings and Thematic Analysis

Following the quantitative analysis, four interviews were conducted to gain a deeper, more personal understanding of how participants experienced the gamified FreeCodeCamp module. Speaking to each student immediately after they had finished the module revealed their sincere thoughts on what had motivated or frustrated them, bringing human voices to the trends observed in the surveys. The interview setting was informal and note-based (no audio recording), which helped participants feel comfortable and honest about their learning journey. From their responses, several clear themes emerged regarding motivation, the

usefulness of specific game elements, emotional reactions, and perceived learning outcomes in the gamified learning environment.

6.3.1 Engagement and motivation

All four interviewees reported feeling more motivated and engaged with the gamified module than in their traditional university classes. They described this contrast in striking terms. One student admitted, "I feel like (university) did help me but not as much as it could," emphasizing that conventional lectures taught theory but left gaps in practical skills. Another concurred that in regular classes they learned "practical basics yes, (but) practical advanced not really," suggesting it was only after extra hands-on practice (for example, on FreeCodeCamp) that they truly advanced in skill. These comments emphasise that, although traditional pedagogy is valuable for teaching the fundamentals, it often has limitations when it comes to building confidence and practical proficiency. In contrast, the gamified module boosted their motivation by providing a greater sense of agency and progress in learning.

Students repeatedly noted how *"putting theory into practice immediately"* through coding challenges made a tangible difference, something they had been craving in their university courses. This hands-on, learn-by-doing approach began to bridge the disconnect between theory and practice that they experienced in class. Several interviewees spoke with pride and excitement about moments in the module when they built projects or solved problems on their own, moments that made them *"feel like a real developer"* rather than a passive student. Such experiences indicate a deeper engagement: learners were not only more driven to participate day-to-day but also felt a growing confidence in their developer identity, which they had rarely felt in traditional settings. In sum, the gamified approach appeared to significantly boost both motivation and engagement, making learning to code something they looked forward to rather than a chore.

6.3.2 Perceived Usefulness of Game Elements

During the interviews, participants discussed which specific gamification features helped (or not) their learning, revealing that not all game elements were equally effective. A dominant positive theme was the progress trackingsystem. All of the students agreed that the module's visual progress indicators (the sequence of challenges, each with a completion checkmark and a progress bar) were a major source of encouragement. Seeing their own progress each day had a powerful psychological effect.

One interviewee explained that the progress bar *"helped me visualize how much I'd completed, which motivated me to keep going".* This simple visual feedback system stimulated their intrinsic desire for mastery by providing continuous affirmation of their accomplishments. In fact, many students used the progress tracker as a personal goal-setting tool or a 'daily checkpoint' to help them stay focused on achieving small, incremental achievements. They said that they regularly checked how many challenges were left, and that they felt satisfied each time they could cross another task off the list. In contrast, such an immediate sense of progress was absent in their university experience (where progress is only evident at the end of a semester or via infrequent grades). However, the interviews also made it clear that not all progress indicators were equally motivating. While personal progress bars were universally praised, leaderboards (public rankings) received a mixed response. One student admitted he *"enjoys seeing how I rank compared to others,"* indicating that a public scoreboard added a fun competitive element for him. Most others, however, paid little attention to the leaderboard or even found it counterproductive. They preferred to compete against themselves rather than against classmates or strangers. This insight underscores the importance of examining each gamification element individually rather than assuming all game features motivate everyone equally. In this case, a progress bar fostered a sense of personal accomplishment for all, whereas the leaderboard only inspired a subset of students while leaving others indifferent (or anxious about comparisons).

Another unanimously appreciated feature was the platform's immediate feedback on coding challenges and quizzes. Participants became animated when discussing the instant feedback and hint system. Unlike in a traditional class (where one might wait days or weeks for assignment results) here students received feedback within seconds of running their code.

One learner said this *"instant results helped me learn from mistakes right away."* Others agreed with that sentiment, noting that the quick feedback made them more willing to experiment and tackle difficult problems, since they knew they would immediately see what worked and what didn't. Instead of getting discouraged by errors, students came to view mistakes as part of an interactive dialogue: try a solution, get feedback, adjust, and try again. One student remarked, *"It was like having a tutor alongside me,"* comparing the on-demand hints and automatic tests to having a personal guide during practice. All four interviewees at some point used words like "helpful" or "useful" to describe this feedback loop. They felt that instantaneous feedback not only accelerated their learning (by correcting misunderstandings on the spot) but also reduced frustration, it kept them from feeling stuck for long. This finding aligns with educational theory emphasizing the importance of timely feedback for sustaining motivation and understanding. In short, the immediate feedback mechanism was seen as highly useful, directly supporting their learning process rather than serving simply as a game.

Participants also highlighted the design of the coding challenges and quizzes themselves, as a crucial factor in their experience. Many described the FreeCodeCamp challenges as engaging and well-structured, with a step-by-step increase in difficulty that kept them in a productive learning zone. One participant reflected that the challenges *"kept me mentally engaged and encouraged me to reflect and improve continuously,"* indicating that the progression of tasks was neither too easy nor too hard, but just challenging enough to promote focus and growth. In educational terms, this approach helped to maintain a state of "flow," where learners are fully absorbed in solving problems at the edge of their ability. The interviews suggest that it wasn't simply the points or badges (the extrinsic rewards) that pushed them to continue, but rather the intrinsic satisfaction of solving meaningful problems and seeing real improvement. As one interviewee noted a difference with her university coursework: *"in my class, we covered a lot of concepts, but here I actually had to use them immediately. That made the theory click."* This comment illustrates how applying concepts in practice helped solidify her understanding in a way traditional classes had not. In essence, the quality and structure of the learning content (the challenges) were seen as highly useful and motivating. Gamification elements alone would likely have felt hollow without substantive challenges to back them up.

The students' praise for the challenge design reinforces that a gamified course must still rest on solid instructional design to truly engage and teach effectively.

When it came to achievements and rewards (like points, badges, and certificates), the interviews revealed a more complex and sometimes ambivalent view. Every participant earned a completion certificate for the module, and they discussed how that achievement felt and whether it mattered. Two of the four described the certificate as *"motivating to have"* largely because it was tangible evidence of their effort. One admitted he valued it since *"it can be relevant for my resume,"* highlighting a clear extrinsic motivation for finishing the curriculum. For these individuals, the prospect of obtaining a certificate provided an additional incentive to complete the course, as it had real-world value beyond the immediate learning experience. However, even those who valued earning a certificate considered it to have little influence on their day-to-day engagement. In the words of one student, *"the certificate was always at the back of my mind as a goal, but it's not what got me to open the laptop each night , that was more the fact that I was enjoying the challenges."* In other words, the prospect of a badge or certificate helped drive them to *finish* the module, but it was not the primary reason they *kept going each day*. The other two participants were almost indifferent to the certificate; they saw it as a nice bonus but not a learning motivator. As one laughed, she sometimes *"forgot there even was a certificate until it popped up at the end."* What consistently motivated her instead were the small wins along the way, solving a tough challenge, improving her code, seeing her progress bar move forward.

Interestingly, one learner did confess to a more emotionally charged reaction to the points and badges. He likened *"earning points and getting badges"* to *"a dopamine boost - the brain thinks it has received something."* For him, accumulating points clearly triggered a short-term excitement, a burst of pleasure upon success. However, he also reflected on the other side of the coin: *"The downside is that if I don't receive points, I feel very bad, which can affect my learning experience."* It captures the double nature of gamification's extrinsic rewards. On the one hand, points and badges stimulated engagement by triggering the brain's reward system, providing a motivational boost when he succeeded. However, when progress stalled and the rewards didn't come, he became discouraged, which affected his mood and his motivation to continue. In our conversation, this student recognized that his motivation was becoming too

tied to the external rewards. He concluded that, while the gamified points and badges got him initially, he needed to *"make sure I'm learning for myself, not just for points."* The other interviewees appeared to find a healthier balance from the start, enjoying collecting badges and seeing points accumulate, but never saw them as the main purpose of learning. In fact, all four participants explicitly stated that they enjoyed the learning process itself, which indicates that their intrinsic motivation (interest and enjoyment in coding) remained strong throughout the module. The general consensus was that the points and badges were fun extras but real learning progress and enjoyment were the true drivers. This reinforces the idea that gamified rewards should complement, not replace, the intrinsic satisfaction of learning. If overemphasized, extrinsic rewards can undermine intrinsic motivation, so a careful balance is needed in design.

