THE EFFECT OF GAME ELEMENTS ON TIME-SPENT BY STUDENTS ON A WEB-SUPPORTED INFORMATION TECHNOLOGY COURSE

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AHMET KAZIM KARAKUŞCU

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
COMPUTER EDUCATION AND INSTRUCTIONAL TECHNOLOGY

MAY 2021

Approval of the thesis:

THE EFFECT OF GAME ELEMENTS ON TIME-SPENT BY STUDENTS ON A WEB-SUPPORTED INFORMATION TECHNOLOGY COURSE

submitted by **AHMET KAZIM KARAKUŞCU** in partial fulfillment of the requirements for the degree of **Master of Science in Computer Education and Instructional Technology Department, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** _____

Dr. Hasan Karaaslan
Head of Department, **Comp. Edu. and Inst. Tech.** _____

Assist. Prof. Dr. Cengiz Savaş Aşkun
Supervisor, **Comp. Edu. and Inst. Tech., METU** _____

Examining Committee Members:

Assist. Prof. Dr. Halil Ersoy
Comp. Edu. and Inst. Tech., Başkent University _____

Assist. Prof. Dr. Cengiz Savaş Aşkun
Comp. Edu. and Inst. Tech., METU _____

Assist. Prof. Dr. Göknur Kaplan
Comp. Edu. and Inst. Tech., METU _____

Date: 12.05.2021

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Surname: Ahmet Kazım Karakuşcu

Signature:

ABSTRACT

THE EFFECT OF GAME ELEMENTS ON TIME-SPENT BY STUDENTS ON A WEB-SUPPORTED INFORMATION TECHNOLOGY COURSE

Karakuşcu, Ahmet Kazım
Master of Science, Computer Education and Instructional Technology
Supervisor: Assist. Prof. Dr. Cengiz Savaş Aşkun

May 2021, 69 pages

Today, online learning platforms are being utilized at almost all education levels, but there are problems in student participation and engagement. On the other hand, an emerging concept of using game elements in non-gaming contexts showed potential to solve these engagement problems in educational settings. This study aimed to investigate the effect of game elements on the time-spent by students on the online portion of a web-supported information technology course (WITC) at the university level. The course was delivered in class; however, homework, activities, and readings were completed online. There were two stages throughout the semester, and the same participants took part in both stages in this quasi-experimental research study. In the first stage of the study, there were no game elements in the online portion of the WITC. In the second stage, game elements were added to the online portion. The time-spent by the students in the first stage and the time they spent in the second stage were compared. Results showed a significant increase in the time-spent by students on the online portion of the WITC in the second stage with a large effect size.

Keywords: Gamification, Game Elements, E-learning, Time-Spent, Engagement

ÖZ

OYUN ÖĞELERİNİN WEB DESTEKLİ BİLGİ TEKNOLOJİLERİ DERSİNDE ÖĞRENCİLERİN GEÇİRDİKLERİ SÜREYE ETKİSİ

Karakuşcu, Ahmet Kazım
Yüksek Lisans, Bilgisayar ve Öğretim Teknolojileri Eğitimi
Tez Danışmanı: Dr. Öğr. Üyesi Cengiz Savaş Aşkun

Mayıs 2021, 69 sayfa

Günümüzde hemen hemen tüm eğitim kademelerinde çevrimiçi öğrenme platformları kullanılmaktadır ancak öğrenci katılımı açısından sorunlar yaşanmaktadır. Öte yandan, gelişmekte olan bir kavram olarak oyun öğelerinin oyun dışı bağlamlarda da kullanımı, eğitim ortamlarındaki bu katılım sorunlarını çözme potansiyeli göstermektedir. Bu çalışma, oyun öğelerinin öğrencilerin üniversite düzeyinde web destekli bir bilgi teknolojisi dersinin çevrimiçi kısmında harcadıkları zaman üzerindeki etkisini incelemeyi amaçlamaktadır. Ders, sınıf ortamında işlenmekle birlikte ödevler, aktiviteler ve okumalar dersin çevrimiçi kısmında tamamlanmıştır. Bu yarı deneysel çalışmada, dönem boyunca iki aşama olmuş ve her iki aşamada da aynı katılımcılar rol almıştır. Çalışmanın ilk aşamasında, web destekli dersin çevrimiçi kısmında herhangi bir oyun öğesi yer almamıştır. İkinci aşamada, çevrimiçi kısma oyun öğeleri eklenmiştir. Öğrencilerin çevrimiçi kısımda ilk aşamada geçirdikleri süre ile ikinci aşamada geçirdikleri süre karşılaştırılmıştır. Sonuçlar, ikinci aşamada öğrencilerin dersin çevrimiçi kısmında harcadıkları sürede önemli bir artış olduğunu ve bu artışın etki büyüklüğünün yüksek olduğunu göstermiştir.

Anahtar Kelimeler: Oyunlaştırma, Oyun Öğeleri, E-öğrenme, Harcanan Süre, Katılım

To my mother and best friend

ACKNOWLEDGEMENTS

First, I would like to express my deepest gratitude to Assist. Prof. Dr. Cengiz Savaş AŞKUN, my thesis supervisor and my first teacher in CEIT, for his relentless encouragement, support, wisdom, and inspiration from the beginning of my undergraduate years to the end of master's degree. I would also like to thank Nigar MİZAM, my dear friend. In the difficult times of my master's degree, she was always with me, she helped me, and she always encouraged me when I was depressed and unmotivated.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS

CEIT: Computer Education and Instructional Technology

IT: Information Technology

LMS: Learning Management System

SPSS: Statistical Package for the Social Sciences (statistical analysis software)

WATS: Weekly Average Time-Spent

WITC: Web-Supported Information Technology Course

CHAPTER 1

INTRODUCTION

The purpose of this study is to examine the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at a Computer Education and Instructional Technology (CEIT) department. In this chapter, the foundations and background of the study are discussed. The chapter consists of the background of the study, the background of the problem, statement of the problem, purpose and significance of the study, research question and hypotheses, definition of terms, and organization of the study sections.

1.1. Background of the Study

Lately, e-learning in schools at all levels has become a popular field as it began to be seen as a solution to the problems of time and place in learning. Many research studies carried out in order to further investigate and improve the effectiveness of e-learning in education. The most crucial topic in this research is to make e-learning a platform for learning rather than teaching (Ehlers, 2009). Thus, the focus is being changed from what is being taught to what is learned. In order for learning to take place, engagement and motivation are key factors (Lee & Doh, 2012). As learning becomes an independent and individual process, e-learning systems should provide better opportunities and features to increase engagement and motivation. Thus, in recent years, a new term, gamification, started to have increased attention of researchers in the e-learning field to meet the need for engagement in online learning environments.

Gamification refers to using game design elements in non-gaming environments (Deterding, Dixon, Khale, et al., 2011). Using game elements in non-gaming contexts is a new concept to increase motivation and engagement in learning, as it is stated that

users of a learning system learn better when they are motivated and engaged (Lee & Doh, 2012). Gamification is considered as a new field in education to solve e-learning problems (Gudoniene et al. 2016; Kapp, 2012b; Koivisto & Hamari, 2014) .

The purpose of this study is to investigate the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at the university level. For this purpose, a quasi-experimental study was designed to analyze how game elements affect students' engagement.

1.2. Background of the Problem

As time progresses, educational systems are also trying to keep pace with emerging technologies. With new technology and new systems, new problems arise in education. As in traditional education, motivation and engagement are also standing before educators as leading problems in online learning. This is true because neither eye contact nor a teacher's direct control is present during the online learning process (Dreyfus & Dreyfus,1986; Flores-Morador, 2013). Participation and drop-out rates are the major problems that online learning systems are facing. Some statistics about this situation are surprising that drop-out rates are as close as 80%, whereas some other research studies put the rates as low as 20% to 50% (Tyler-Smith, 2006). Previous research studies on this problem showed that in e-learning courses, drop-out rates were slightly higher than in traditional settings (Salomon, 2003).

It is seen in the studies that engagement has a significant effect on student success (Lei et al., 2018). Due to the effect of engagement on academic success, it has an important place in online education. The previous section mentioned that game elements have a positive effect on engagement. For this reason, a quasi-experimental study was conducted in the online portion of a WITC at the university level to see the effect of game elements on engagement, treated as time-spent by students in this study.