Another recurring theme was the use of 'streaks' and other mechanics designed to form daily habits. FreeCodeCamp subtly tracks how many days in a row a user completes challenges (similar to the streak feature in apps like Duolingo). Despite not being a prominent feature of the platform, some interviewees took it upon themselves to maintain a daily coding streak during the module. They discussed this almost like a personal mini-game within the experience. *"Starting to develop a streak is nice because then I'm motivated to not lose it,"* one student explained, comparing it to her experience with Duolingo where breaking a streak feels like losing an asset. *"After some point you get 'attached' so you don't want to lose the sign of commitment,"* she added, referring to the streak counter as a badge of honor in itself. This extrinsic mechanism (the streak count) helped them create a consistent study routine. Even on busy days, knowing they had a streak to uphold pushed them to squeeze in at least a few minutes of practice. One student shared that *"daily streaks keep me motivated and even if I don't have much time I'm learning something for 3-5 minutes daily, which makes the whole process more consistent."* From an educator's perspective, this is a very positive outcome: an external motivator (maintaining a streak) led to the formation of a good habit (regular daily practice), which in turn should improve learning. For example, none of the participants reported rushing through tasks just to keep the streak alive; instead, they used it as a friendly reminder not to skip practice. For some, streaks even introduced a light social dimension. One participant excitedly told how she and the other participants would compare their streaks and progress pace and gently compete. Although the platform itself did not have

built-in friend lists or social sharing for streaks, these learners found ways to bring peers into the loop by informally sharing their progress. This added an extra layer of accountability and fun, hinting at the potential power of social learning elements even in a self-paced context.

The topic of social interaction (or its absence) emerged as a little but significant theme in the interviews. When asked about the disadvantages of the gamified module or what they would change, several participants highlighted the solitary nature of the experience. Although they valued the flexibility to work at their own pace, some missed the sense of community and the opportunity to collaborate with peers on problem-solving.

One student noted that *"it might be even more fun if we could solve some challenges together or share solutions,"* expressing a desire for collaborative elements that the FreeCodeCamp platform doesn't currently emphasize. This sentiment, like many others, echoed what we saw in the survey results, where a majority of respondents agreed that gamified platforms often lack sufficient collaboration and social interaction. Learners acknowledged this as a limitation: in the real world, web development often involves teamwork and community support, yet their practice environment in this study felt isolated at times. However, it's worth noting that not everyone saw the lack of social features as a negative. One participant actually appreciated the solitude, saying it allowed him to focus and *"learn at my own pace without feeling behind."* This diversity of opinion suggests that the optimal learning environment should blend both worlds, offering the benefits of gamified, self-paced learning alongside opportunities for social learning. In the context of this study, the absence of built-in collaboration was partly mitigated by the participants' own efforts (for example, discussing challenges with friends outside the platform or using online forums). Even so, the students felt this was an area where the platform could improve. By noting this gap between the collaborative nature of real-world learning and the isolated nature of their gamified training, participants implicitly suggested that future gamified learning tools should consider integrating more community features to enhance engagement.

6.3.3 Emotional Response

Beyond practical motivations, the interviews revealed strong emotional responses to the gamified learning experience. Overall, participants spoke of the module in positive emotional terms, using words like fun, enjoyable, and even “addictive” (in a good way) to describe how it felt to learn with game elements. Several students remarked that they were genuinely enjoying the process of working through challenges, which is a clear indicator of intrinsic motivation. One student explicitly said that enjoying the coding challenges was what got him to “open the laptop each night,” rather than any external reward. Many recounted moments of excitement and pride during the module, for instance when completing a project or solving a difficult problem. These moments were often accompanied by visible excitement in their voices during the interviews. One participant described how finishing a particular challenge and seeing the congratulatory message *“test passed!”* on the screen gave them a feeling of pride, it was a concrete affirmation of their success that helped conquer a moment of self-doubt. Such emotional highs (pride, relief, excitement) seem to play a key role in reinforcing their motivation to keep learning.

At the same time, the interviews also touched on the emotional challenges and complexities introduced by gamification. The earlier example of the student who felt a “dopamine rush” from points (and oppositely felt very bad when points weren’t coming) illustrates how game rewards can impact learners’ emotions. Gamification can introduce highs and lows: the excitement of earning points, badges, or maintaining a streak, and the frustration or discouragement if progress slows down. Some participants admitted to feeling anxious or disappointed on days when they struggled with a task and didn’t make visible progress. However, an encouraging finding is that most students remained emotionally resilient in the face of these downsides, even if it was just for a research test of mine and not an university exam they all were very engaged with the project.

They were aware of the potential stress caused by external comparisons or rewards, and they actively refocused on the learning process itself when they experienced negative emotions. The student who mentioned feeling discouraged by a lack of points also recognised this problem and reminded themselves to focus on their personal learning goals (“learning for myself, not just for points”). Others naturally maintained a balance, as evidenced by all four

interviewees stating that they enjoyed the learning process for its own sake. This self-awareness helped prevent gamification from undermining their confidence. In fact, students noted a boost in self-confidence by the end of the module. They felt more confident tackling new coding problems, which they attributed to the safe, supportive environment of the gamified platform (where mistakes were treated as learning opportunities rather than failures). One student remarked that when she encountered a bug in her code, she didn't panic as she might have before; instead she saw it as "another puzzle to solve," reflecting a shift towards a more positive, game-like mindset about challenges. Such comments suggest that the gamified experience not only engaged students intellectually but also emotionally empowered them, making them more optimistic, persistent, and confident in their abilities. In summary, the emotional response to the gamified module was largely positive: students felt enjoyment, excitement, and pride in their achievements, and while they did experience occasional frustration or anxiety, they learned to navigate those feelings by focusing on personal growth and the inherent fun of coding.

6.3.4 Perceived Learning Outcomes

Crucially, the interviewees also spoke about how the gamified module impacted their learning outcomes, that is, what they felt they learned or accomplished, and how it compared to their prior learning experiences. A clear theme was that students believed the gamified approach helped them achieve more, in a shorter time, than they expected. Many were pleasantly surprised at their own progress in web development over the few weeks of the module. For example, one participant noted, "in my class, we covered a lot of concepts, but here I actually had to use them immediately. That made the theory click." This immediate application of theoretical knowledge not only kept them engaged (as discussed earlier) but also improved their understanding and retention of the material. They pointed out that they built small projects or solved more complex exercises by the end of the module, things they never thought they could do that fast their learning journey. One interviewee described a sense of accomplishment in having built a functional website by Week 4 of the program, which greatly exceeded her initial expectations of what she could achieve in that timeframe. Although this study did not include a formal exam or a non-gamified control group for direct comparison,

the self-reported improvements are telling. Learners felt that their practical skills and confidence grew noticeably through the gamified module. They credited the module's structure and motivational features for this growth, saying that it encouraged them to practice more consistently and tackle more advanced topics than they would have otherwise. In particular, the frequent hands-on practice and the motivation to keep progressing made them spend more time coding. This extra practice translated into better proficiency. One student, who initially doubted that an online self-guided course could help with real-world projects, conceded after the module that the experience did help him *"get closer to a real-world project mindset"* by requiring him to build small projects and practice regularly. He shifted from skepticism to seeing the gamified approach as nearly on par with traditional instruction in its ability to bridge theory and practice.