1.3. Statement of the Problem

Lack of engagement is a challenging problem for both fully online and web-supported courses in all settings using online learning systems. In order to overcome this problem, many different tools and innovative methods are being used by educators individually. Nevertheless, there is not an overall accepted way of solving engagement problems.

With the emergence of the concept of gamification, which means the use of game elements and mechanics in educational environments, the hope has emerged that problems such as lack of engagement and motivation might be solved. Gamification is started to be investigated and applied in many settings and showed important results. It might help learners attain specific behavioral changes, get faster feedback, achieve more visible improvement, and increase motivation and engagement with the help of applied game elements into the online learning environments.

Despite research studies that showed that using game elements has positive effects in online learning environments, some other research studies showed no effect (Cechanowicz et al., 2013). Another research study on the effectiveness of gamification concludes that it has positive effects; yet, these effects need a specific context that the gamification is being applied and used (Hamari et al., 2014). It can be seen that using game elements in non-game contexts is still a new concept and needs more investigation to have a brighter explanation of how to design and implement appropriately into specific online learning contexts.

1.4. Purpose and Significance of the Study

The purpose of this research study is to investigate the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at the Computer Education and Instructional Technology (CEIT) department of a large state university.

This research study will help teachers and educators for the future implementation of game elements into web-supported courses. It is also hoped to provide meaningful and practical information to the learning institutions who wish to use game elements for their online learning platforms.

This research study will contribute to the gamification literature in how it is designed and implemented. The data obtained from this study will help teachers and educators in terms of how they will design and implement game elements into their web-supported courses at universities or various educational institutions.

This current study will contribute to the literature by indicating the effect of game elements on time-spent by the students. This study, carried out at a university-level WITC, will also contribute to the literature regarding the context in which it was conducted and the method used.

1.5. Research Question and Hypotheses

The aim of this study is to answer the following research question:

What is the effect of game elements on time-spent by students on the online portion of a WITC?

- H_0: There is no statistically significant difference between the control (without game elements) and experimental group (with game elements) in terms of time-spent by students on the online portion of a WITC.

- H_a: There is a statistically significant difference between the control (without game elements) and experimental group (with game elements) in terms of time-spent by students on the online portion of a WITC.

1.6. Definitions of Terms

Engagement: Engagement refers to someone being actively involved in tasks and activities. In this study, "engagement" is indicated as the time-spent by the students in the online portion of the web-supported information technology course.

Game Elements: It is the name given to the features or elements of games that keep people busy. Werbach & Hunter (2015) examines game elements under three main categories: Dynamics, Mechanics, and Components. Detailed information is in the 2.4.1 Elements of Game. In this study, when "game elements" are mentioned; points/score, rewards, levels, leaderboard, challenges, competition, and feedback are meant.

Gamification: Application of game-design elements and game principles in non-game contexts (Deterding, Dixon, Khaled, et al., 2011).

LMS: Stands for Learning Management System which are basically websites that are used as online learning platforms by institutions such as schools, universities, etc. Moodle is one of the well-known LMS application.

Moodle: Online learning platform designed to provide learners, educators, and administrators with an integrated online system.

Time-Spent: The time from the moment the student logs on to the online platform until he/she leaves.

Web-Supported Online Course: A form of course which uses online platforms (i.e., Moodle) to support face-to-face classroom education. Such course on information technology will be referred to as WITC, i.e. web-supported information technology course.

1.7. Organization of the Study

Chapter One of the study presents the introduction, background of the study, background of the problem, statement of the problem, purpose and significance of the study, research question and hypotheses, definitions of terms, and organization of the study.

Chapter Two is a review of recent literature on the topic of the research study.

Chapter Three provides detailed information about the methodology used in this study. Moreover, research study questions are reiterated. Instruments, participants, and sampling of the study are also presented in this chapter.

Chapter Four presents the results of the study in a straightforward way. In this section, the quantitative data collected during the study are presented in detail. SPSS calculations, graphs, and results made on these quantitative data are indicated one by one.

Chapter Five consists of parts about the conclusion and discussion of the study. In this section, the results obtained in this study are discussed. Similarities and differences with other studies have been examined in detail. Suggestions have been made for future studies.

CHAPTER 2

LITERATURE REVIEW

The purpose of this study is to investigate the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at the university level. This chapter consists of games, flow theory, today's generation, and gamification sections that examine the literature.

2.1. Games

2.1.1. What is Game?

Games have been in our lives for long periods. Since the beginning of recorded history, games have existed in societies as instruments for entertainment, relationship-building, training, and possibly for survival (McGonigal, 2011). In the first place, to better understand the term "gamification," it is essential to understand the term *game* as gamification relates to it. However, it should not be mixed with the term *play*, which is conceived as a different category (Salen et al., 2004).

To better understand what a game is, it might be better to look at the research studies on games and authors' definitions from the field. According to Klopfer et al. (2009) "games" relate to structured or organized "play," which is often voluntary and requires either cognitive or physical active participation. Moreover, "play" is often regarded as freer, more flexible than "games." According to the Hogle (1996), a "game" is usually a contest of either physical or cognitive skills and abilities, requiring the player to follow a predefined set of rules to attain a specific goal. Perhaps the most detailed study of games was presented by Caillois (1961), defining a *game* as an activity that is voluntary and fun, distinct from the real world, unpredictable, unproductive in that the activity generates no products of external value, and controlled by rules. Akıllı

(2007, p.4) defines the game as “a competitive activity that is creative and enjoyable in its essence, which is bounded by certain rules and requires certain skills.” There are numerous different definitions of the game as the concept itself is very broad and comprehensive. According to McGonigal (2011) there are four main factors that define the game;

- *Goals* is what players need to achieve.
- *Rules* is to limit players while they are trying to achieve goals.
- *Feedback system* tells players how close they are to achieve a specified goal.
- *Voluntary participation* is a player’s willingness to accept these three elements of the game.

Thus, games, in general, are fun and enjoyable and have rules, challenges, goals, and objectives with feedback methodologies.

Prensky (2001) defines six structural components of the game;

- *Rules* limit players' actions in a game.
- *Goals/objectives* give players the need to achieve.
- *Outcomes/feedback* lets players observe and measure the progress towards achieving their goals.
- *Competition/challenge* are problems on the way that players need to solve in order to achieve their goals.
- *Interaction* is playing together with other people.
- *Representation* is about the context of the game, its story behind and the content it has.

Prensky (2001) also states that these elements are essential to what makes a game engaging and what makes players engaged.

2.2. Flow Theory

In the previous section, the features of the game and the game definitions of the researchers and authors in this field were examined. Based on these definitions, it seems that games are activities with numerous different types on different platforms that generally have certain rules and aim to entertain the players within a particular framework. So, games are played for entertainment and fun because they are entertaining and fun. What makes a game is *fun* is another question that needs to be answered. Prensky (2002) defines *fun* as amusement, a positive feeling that makes people return and do things again when they have fun doing it. He further explains that the more fun things are done, the sooner goals are achieved, the better outcome is achieved, and the more goals can be achieved (Prensky, 2002). This situation reveals the phenomena known as "flow," where the player is now separated from time and place, focused solely on doing what they enjoy and have fun (Csikszentmihalyi, 1990). According to Prensky (2001), in the state of flow, the person can easily overcome the difficulties he/she faces, solves the problems that arise in the best way, and the pleasure he receives while doing all these reaches the maximum levels.

State of “flow” is not only limited to games, however. In many fields, people can be in a state of flow, such as sports, work, or even learning (Prensky, 2001). Being able to put students in such a “flow” state and keep them focused for a long time is essential in terms of being a method that can solve the problems encountered in education. In order to achieve this flow state, Csikszentmihalyi (1990) mentions the importance of two situations. The first is that the activity should not be boring for the person to remain in the “flow” state, and the second is that the activity must be challenging enough. A graphic representation of this situation is presented below (see Figure 2.1). According to the author, the activity should not be too difficult; one should not lose the sense of achievement and hope, nor should it be too easy so that one should not get bored quickly (Csikszentmihalyi, 1990). These are two major components of the flow zone, but to achieve these two factors, designers must work more to find what is challenging for players and what is not and what skills the player has. When these are

combined, the player can enter the state of flow and achieve and motivate to do it more.