The interviews also reinforced the quantitative performance gains noted earlier in the Results. Participants' qualitative descriptions of their learning progress aligned with the improvements seen in their coding test scores and project outcomes. For instance, they talked about increasing their coding speed and problem-solving abilities, which corresponds to the faster completion times and higher success rates recorded during the module. They also reported feeling much more confident in their coding skills by the end. This boost in self-efficacy is a valuable learning outcome in itself for novices: by feeling "more like real developers" and less like unsure beginners, they are more likely to continue learning and tackling new challenges beyond this course. The timely feedback and iterative practice in the gamified module seem to have helped solidify their knowledge, as students often mentioned understanding concepts better because they actually applied them (and corrected mistakes immediately). In their view, the gamified module was not just a fun add-on to learning, but a highly effective educational experience. Interviewees explicitly stated that they found the gamified platform more helpful for learning practical skills than some of their lecture-based university courses. They acknowledged that traditional classes gave them a foundation in theory, but it was this gamified, practice-intensive approach that truly advanced their abilities and confidence. That said, the students also identified areas where learning outcomes could be further improved. As discussed, they felt that incorporating opportunities for collaboration (working through problems with peers or sharing solutions) could enhance learning by reflecting real-world teamwork. They also cautioned that while gamification boosted their

short-term engagement, it should always be implemented in a way that supports long-term learning, meaning extrinsic rewards should never eclipse the goal of mastering the material.

6.4 Key Findings by Research Question

RQ1: Effects of Traditional Pedagogy on Novice Motivation and Outcomes

Traditional university teaching methods were found to be of limited success in motivating beginner web developers. Many participants described these methods, including lectures and theory-heavy lessons, as "detached from practice". This often led to a focus on external rewards like grades rather than genuine skill mastery. Novices reported feeling less engaged and uncertain about their progress in standard classes. Some admitted to doing the minimum required, indicating a reliance on extrinsic motivation. Consequently, their perception of learning outcomes was modest, often doubting the practical applicability of lecture-based knowledge. The lack of immediate feedback and interactivity in traditional settings appeared to dampen motivation, leading to hesitancy and insecurity. Reduced feedback loops slowed down the willingness to experiment or tackle challenges. The findings confirm that novices thrive when they can view progress as an achievement itself, rather than solely worrying about exam performance, highlighting a need for more engaging, practice-oriented approaches.

RQ2: Influence of Specific Gamification Elements on Intrinsic Motivation The introduction of game elements (points, badges, a leaderboard, themed coding challenges, and instant feedback) had a generally positive impact on intrinsic motivation, with most participants feeling more driven by enjoyment, curiosity, and a desire to improve.

- **Points and Progression:** Points for completing exercises were a strong motivator, providing a visible measure of progress and a sense of accomplishment. This aligns with the idea that points can satisfy the need for competence. However, some noted the potential to "game the system" if points weren't tied to meaningful tasks.

- **Badges and Certificates:** Digital badges were likened to "trophies" that recognized effort and milestones, boosting confidence and encouraging continuation. Their motivational impact was higher when perceived as meaningful. While providing an extra motivational push, the learning content itself remained more important.
- **Leaderboards :** Leaderboards had a mixed influence. About half the participants found the friendly competition exciting and motivating. Others were indifferent or anxious, with lower-ranking students sometimes feeling "left behind". This suggests competitive gamification should be used carefully.
- **Challenges and Quests:** Themed coding challenges framed as "quests" were highly praised for fostering intrinsic motivation. They added a storytelling element and clear goals, making learning feel like an exploratory game. Many found these challenges "fun" and "addictive," often doing extra practice unprompted. This reflects the power of well-designed challenges to foster engagement and tap into curiosity and perseverance.
- **Immediate Feedback:** Instant feedback on code or quizzes significantly influenced motivation. Students appreciated immediate responses, which kept them motivated to iterate and learn from errors on the spot, likening it to having a personal tutor. Quick feedback satisfies the need for competence and turns learning into an interactive loop. In summary, points and feedback were most universally effective, challenges provided deep engagement, and badges offered meaningful rewards, while leaderboards had varied effects. Importantly, the extrinsic nature of points or badges did not appear to undermine intrinsic motivation in this short-term study.

RQ3: Perceived Usefulness of Gamification for Learning Participants generally felt that gamification positively contributed to their learning, primarily by increasing engagement and practice time. More time on task, driven by enjoyment, led to improved coding skills. This aligns with research showing gamification features increase learner engagement and time-on-task, correlating with skill acquisition. Instant feedback was particularly valued for its direct pedagogical benefits, helping students quickly understand and correct errors, leading to a faster and deeper grasp of concepts. Gamification, in this sense, can act as a form of tutoring. The structured progression within the gamified course, with clear, gamified goals, also provided a helpful roadmap, breaking the curriculum into manageable chunks. This

highlights that effective gamification is about structuring the learning experience meaningfully, not just extrinsic rewards. Many felt a better command of fundamentals by the end of the 4 weeks due to continuous active learning. However, not all elements were seen as equally useful for learning. Some questioned the educational value of leaderboards and saw badges as nice rewards that didn't directly teach new knowledge. True learning came from engaging with material, coding, problem-solving, and feedback, with gamification motivating and structuring these engagements. This suggests gamification primarily boosts applied skills and confidence. In essence, gamification creates the conditions for better learning through motivation, practice, and feedback.

RQ4: Learner Experiences – Engagement, Performance, and Self-Confidence Students highlighted improvements in engagement, performance, and self-confidence.

- **Engagement:** Learners reported higher engagement, using terms like "immersive," "fun," and "interactive". They looked forward to learning sessions and often lost track of time during challenges, indicating deep engagement and increased attention to learning tasks. This is consistent with studies reporting higher student participation with gamification.
- **Performance:** Students felt their performance, in terms of skill acquisition and project completion, was enhanced. Many were surprised by their own progress, completing more exercises or tackling advanced topics than expected. While these are subjective assessments without a control group, the confidence displayed suggests meaningful improvement in practical competence. The key takeaway is that students felt more capable.
- **Self-Confidence:** A profound change was observed in self-confidence regarding coding. Nearly all students reported increased confidence, feeling less afraid to tackle new coding problems. This boost was attributed to steady progression, tangible rewards affirming progress, and a safe failure environment where mistakes were treated as learning opportunities. These three aspects—engagement, performance, and confidence—appeared to be mutually reinforcing. This supports motivational theories suggesting that when basic psychological needs are met, engagement and

self-belief grow. The growth in confidence is particularly significant for novice developers, potentially improving retention in fields notorious for causing self-doubt.

6.5 Summary

In summary, the interview findings indicate that the gamified web development module had a positive impact on learning outcomes as perceived by the students. They emerged from the experience with stronger practical skills, greater confidence in coding, and a clearer sense of progress than they typically gained from traditional instruction. The combination of frequent practice, instant feedback, and engaging challenges helped them learn more effectively in a short period. Importantly, they attributed these gains to the thoughtful integration of game elements with solid instructional content, the gamification provided motivation and structure, but it was the actual coding practice and problem-solving that made the theory "click" and skills grow. This suggests that gamification, when well-designed, can do more than just make learning enjoyable; it can also enhance the effectiveness of learning by keeping students persistently engaged in meaningful practice. The students' voices in these interviews give valuable context to the earlier quantitative results, painting a picture of novice developers who generally thrived in a gamified learning environment, they were more motivated, more emotionally invested, and in the end, more skilled and confident in web development than they were before. Linking back to Marczewski's Player Type Framework in Chapter 2, Player 1 (P1) is the Achiever, driven by the completion of milestones quickly and the receipt of visible rewards; Player 2 (P2) is the Explorer, fuelled by curiosity and creative experimentation; Player 3 (P3) is the Socialiser, energised by collaborative feedback; and Player 4 (P4) is the Killer, spurred on by friendly competition and maintaining a winning streak.

The most interesting finding is that almost all of the qualitative responses to the open-ended questions in my anonymous questionnaire were touched upon during the interviews. This finding lends even greater relevance to the data drawn from the questionnaire, providing better explanations of many of the research questions on which the entire study is based.