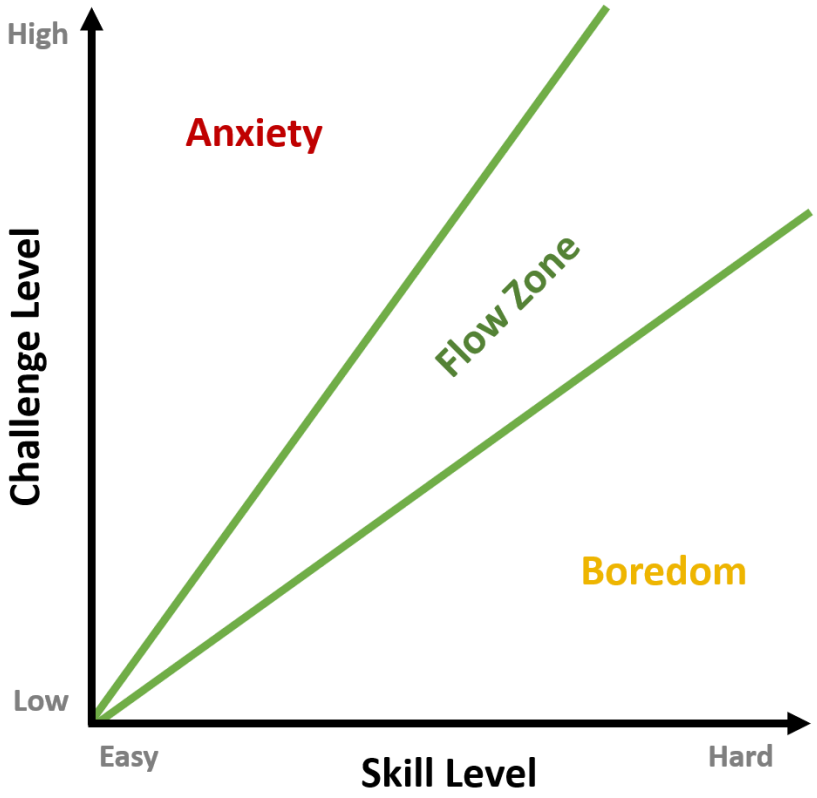


Figure 2.1. Flow Zone. *Note.* Adapted from *Flow: The Psychology of Optimal Experience*, by M. Csikszentmihalyi, 1990, p. 74, Harper and Row Press. Copyright by 1990 by Harper and Row.

Digital games are much more engaging than traditional games because, with the help of technological advances and daily devices we use today, such as laptops, smartphones, tablets, etc., games have many more possibilities to make them more engaging. Prensky (2001) states that *flow* is a major element of good game design. He also describes 12 major elements of what makes a game engaging as follows.

An engaging game;

- is a form of fun as it gives enjoyment/amusement and entertainment.
- is a form of play as it provides involvement.

- has rules that set its structure.
- has goals that lead to motivation.
- is interactive, which gives a person the feeling of doing.
- is adaptive, which gives flow.
- has feedback which gives learning.
- has win states which provide ego gratification.
- has challenges, which gives adrenaline.
- has problem-solving, which gives creativity.
- has social interaction, which gives social groups.
- has representation and story, which gives emotions/feelings.

When combined and designed carefully, those factors make a game engaging and put players engaged in doing it again.

2.3. Today's Generation

With the development of technology, students have to learn in a more technological world. Compared to the previous generation, today's generation is more adapted to life with technology (Tulgan, 2013). Today's generation, also called Generation Z (Tulgan, 2013), uses technological tools such as computers, tablets, and smartphones more frequently. This change has many different reflections in the field of education. In our daily lives, with the help of technological tools, we can engage things around us very quickly and lose interest very quickly.

According to Prensky (2005) today's students do not have short attention spans as contradicting others, claiming the opposite (Berkup, 2014; Rothman, 2016). Prensky (2005) further explains that today's students who have concentration problems at school and cannot pay attention can stand without leaving their computer for hours when it comes to activities such as computer games, technology, and the internet. So, it is obvious that students engage in activities they are interested in, and today's students are engaged in activities involving digital platforms.

In order to prevent today's students from getting bored and making them engage, the aforementioned "flow theory" can be effective because students are more motivated when they are in the flow zone and can give their full attention. Games, which is one of the most successful tools for putting today's students into flow zone, began to attract the attention of educational researchers. Because of this opportunity, many research studies have been carried out to discover how games can be used effectively for educational purposes.

A widespread type of game amongst today's students is video games. Beginning from the 1970s and 80s, video games have become more and more popular as a form of entertainment (Entertainment Software Association, 2015). Over time, the gaming industry began to evolve and spread.

Video games are challenging for players, and they have specific goals. Moreover, video games are interactive applications that provide story, graphics, and music elements altogether, and when used properly, these elements attract the players' interest in non-gaming topics like school subjects (Watson et al., 2011). Consequently, the "gamification" concept, detailed below, is also started to gain attention after video games showed the potential in game-based learning research studies. With the help of advancing technology and expanding gaming industry, widened usage of games started to become a field of attraction for educational researchers (Fotaris et al., 2016). They viewed this new area with big interests. Scholars focused on game-based learning, and video games showed potential in educational settings. As a result of the studies carried out in this direction, it has begun to be seen that games are effective tools that can increase engagement when they are designed for education and learning environments (Lee & Doh, 2012).

2.4. Gamification

Gamification is often regarded as a game when it is heard by someone new to the term. Although it contains game elements, it is not appropriate to understand gamification with the definition of the game.

Gamification's one of the main objectives is improving engagement. By improving engagement, learners' motivation will also be improved. This objective is also supported by the fact that learners learn better when engaged (Lee & Doh, 2012).

The main idea is to take the core elements of games and apply them in real-world situations, often with the intention of encouraging specific behaviors within the gamified scenario. Restating the difference between gamification and games, while the design elements used in games are oriented around entertainment purposes, gamification focuses on learning. To clarify the design elements used in gamification, Deterding, Dixon, Khale, et al. (2011) created a taxonomy of game design elements used in gamification as follows:

Table 2.1 *Five Levels of Game Design Elements* (Deterding, Dixon, Khale, et al., 2011)

Level	*Description*	*Example*
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns

Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	MDA; challenge, fantasy, curiosity; game design atoms; CEGE
Game design methods	Game design-specific practices and processes	Playtesting, play centric design, value conscious game design

E-learning is a new way of setting education without restricting learners with time and space. Even though gamification is also a new and innovative field in education, it still has many problems that need to be solved. The major problem of e-learning platforms is that it lacks participation and motivation. Herein, gamification starts to play an important role as it is solely based on increasing user engagement and user involvement via game elements.

Until now, the concepts of play, game, and gamification have been examined. The model developed by Deterding et al. (2011) will be helpful in examining the parts that distinguish them.

Deterding et al. (2011) provided a clearer understanding of how the concept of gamification is among all these game concepts with the model he prepared. The authors of this new gamification model propose a new model for situating gamification. In this model, Deterding et al. (2011) show that gamification relates to the game, not play or playfulness. Moreover, gamification differs from the game as gamification is not a standalone game but has game elements inside. Having game elements does not necessarily make it a game when the design and structure differ

entirely. A game has a purpose of providing fun and enjoyment, while gamification has a purpose around learning and education.

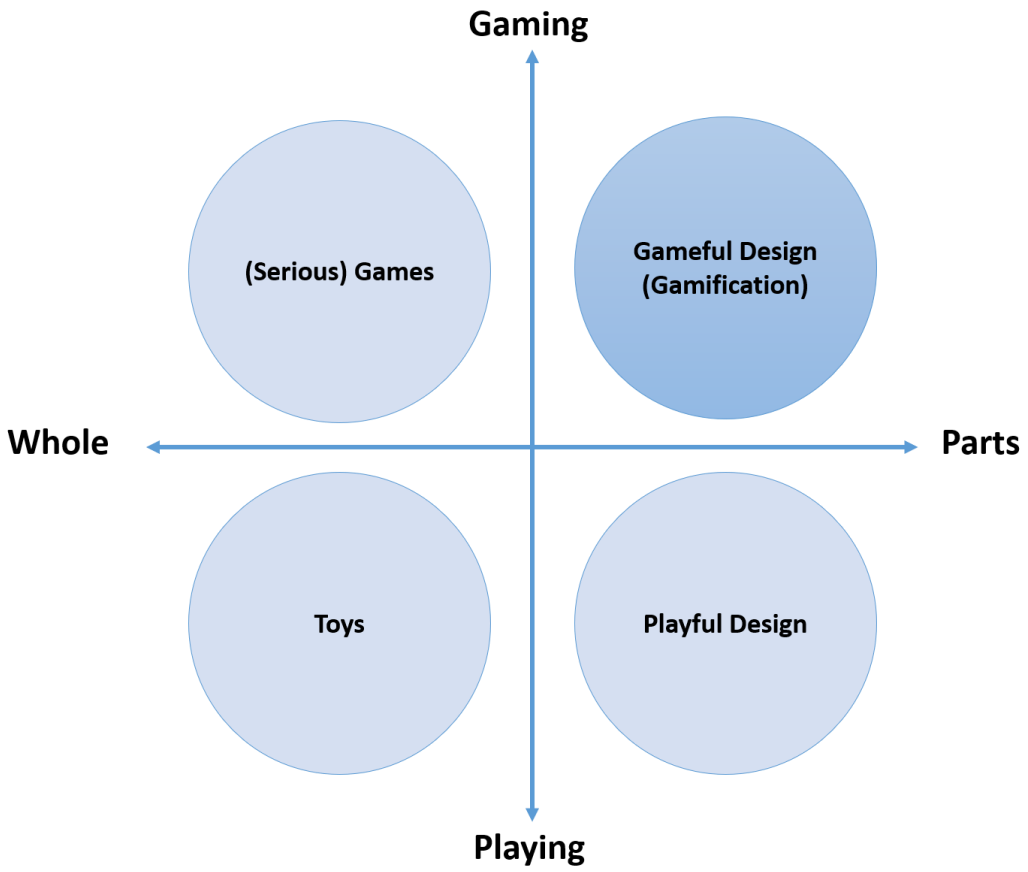


Figure 2.2. Place of Gamification in Game Literature. *Note.* Adapted from "From Game Design Elements to Gamefulness: Defining Gamification" by S. Deterding, D. Dixon, R. Khaled, and L. Nacke, 2011, *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9-15, p. 13, Copyright 2011 ACM 978-1-4503-0816-8/11/09.

2.4.1. Elements of Game

Examining game elements becomes a necessity since gamification is based on the use of game elements in non-game environments, which is obvious from the definition of gamification. Werbach and Hunter (2015) examine the game elements in three different categories, which are dynamics, mechanics, and components (see Table 2.2), and addressing these categories hierarchically (see Figure 2.3). In addition to

addressing the categories hierarchically, they also emphasize the importance of hierarchy in categories (Werbach & Hunter, 2015).

Table 2.2 *Game Elements in Categories* (Werbach & Hunter, 2012)

Category	*Elements*
Dynamics	Constraints, Emotions, Narrative, Progression, Relationships
Mechanics	Challenges, Chance, Competition, Cooperation, Feedback, Resource Acquisition, Rewards, Transactions, Turns, Win States
Components	Achievements, Avatars, Badges, Boss Fights, Collections, Combat, Content Unlocking, Gifting, Leaderboards, Levels, Points, Quests, Social Graphs, Teams, Virtual Goods

Before mentioning the importance of the hierarchy in the categories, it is valuable to mention the meanings of the categories so that the importance of the hierarchy in the categories will be more meaningful and easier to understand. Werbach and Hunter emphasize dynamics strikingly with the expression "dynamics are the elements that exist at the 30,000-foot level" because they basically aim to motivate through features such as social interaction, progression, or narrative (Werbach & Hunter, 2015). On the other hand, mechanics are elements that have aspects such as chance, challenges, rewards, or turns used to draw the player into the game (Werbach & Hunter, 2015). Finally, components are specific elements such as avatar, badges, points, or teams that could be observed concretely. After examining the meanings of all categories, "it's critical to separate out the high-level design principles from the mid-level action

structures and the surface-level manifestations" statement of Werbach and Hunter will be an effective discourse in revealing the importance of hierarchy (Werbach & Hunter, 2015). When this distinction is made, and *dynamics*, *mechanics*, and *components* are considered and included in the gamification work, the chance of increasing success and being effective will be high (Werbach & Hunter, 2015).

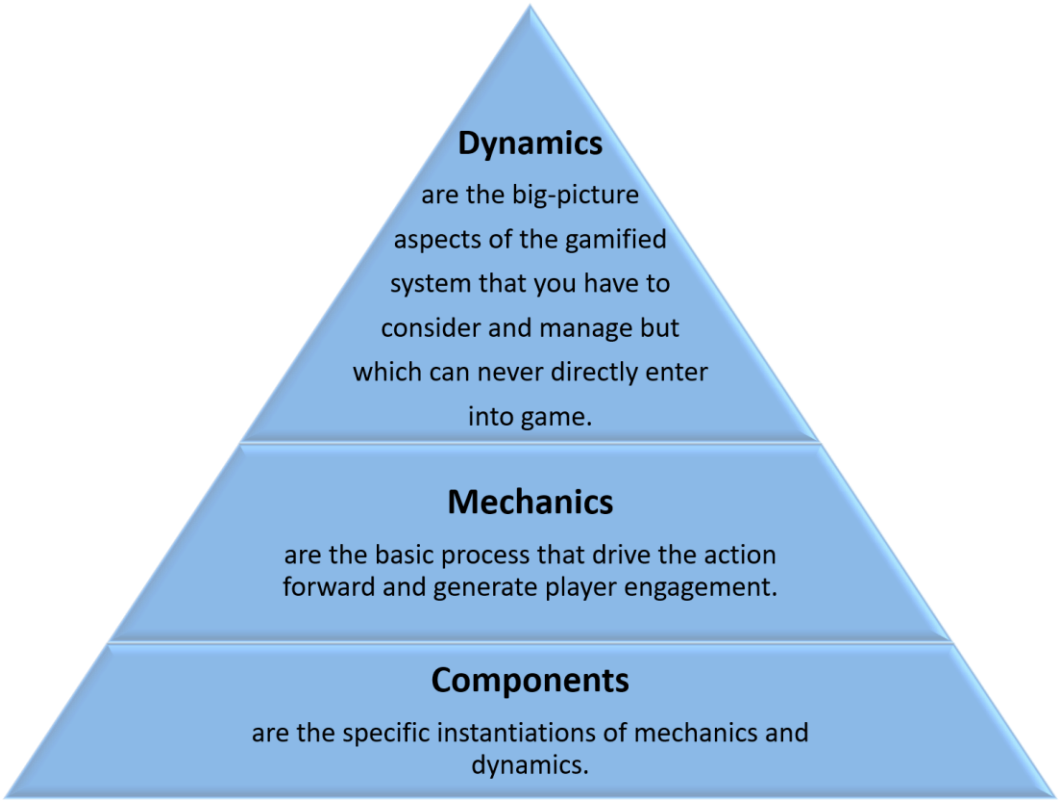


Figure 2.3 Hierarchy of Game Elements. *Note.* Adapted from *The Gamification Toolkit: Dynamics, Mechanics, And Components for The Win*, by K. Werbach and D. Hunter, 2015, p. 82, Wharton School Press. Copyright by 2015 by Kevin Werbach and Dan Hunter.

2.4.1.1. Dynamics

Dynamics are elements that necessary to be considered and managed for success in gamification. However, dynamics such as constraints, narrative, or relationship could not be applied directly (Werbach & Hunter, 2015).

- **Constraints** are intended to guide the game in a specific way by informing about the limits of the game.
- **Emotions** are feelings such as curiosity and competition experienced by the players, which are used to achieve the desired results in the game.
- **Narrative** basically aims to give meaning to players' interactions and journeys within the game by providing a continuous and compelling story and content.
- **Progression** shows the progress during the game by aiming at making players feel that their actions and efforts throughout the game have paid off.
- **Relationships** support establishing emotional bonds in players through various ways of interaction such as relationships, cooperation, and companionship.