7. Conclusion

7.1 Confirming, Extending, or Challenging the Literature

The findings validate that gamification can significantly boost student engagement and motivation, aligning with a large body of research. The study extends this to the specific domain of web development. The detailed analysis of individual elements supports theories that different game mechanics have distinct motivational effects. For instance, the mixed reaction to leaderboards supports and extends findings on the potential downsides of competitive gamification, while also showing how students might self-regulate. The positive impact of immediate feedback confirms its established pedagogical importance and illustrates its effectiveness within a gamified context. Regarding learning outcomes, the study suggests gamification can enhance applied skills and project performance, consistent with some prior work, even if exam-like theoretical knowledge wasn't measured. This helps reconcile mixed results in the literature by highlighting the importance of timeframe and measurement: early-phase improvements (engagement, practical skills, confidence) can be clear, while other metrics may require longer study. The study also challenges the notion that extrinsic rewards inevitably diminish intrinsic motivation in the short term, suggesting they can coexist and even bolster intrinsic interest for novices if tied to genuine progress. However, the need for careful long-term balancing is acknowledged. Focusing on novice web developers, the study found that the creative aspect of the field did not make gamification less applicable and may have even been stimulated. The existing high student interest in web development is noted as a context factor. Overall, the findings support and enrich existing literature, offering new insights into element-specific effects, design, context, and early-stage impacts.

7.2 Significance of the Findings

The findings are significant for web development education and digital pedagogy. Gamified learning can address challenges like high dropout rates and low engagement in traditional

programming courses by making the process enjoyable and confidence-building, potentially leading to better skill acquisition and more individuals pursuing careers in the field. The research highlights the importance of nurturing intrinsic motivation, showing that gamification can help students become self-motivated learners, crucial for fields requiring continuous self-driven exploration like web development. This is particularly relevant for digital learning environments like online bootcamps, suggesting educational software can embed motivational design. The success of elements like immediate feedback and incremental challenges reinforces their general pedagogical value, suggesting educators can integrate these practices even without full gamification. The study serves as a proof of concept for active, student-centered, and responsive learning strategies. From a digital pedagogy perspective, the findings emphasize personalization and student experience, showing that allowing individualized journeys and recognizing diverse motivations can lead to better outcomes and a sense of ownership. Lastly, the research suggests gamification can foster a more positive attitude toward learning itself, instilling curiosity and resilience, which is invaluable for continuous learning in rapidly evolving tech fields. This contributes to a more growth-oriented learning culture.

7.3 Addressing Identified Literature Gaps

The research addressed several identified literature gaps:

- **Gap 1 (Lack of analysis of individual gamification elements):** Addressed by tracking the impact of specific elements (points, badges, etc.), showing distinct influences and providing granular evidence.
- **Gap 2 (Context-dependence - lack of studies in web development):** Addressed by targeting a web development course for novices, providing data unique to this setting and confirming gamification's effectiveness in this domain.
- **Gap 3 (Balance between intrinsic and extrinsic motivation):** Addressed by monitoring motivational drivers, finding that in the short term, extrinsic rewards and intrinsic motivation were complementary, with external rewards often sparking internal interest.

- **Gap 4 (Inadequate measurement of learning outcomes):** Addressed by using a mixed-methods approach measuring quantitative and qualitative outcomes, including skill development indicators, self-reported data, and interview insights, allowing for a holistic assessment.
- **Gap 5 (Short-term vs. long-term effects):** Addressed by examining an intervention over one month, noting sustained enthusiasm and engagement beyond initial novelty, providing data on early-stage impacts over multiple weeks.
- **Gap 6 (Lack of social and collaborative elements):** This gap was confirmed as the study's implementation was primarily individual-focused. Mild social components like leaderboards showed potential, and student feedback highlighted a desire for more collaboration, framing this as a key recommendation for future work. The thesis significantly advances the conversation, particularly on individual elements, web development context, motivation balance, comprehensive learning measurement, and extended short-term impact.

7.4 Limitations of the Study

The study has several limitations:

- **Small Sample Size:** A single class of novice web development students limits generalizability and statistical robustness. The results are more exploratory than definitive proof.
- **Short Timeframe:** The four-week intervention is too short to assess long-term learning, motivational impacts, or whether novelty effects might wear off. It captures early impacts rather than the full trajectory.
- **Reliance on Self-Reported Data:** Data from surveys and interviews are subject to biases like social desirability or memory errors. Self-reported improvements are subjective and not always independently verified by objective measures.
- **No Formal Control Group:** The lack of a parallel non-gamified control group means improvements cannot definitively be attributed solely to gamification, as other factors

(novelty, instructor enthusiasm) could have played a role. Causal influence is likely but not conclusively proven.

- **Platform and Implementation Specifics:** Findings are tied to the specific gamification platform and design choices made. Different implementations might yield different effects. Generalizing to all gamification approaches should be done cautiously. These limitations suggest conclusions should be seen as preliminary and context-dependent, providing a basis for further investigation.

7.4.1 Directions for Future Research

Several directions for future research emerge:

- **Larger-Scale Studies:** Involve larger, more diverse samples across multiple institutions to improve generalizability and allow for more sophisticated analysis.
- **Longer-Term Research:** Extend interventions over entire semesters or academic years to study sustainability of motivation, long-term learning outcomes, knowledge retention, and impact on progression in the field.
- **Inclusion of Control and Comparison Groups:** Employ randomized controlled trials or comparisons with alternative pedagogical approaches to isolate gamification effects and quantify improvements.
- **Exploring Different Gamification Designs and Platforms:** Experiment with various feature configurations (e.g., narrative, avatars, adaptive difficulty), specific elements in isolation, and different platforms to map the design space of gamification.
- **Collaborative and Social Gamification Elements:** Incorporate and study team-based challenges, peer competition, or community contribution rewards to investigate the impact of social learning in gamified contexts.
- **Examining Learning Depth and Long-Term Retention:** Include measures of knowledge retention, skill transfer to new problems, conceptual understanding, and higher-order skills like creativity and problem-solving.
- **Personalization and Adaptive Gamification:** Investigate systems that personalize the gamified experience based on individual student performance or preferences to

potentially enhance motivation and learning efficiency. Such research will help transition gamified learning from a promising innovation to an evidence-backed mainstream practice.

7.5 Practical Implications

The research offers practical implications for various educational stakeholders:

- **For Course Instructors:** Can use even small gamification techniques (points, badges, leaderboards for friendly competition, framing assignments as challenges) to boost engagement. Emphasize prompt, formative feedback to keep students motivated. Create a classroom atmosphere that celebrates progress and effort.
- **For Curriculum and Course Designers:** Integrate structured progression (levels, milestones) and interactive tasks with immediate feedback into course design. Design courses to encourage consistent engagement. Include optional challenges and stretch goals. Crucially, align gamification with meaningful learning outcomes.
- **For Educational Institutions and Administrators:** Support and invest in gamified learning platforms and professional development for instructors on effective gamification aligned with pedagogy. Pilot gamification in key first-year courses to evaluate impact on retention and satisfaction. Foster a culture of innovative teaching and integrate gamified learning data into teaching effectiveness assessments.
- **For Online Learning Platforms and Developers:** Prioritize features like instantaneous feedback, clear progress indicators, flexible reward mechanisms, and potentially community features and theming based on student preferences. The core message is that gamification, viewed as a structured enhancement of pedagogy focusing on frequent feedback, visible progress, challenges, and achievement recognition, is a viable strategy to improve student engagement, motivation, confidence, and ultimately, the learning experience.

8. Aknowledgments

I would like to thank my mother and sister for their unconditional support and Andrea for encouraging me to follow this path.

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Lastly, I apologize if I forgot to mention anyone by name—otherwise, this acknowledgment would be as long as the thesis itself. This makes me realize how rich I truly am.