2.4.1.2. Mechanics

Mechanics are elements used to draw the player into the game in order to advance the action in the game and maintain continuity in the game by revealing the progress of the game and guide the players. Mechanics are more concrete compared to dynamics but more abstract than components (Werbach & Hunter, 2012).

- **Challenges** are tasks, stages, interactions that aim to keep the players in the game by pushing their limits, requiring tenacity and great work.
- **Chance** is basically the probability of getting something in the game, just like in real life.

- **Competition** is when a player or a player team, or a large team of multiple teams, is in a race to win or achieve something in the game or simply to succeed.
- **Cooperation** is when players or teams of players work cooperatively to complete a task or to win or achieve success.
- **Feedback** is the visual presentation of players' progress in the game with elements such as badges, leader boards, messages.
- **Resource Acquisition** is when players collect items during the game that they can use to achieve a future goal or pass a critical stage.
- **Rewards** are awarded when players reach a goal or complete a stage or end a mission.
- **Transactions** are the buying, selling, or exchanging of acquired items by players throughout the game.
- **Turns** mean players or groups of players play in their turn. Some games might be based on sequences, while some games might not contain any sequences at all.
- **Win States** are settings that indicate a predetermined goal in the game, or a level or mission of the game was completed by who or which team under specified conditions.

2.4.1.3. Components

Components could be defined as specific examples of mechanics and dynamics (Werbach & Hunter, 2012).

- **Achievements** are goals/objectives that players must achieve throughout the game.
- **Avatars** refer to visual representations of players in the game that can be selected or created by players to represent themselves.

- **Badges** are items used to visually represent success achieved by players.
- **Boss Fights** represent the fight players face at the end of the game or at the end of a stage in the game against a character that is automatically controlled by the computer.
- **Collections** are any items collected, earned, or acquired by players throughout the game.
- **Combat** are fights, battles, or struggles against a single rival/opponent or team in the game.
- **Content Unlocking** means unlocking new levels, stages, new places, items for players as a result of the completion of predetermined actions, missions, challenges, or achievements.
- **Gifting** is giving of the preferred item or resource to other players without receiving anything in return, as in real life.
- **Leaderboards** are lists that rank players or teams in the game according to the items, points, levels, resources, or skills they have acquired or by scoring all of those according to a predefined algorithm.
- **Levels** are stages that represent the degree, stage, progress that a player has achieved or could achieve.
- **Points** are indicators that represent the player's performance numerically in the game.
- **Quests** are missions that must be completed in order to receive an item as a reward.
- **Social Graphs** are displays that allow the player to see the progress of other players in the social network and relate with them.
- **Teams** are groups formed by players who come together to fulfill a common task, goal, or success.

- **Virtual Goods** are items that are in-game goods that do not have any real-life value but could provide an advantage to the player in the game. They could be purchased with in-game currency or real-life money or can be earned for success in the games.

2.4.2. Gamification and Engagement

In the previous sections, how gamification was defined differently by different people was examined. In this study, the concept of gamification is based on the definition of "gamification is the use of game elements in non-game environments"(Deterding, Dixon, Khaled, et al., 2011, p.3).

Engagement might be explained with the "unhindered voluntary attention of person" on the subject and/or activity. In educational environments, this might be narrowed down to student's attention in the classroom towards the lesson or in an e-learning environment. As discussed why games are engaging, it is clear that the elements of the game, such as fun, challenging, and rewarding, are leading concepts that make games engaging (see Figure 2.4). Thus, integrating those elements into a learning environment where in a classroom or an e-learning environment increases the engagement of students. There are studies which showed that gamification indeed increased engagement in both classroom or online environment (Hamari et al., 2014).

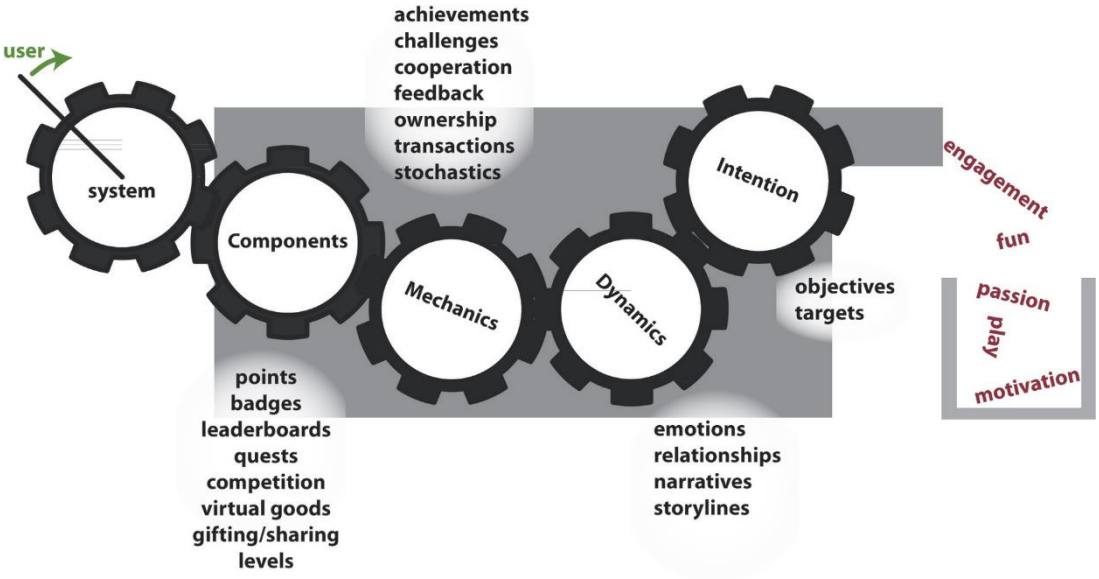


Figure 2.4. Illustration of Relationship Between Core Elements of Gamification. *Note.* Reprinted from "Gamification" by L. C. Wood and T. Reiners, 2015, *Encyclopedia of Information Science and Technology,* 3039–3047, p. 3041. (DOI: 10.4018/978-1-4666-5888-2.ch297 Copyright), Copyright 2015 © 2015, IGI Global© 2015, IGI Global.

2.4.3. Gamification Use Cases and Results

Gamification is being reviewed increasingly and is still being investigated by researchers as there is no generally accepted way of designing and implementing gamification (Hamari et al., 2014). With the proving itself and understanding the importance of gamification, a rapid increase in research started to occur (Katsigiannakis et al., 2017). Gamification is not used only in education but also in many different areas such as business, health, social policy, etc. (Caponetto et al., 2014). According to the results of a literature review on the subject of "gamification and education" conducted in 2014, engagement and motivation were two of the major elements which researchers are focusing on (Caponetto et al., 2014). Results also showed that almost half of the 119 studies (51%) consisted of theoretical studies, while the other half consisted of empirical studies. In addition, 39% percent of papers provided statistical proof gathered from data which is collected in experiments.

Many research shows that gamification produces beneficial and positive results the majority of the time (Hamari et al., 2014). However, there are studies that gamification showed mixed results (De-Marcos et al., 2014), as well as studies that showed negative results (Hanus & Fox, 2015).

Considering the results of the experimental studies on gamification, most of them have positive results on the *motivation* and *success* of the users (Hamari et al., 2014). However, there are also studies that show no effects at all. In a study conducted to investigate the effect of gamification on students' achievement, results showed no difference between randomly assigned groups of the student (Mizam, 2019). In another study that was carried out to investigate the effects of gamification on students' achievement and attitude towards math course, results also showed no significant difference between experiment and control groups (Türkmen & Soybaş, 2019).

Apart from the positive or neutral results of the experimental studies conducted in gamification, there were also studies with negative results when the users' motivation was considered. Results of one study revealed that students in a gamified course showed less motivation than the non-gamified group (Hanus & Fox, 2015).

CHAPTER 3

DESIGN AND METHODOLOGY

The purpose of this research study is to examine the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC). The chapter consists of research question and hypotheses, design of the study, participants and sampling, instruments and data collection, intervention, and data analysis with assumptions, limitations, and delimitations.