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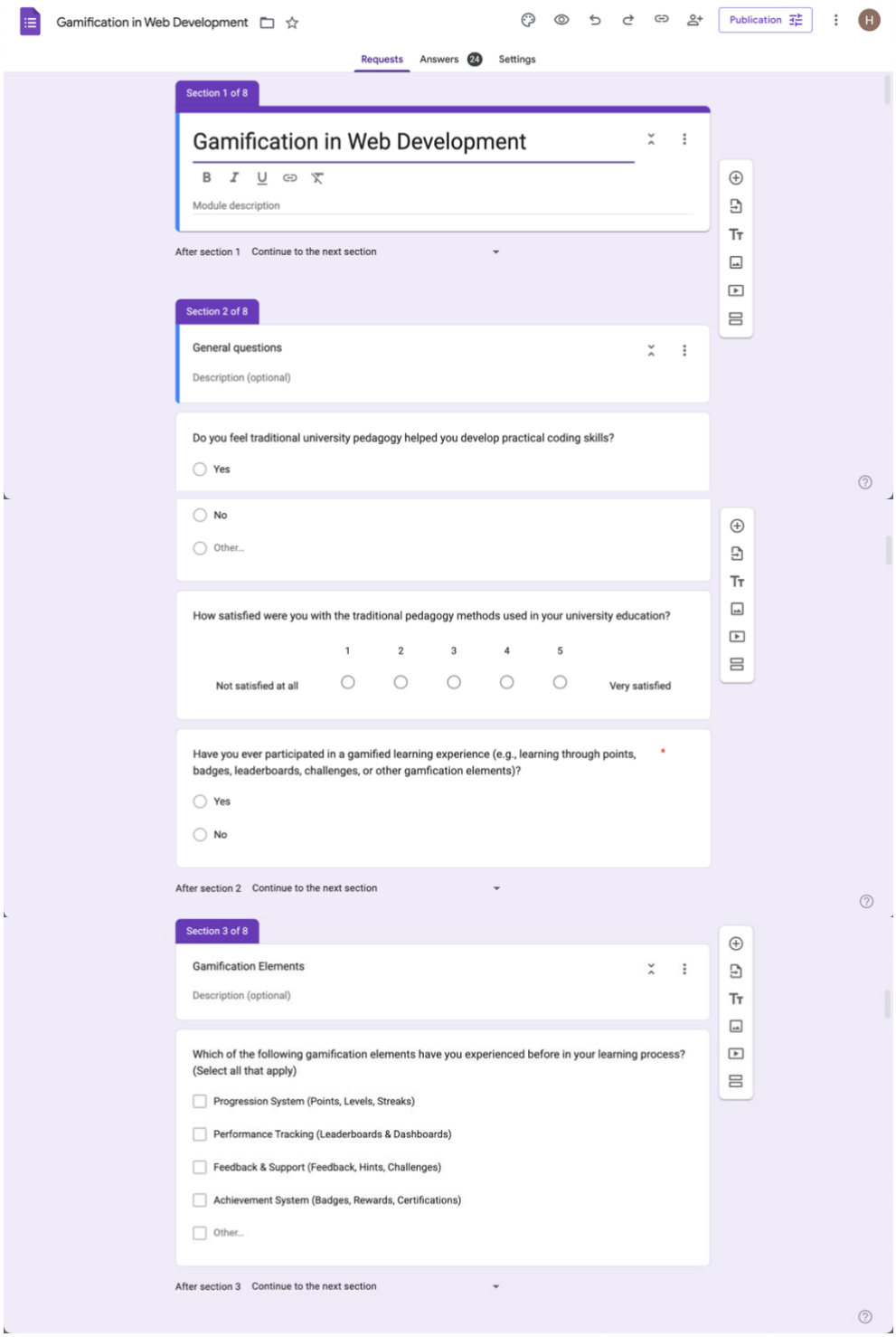
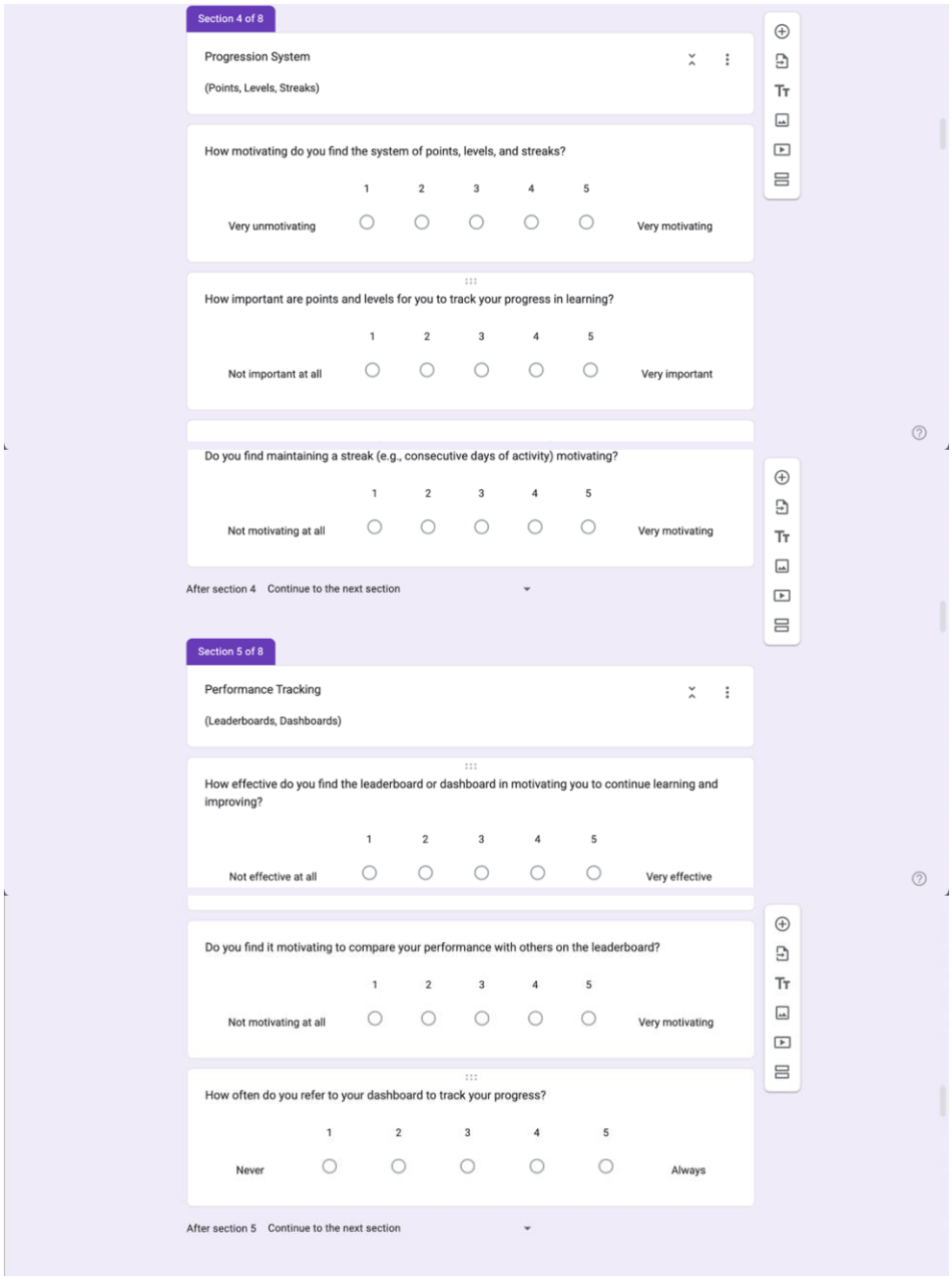
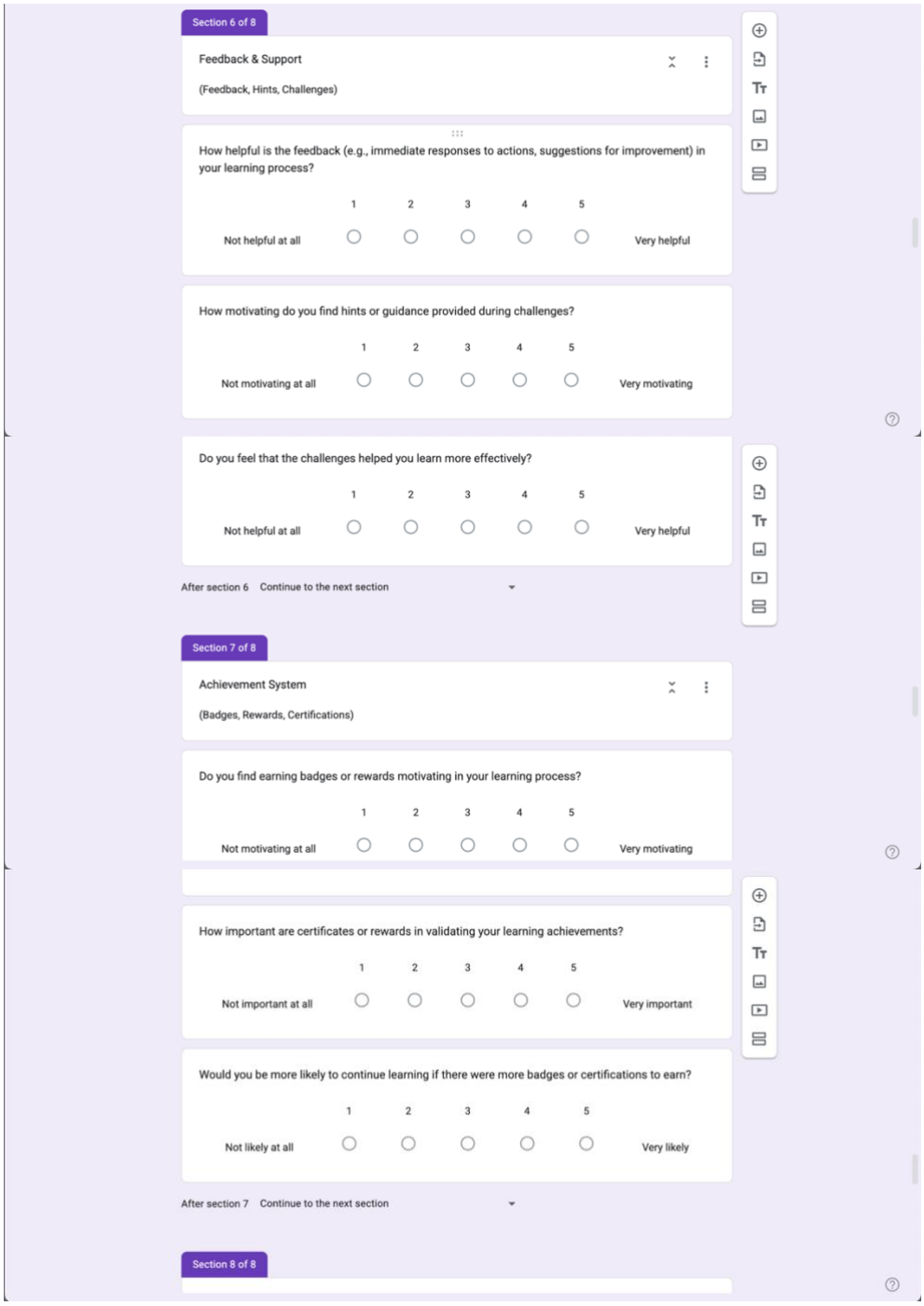
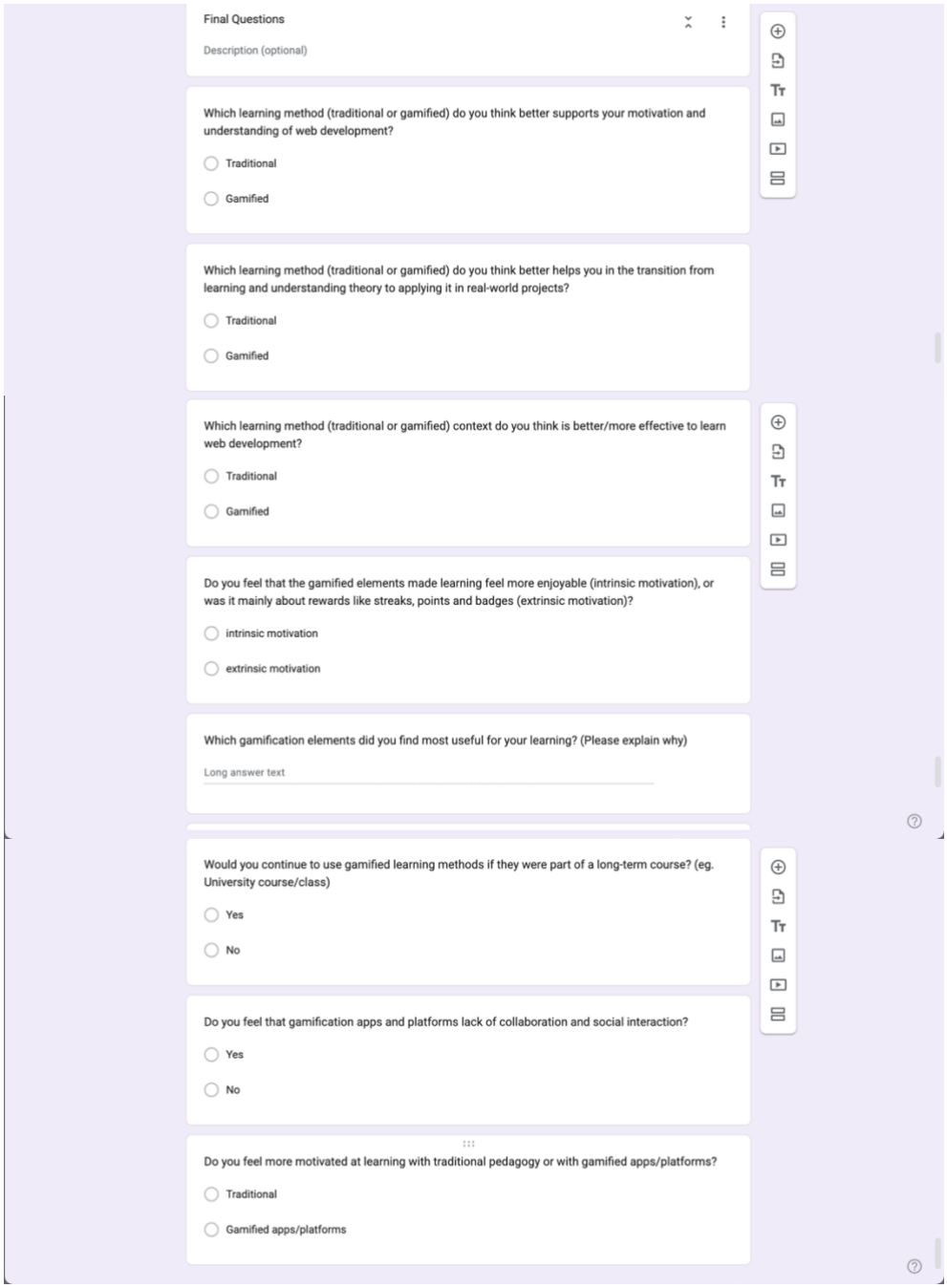
Appendix A