3.1. Research Question and Hypotheses

The aim of this study is to answer the following research question:

What is the effect of game elements on time-spent by students on the online portion of a WITC?

- H_0: There is no statistically significant difference between the control (without game elements) and experimental group (with game elements) in terms of time-spent by students on the online portion of a WITC.

- H_a: There is a statistically significant difference between the control (without game elements) and experimental group (with game elements) in terms of time-spent by students on the online portion of a WITC.

3.2. Design of the Study

This study aims to examine the effect of game elements on time-spent by students on the online portion of a WITC. To examine the cause-effect relationship, a null hypothesis was created. The most appropriate method to test hypotheses involving cause-effect relationships is to use an experimental design (Creswell, 2014; Fraenkel & Wallen, 2009).

To study cause-effect relationships in experimental design, it is required to control the experiment's setting and manipulate the independent variable (Creswell, 2014). For this purpose, a web-supported IT course, accessible and available to manipulate, was chosen. Because random assignment is not possible due to the web-supported course structure and experiment's settings, a one-group pre-test post-test quasi-experimental design was applied in this study.

In this study, an existing class of first-year students at a large state university was utilized as the sample of the study. The study was completed in one semester in two main stages: before and after the intervention (see Figure 3.1).

O	***X***	***O***
Pre-Test: Time-Spent by the Students Before Intervention in the Online Portion of WITC (Dependent Variable)	Intervention: Adding Game Elements into Online Portion of WITC	Post-Test: Time-Spent by the Students After Intervention in the Online Portion of WITC (Dependent Variable)

Figure 3.1 Research Design of the Study

In this quasi-experimental design study, the same participants took a role in both phases. In the study, the time-spent by the students on the online portion of the WITC was obtained as quantitative data. The quantitative data gathered for each individual in the first half of the semester in which game elements were not present was compared with the data gathered at the end of the second half of the semester in which game elements were present. By adding game elements, activities inside the online portion of the WITC turned into either a challenge or a task. Points, however, were another important part of the intervention. After completing each activity, students were rewarded with points based on their performance. They were used to display the achievement of students and could be seen by other students. After the semester, both quantitative data for the first and second half of the semester were analyzed and compared.

3.2.1. Threats to Internal Validity

The one-group pretest-posttest design used in this study is considered a weak design due to its nature (Fraenkel & Wallen, 2009). The weak experimental design studies are more vulnerable to threats to internal validity compared to true experimental design studies (Fraenkel & Wallen, 2009). This section examines some of the possible threats to internal validity encountered in the design used in the current study.

Instrumentation threat to internal validity might occur in three different ways: instrument decay, data collector characteristics, and data collector bias (Fraenkel & Wallen, 2009). This study was carried out in the online portion of the WITC, and the quantitative data was provided by a plugin added to the online platform. In other words, since there was no personal judgment, evaluation, or grading for quantitative data in this study, instrument decay was not a potential threat to internal validity. Moreover, since the quantitative data was collected by a web application in an online platform, not by an individual, data collector characteristics and data collector bias were not a potential threat to internal validity for this study.

Maturation threat is a type of threat that might be encountered, especially in studies with pre-test post-test designs (Fraenkel & Wallen, 2009). One of the situations where this threat occurs is the long duration of the study (Fraenkel & Wallen, 2009). Sometimes with years of work, subjects change physically, psychologically, or emotionally during study period. These changes might affect the results of the study in different ways. Regarding this situation that maturation threat might occur, it should be either a very long time or a study with very young participants (Fraenkel & Wallen, 2009). In this study, neither time span is very long, nor the participants are very young. Thus, maturation threat is not a potential threat to the internal validity of this study.

3.3. Participants and Sampling

In this study, an existing class of first-year students at a large state university was utilized as the sample of the study. Since it was challenging to create an online course environment that could be manipulated, the available classroom of students was used as a convenience sampling in this study.

This study included first-year undergraduate students who take the "Information Technology in Education I" course in Computer Education and Instructional Technology (CEIT) department at a large state university, Turkey. Participants were approximately 19-21 years old. There were 22 students, 11 of whom were female, while 11 were male students, who participated in the study.

3.4. Instruments and Data Collection

This study took place in an online portion of the web-supported course using Moodle (v.2.9) learning management system (LMS), an open-source web application. It provides teachers with the necessary tools to create and manage an online learning environment such as creating quizzes, assigning homework, grading student performance, etc. Moreover, it also gathers statistical data about its users, such as login and logout actions, pages viewed by users, actions taken by users such as completing a quiz, attempting a quiz, uploading a file, viewing a course, etc. However, it is not

solely possible to detect how much each student spends time logged in. Thus, to gather the required time-spent data in this study, a plugin named “Timestat” was installed into system, providing detailed user statistics (see Figure 3.2). When the “Timestat” plugin is installed and activated in a lesson, it records the time-spent by students in activities in the lesson.

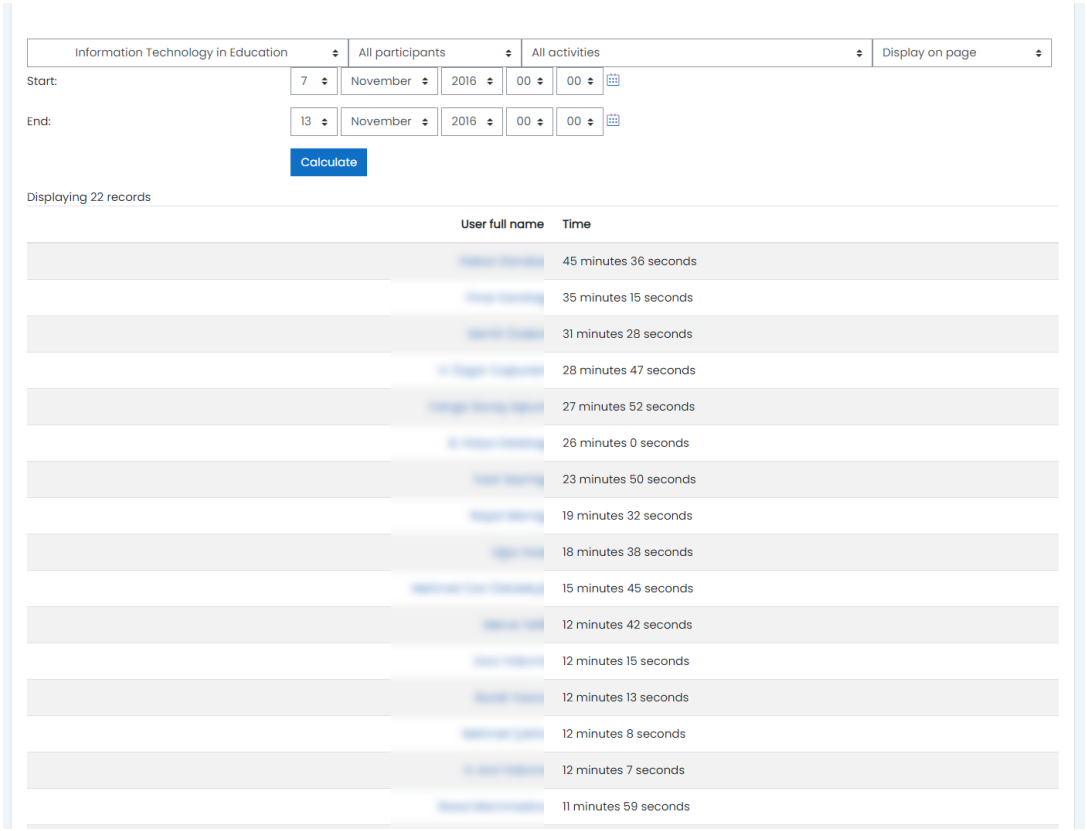


Figure 3.2 Moodle’s “Timestat” Plugin Logs for Students’ Activity

This plugin records student-based time-spent incrementally in terms of seconds. In this way, it was possible to obtain detailed data on time-spent on a student basis by specifying time constraints. With this method, quantitative data before and after the intervention were obtained weekly, and comparisons were made.