Questionnaire questions



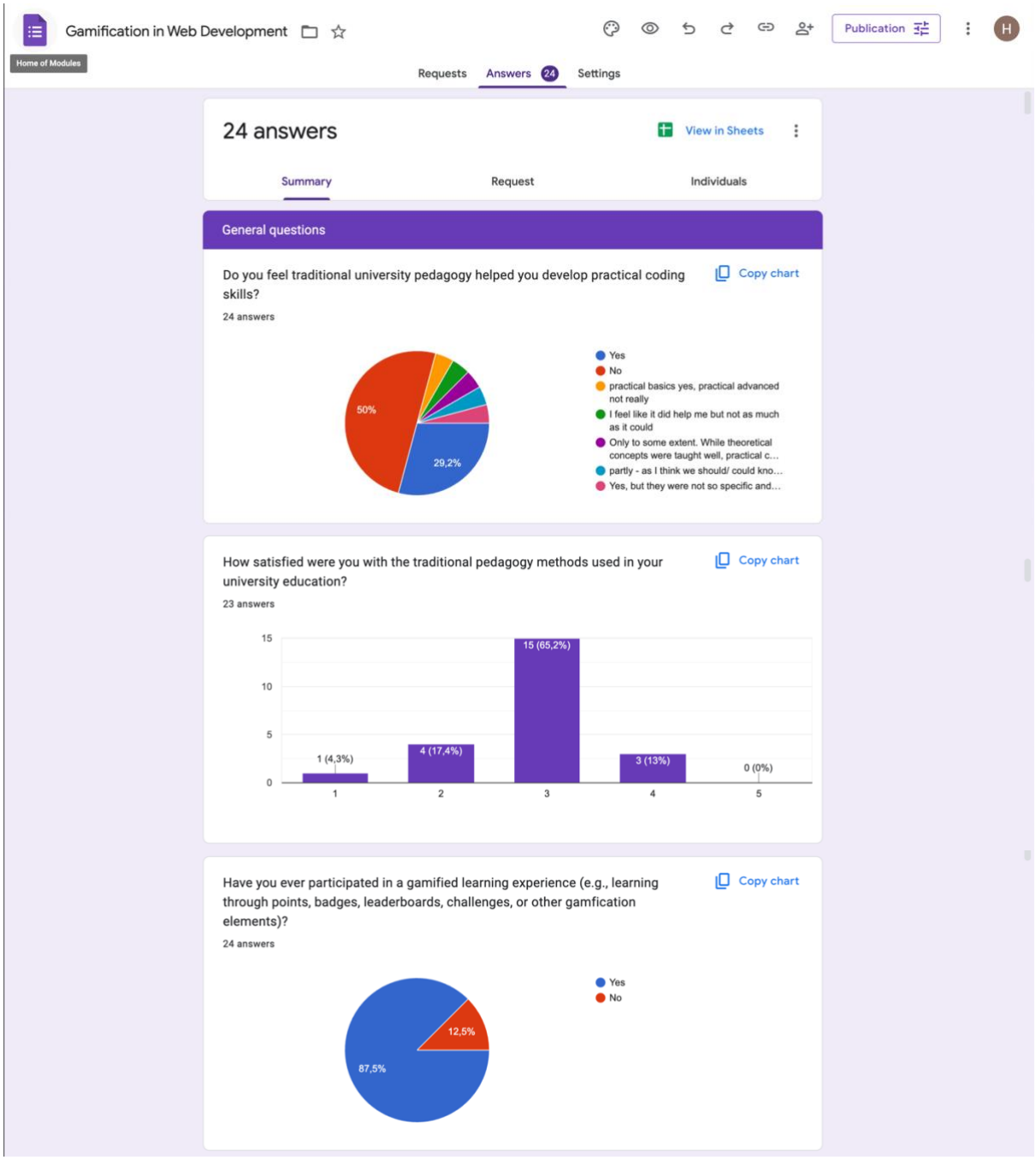

Section 4 of 8
Progression System
(Points, Levels, Streaks)
How motivating do you find the system of points, levels, and streaks?
1 2 3 4 5
Very unmotivating
Very motivating
How important are points and levels for you to track your progress in learning?
1 2 3 4 5
Not important at all
Very important
Do you find maintaining a streak (e.g., consecutive days of activity) motivating?
1 2 3 4 5
Not motivating at all
Very motivating
After section 4 Continue to the next section
Section 5 of 8
Performance Tracking
(Leaderboards, Dashboards)
How effective do you find the leaderboard or dashboard in motivating you to continue learning and improving?
1 2 3 4 5
Not effective at all
Very effective
Do you find it motivating to compare your performance with others on the leaderboard?
1 2 3 4 5
Not motivating at all
Very motivating
How often do you refer to your dashboard to track your progress?
1 2 3 4 5
Never
Always
After section 5 Continue to the next section


Section 6 of 8
Feedback & Support
(Feedback, Hints, Challenges)
How helpful is the feedback (e.g., immediate responses to actions, suggestions for improvement) in your learning process?
1 2 3 4 5
Not helpful at all
Very helpful
How motivating do you find hints or guidance provided during challenges?
1 2 3 4 5
Not motivating at all
Very motivating
Do you feel that the challenges helped you learn more effectively?
1 2 3 4 5
Not helpful at all
Very helpful
After section 6 Continue to the next section
Section 7 of 8
Achievement System
(Badges, Rewards, Certifications)
Do you find earning badges or rewards motivating in your learning process?
1 2 3 4 5
Not motivating at all
Very motivating
How important are certificates or rewards in validating your learning achievements?
1 2 3 4 5
Not important at all
Very important
Would you be more likely to continue learning if there were more badges or certifications to earn?
1 2 3 4 5
Not likely at all
Very likely
After section 7 Continue to the next section
Section 8 of 8


Final Questions
Description (optional)
Which learning method (traditional or gamified) do you think better supports your motivation and understanding of web development?
Traditional
Gamified
Which learning method (traditional or gamified) do you think better helps you in the transition from learning and understanding theory to applying it in real-world projects?
Traditional
Gamified
Which learning method (traditional or gamified) context do you think is better/more effective to learn web development?
Traditional
Gamified
Do you feel that the gamified elements made learning feel more enjoyable (intrinsic motivation), or was it mainly about rewards like streaks, points and badges (extrinsic motivation)?
intrinsic motivation
extrinsic motivation
Which gamification elements did you find most useful for your learning? (Please explain why)
Long answer text
Would you continue to use gamified learning methods if they were part of a long-term course? (eg. University course/class)
Yes
No
Do you feel that gamification apps and platforms lack of collaboration and social interaction?
Yes
No
Do you feel more motivated at learning with traditional pedagogy or with gamified apps/platforms?
Traditional
Gamified apps/platforms

Appendix B

Questionnaire answers



Gamification Elements

Which of the following gamification elements have you experienced before in your learning process? (Select all that apply)

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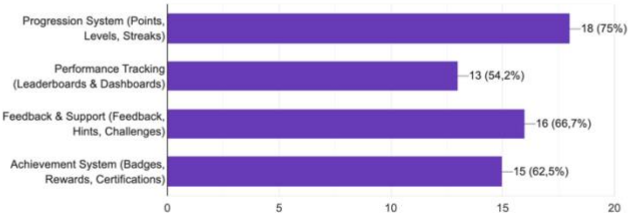
24 answers



Progression System

How motivating do you find the system of points, levels, and streaks?

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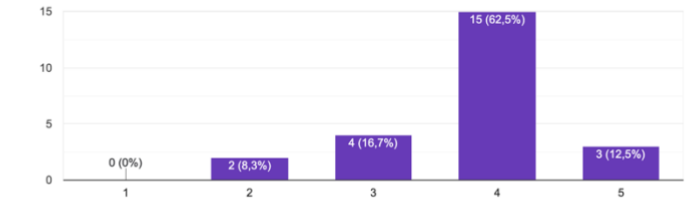

How important are points and levels for you to track your progress in learning?

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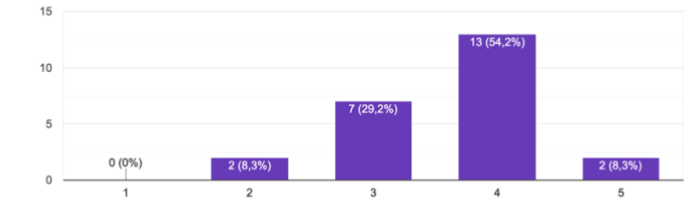
24 answers



Do you find maintaining a streak (e.g., consecutive days of activity) motivating?

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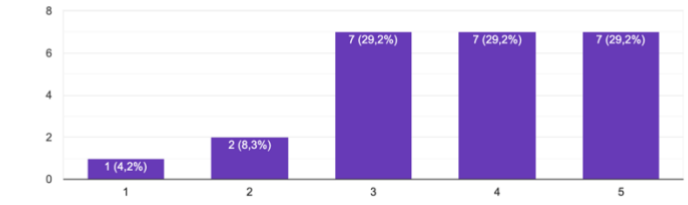

Performance Tracking

How effective do you find the leaderboard or dashboard in motivating you to continue learning and improving?

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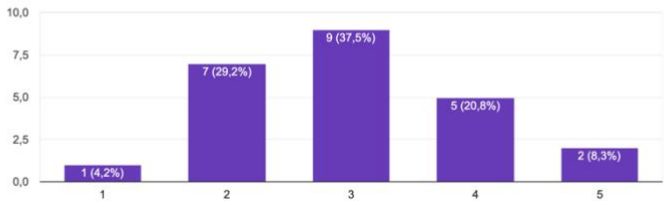

Do you find it motivating to compare your performance with others on the leaderboard?

Copia grafico

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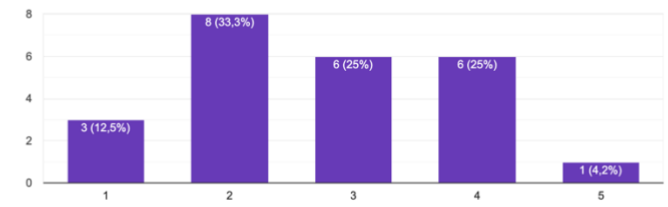

How often do you refer to your dashboard to track your progress?