3.5. Intervention

Students in this study have taken an undergraduate web-supported IT course (WITC). This course consisted of two main parts, online and face to face. Students could use the online part of the course from anywhere with internet access, regardless of location. The course was delivered in class traditionally; however, assignments, activities, homework, and readings were completed in the online portion of the course. Students were learning theoretical information about information technologies in the face-to-face part. In the online part, students participated in the online portion of the course created with Moodle LMS to reinforce their theoretical knowledge. In the online portion of the WITC, students completed activities such as assignments, quizzes, and readings weekly (see Appendix A). The instructors and/or assistants of the course were activating the relevant content in the online section weekly in parallel with the topics covered in the classroom.

During the first half of the semester before the intervention, the time-spent by the students in the online part of the course was collected daily. At the end of the first half of the semester, two add-ons were installed in the online part of the course to add game elements. Game elements were added into the lesson with the help of these plugins called "Level up!" and "Ranking block" (see Table 3.1). This time, the same students used the online portion of the WITC with game elements (see Appendix B).

Students received experience points for each activity they accomplish in the online part of the WITC. Students earned 45 experience points when created a topic on the message board or uploaded documents for an assignment. Again, they earned 9 points for completing a reading text and 3 points for updating the content they had created. Based on their experience points, students earn levels accordingly.

Figure 3.3. Level Badges Rewarded to Students with Level Up! Plugin

There were 10 levels from 1 to 10 and a specific badge designed for each level to show students' status. Acquiring each level, students received a respective level badge (see Figure 3.3).

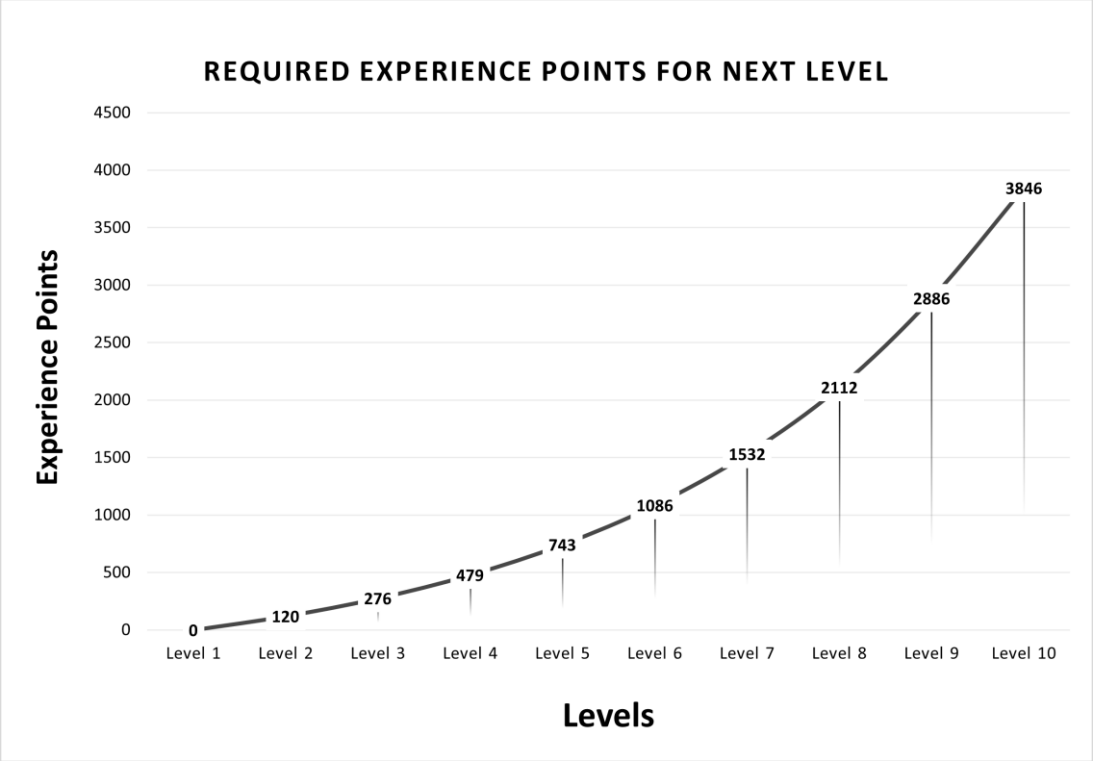


Figure 3.4. Required Experience Points for Next Level

After leveling up, more experience points were required to reach the next level. Thus, the experience points required to level up were increasing exponentially, making it more challenging gradually (see Figure 3.4).

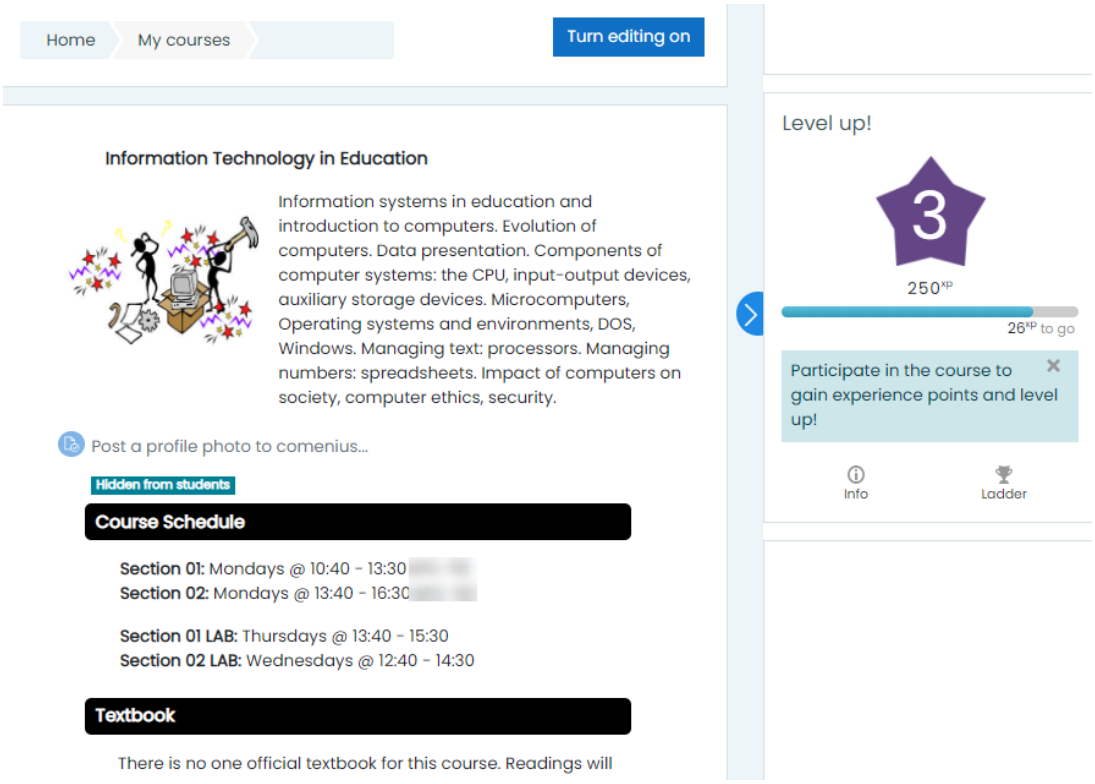


Figure 3.5 Student's Current Level Progress on Sidebar

On the course web page, students could see their current leveling progress as visual feedback and a badge rewarded for their current level in the sidebar (see Figure 3.5).

In addition to their level, students could see the level status and total experience points of the entire class by using the ladder link in the side menu (see Figure 3.6). On the ladder, students were placed from the highest to the lowest score. In this way, each student had the chance to see their level and experience points in the ladder and compare their state with other students.