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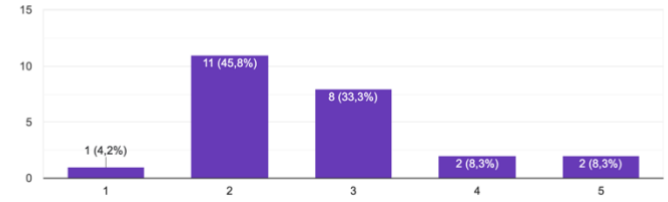

Feedback & Support

How helpful is the feedback (e.g., immediate responses to actions, suggestions for improvement) in your learning process?

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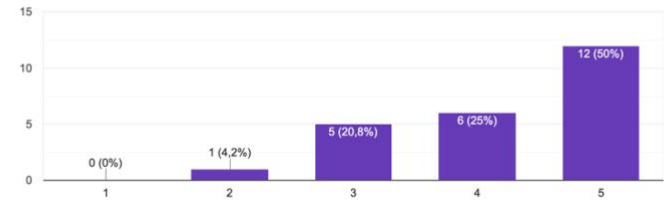

How motivating do you find hints or guidance provided during challenges? Copia grafico

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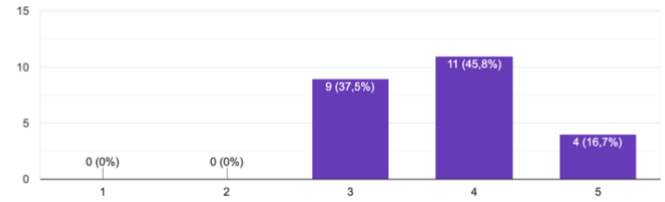

Do you feel that the challenges helped you learn more effectively? Copia grafico

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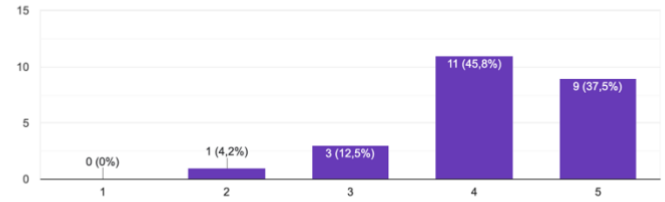
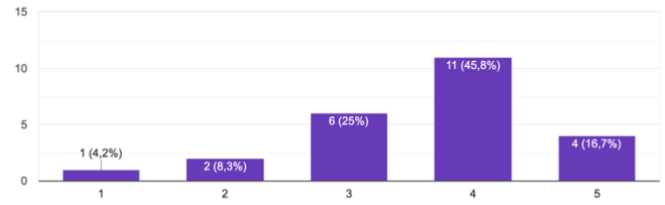


Achievement System

Do you find earning badges or rewards motivating in your learning process? Copia grafico

24 risposte



How important are certificates or rewards in validating your learning achievements? Copia grafico

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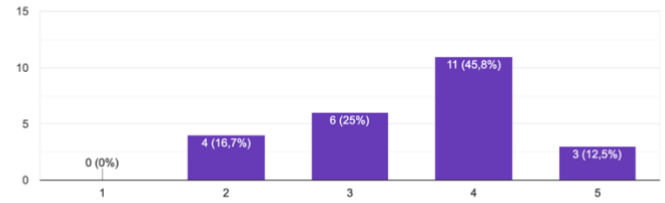

Would you be more likely to continue learning if there were more badges or certifications to earn? Copia grafico

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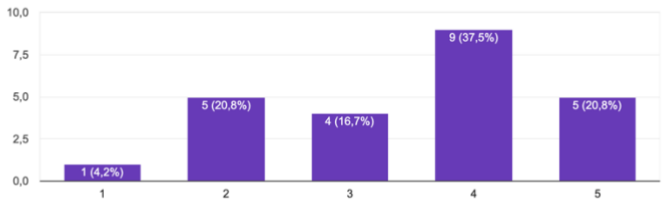

Final Questions

Which learning method (traditional or gamified) do you think better supports your motivation and understanding of web development?

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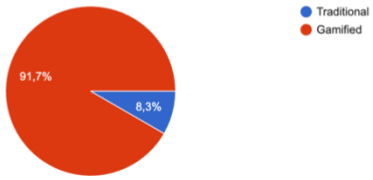

Which learning method (traditional or gamified) do you think better helps you in the transition from learning and understanding theory to applying it in real-world projects?

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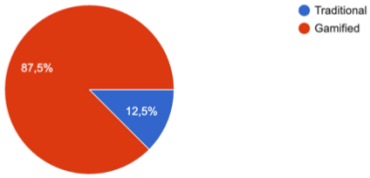

Which learning method (traditional or gamified) context do you think is better/more effective to learn web development?

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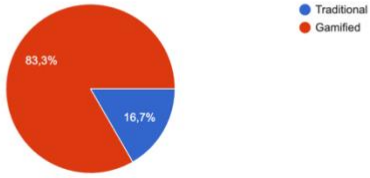

Do you feel that the gamified elements made learning feel more enjoyable (intrinsic motivation), or was it mainly about rewards like streaks, points and badges (extrinsic motivation)?

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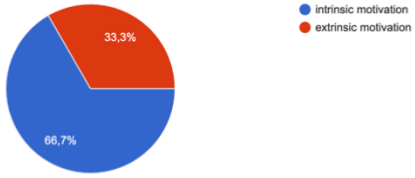

Which gamification elements did you find most useful for your learning? (Please explain why)

17 risposte

Daily streaks and rewards which allow for earning more points. Daily streaks keep me motivated and even if I don't have much time I'm learning something for 3-5 min daily which make the whole process more consistent. Rewards and points give the feeling of having more purpose in learning.

Quizzes

Building streaks with friends, so the social aspect

Quests, points, and levels

Streaks because after some point you get 'attached' so you don't want to lose the sign of commitment bc at the end you spent so much time on that so why give up rn

Streaks

Earning points and getting badges. I guess it's like a dopamine rush, they brain thinks it has received something. But the downside that if things are not working out and I don't receive points then I feel very bad which can affect my learning experience

Which gamification elements did you find most useful for your learning? (Please explain why)

17 risposte

Progression bars, because I can track my improvement.

Streaks also because it gives me the motivation to go back and continue my learning journey

points, rewards and level based learning elements.

Steaks help keeping me motivated, also instant feedback.

Streak, Challeges and Rewards because they increase my motivation and consistency in learning skills

Certifications because they can be relevant for my resume

because they kept me mentally engaged and encouraged me to reflect and improve continuously.

Progress Bar - It helped me visualize how much I'd completed, which motivated me to keep going
Badges - They gave me a sense of achievement and made the learning feel rewarding
Points System - It added a fun, competitive element that pushed me to improve
Immediate Feedback - Instant results helped me learn from mistakes right away

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Strating to develop a streak is nice because then i'm motivated to not lose it (for exaple in Duolingo) so i do it everyday, or having streaks and challenges with friends motivates me to keep going so i don't feel like i'm "failing" them

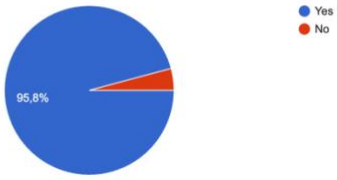
M

Two things are important to me: the content and the scoreboard. The content should be well-structured, cover key web development topics, and be engaging—meaning it includes interactive quizzes or hands-on challenges. A scoreboard is also helpful, as I enjoy seeing how I rank compared to others.

Would you continue to use gamified learning methods if they were part of a long-term course? (eg. University course/class)

Copia grafico

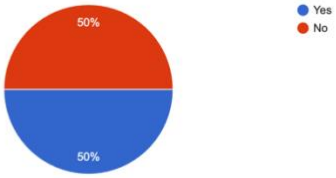
24 risposte



Do you feel that gamification apps and platforms lack of collaboration and social interaction?

Copia grafico

24 risposte



Do you feel more motivated at learning with traditional pedagogy or with gamified apps/platforms?

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23 risposte