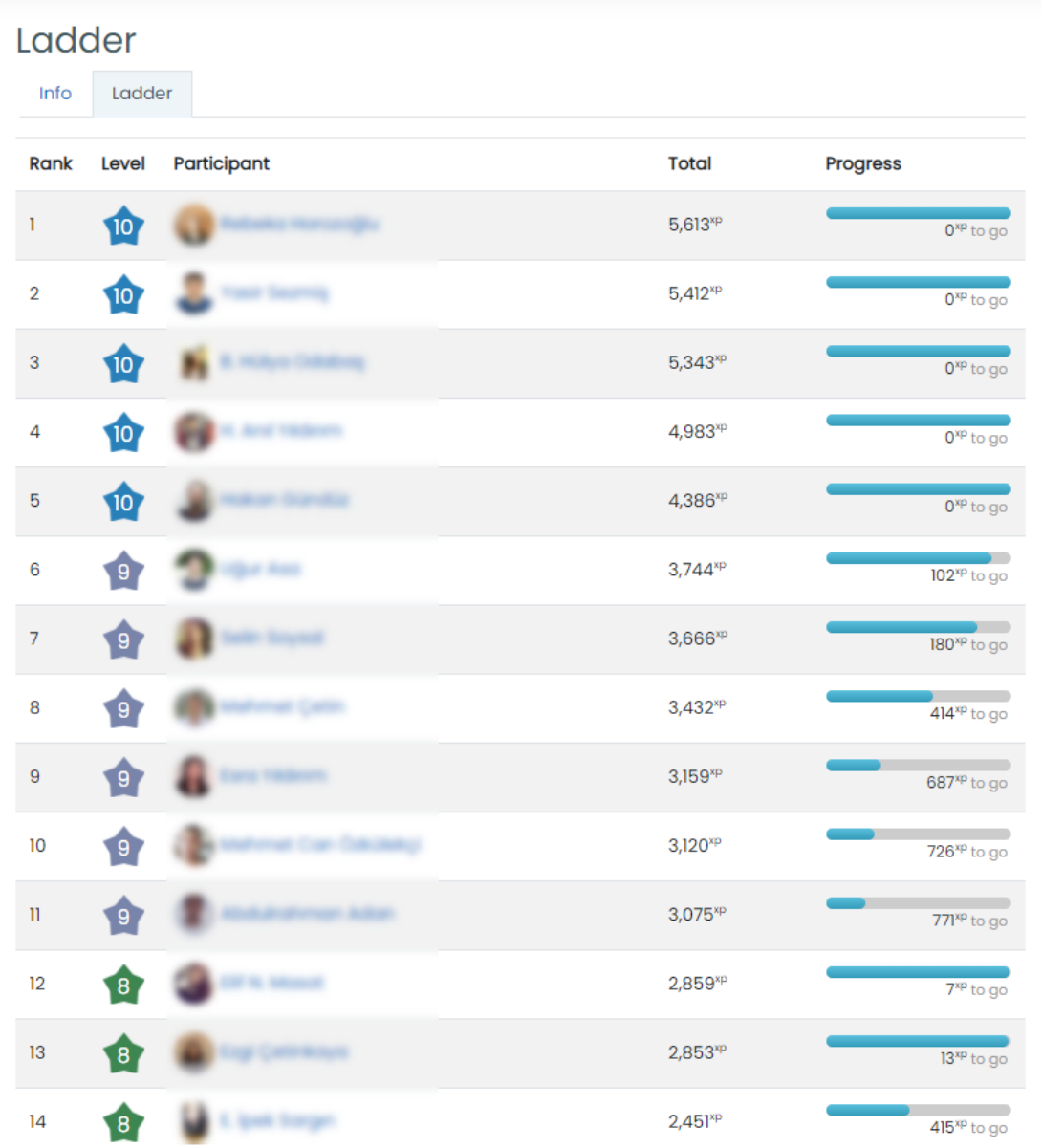


Figure 3.6 Ladder Showing Levels for the Whole Class

Another element was the leaderboard which displayed the students with the highest points in a ranking block (see Appendix C) on the course web page sidebar (see Figure 3.7). Thus, it was visible all the time as long as a student stayed logged in. The ranking block could be monitored by all the students simultaneously.

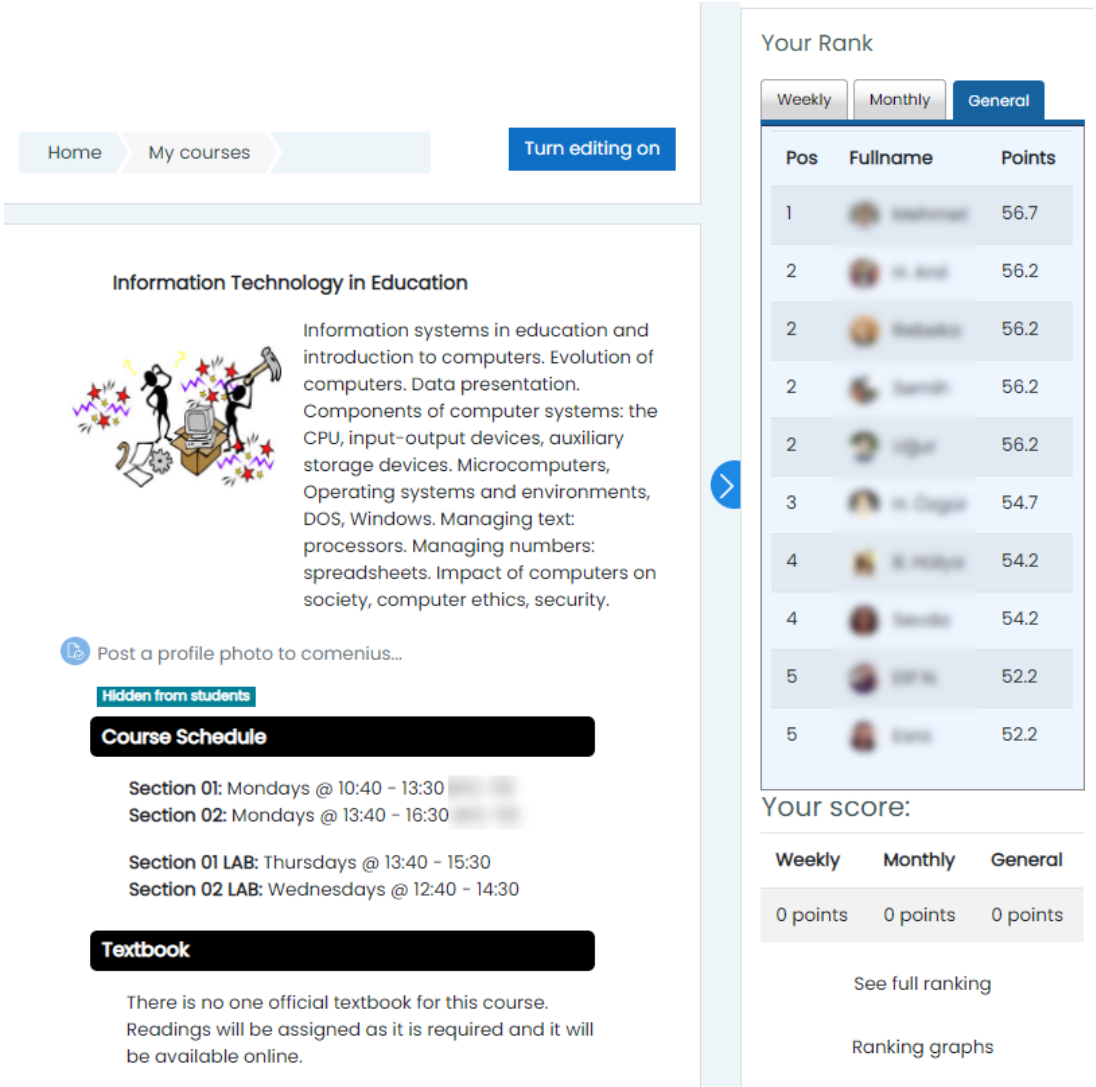


Figure 3.7 Ranking Block in Sidebar

In summary, the intervention was made in the online part of the web-supported course by adding game elements such as levels, leaderboards, points, rewards, feedback, challenges, and competition at the end of the first half of the semester. A detailed description of when and how the game elements in this study emerged is given in the table (see Table 3.1).

Table 3.1 *Game Elements Given with Intervention*

Game Element	*When/Where It Happens*
Points/Scores	Getting experience points after activity completion
Rewards	Getting experience points as reward after activity completion
Levels	Leveling up based on experience points earned.
Leaderboards	Displaying the students with the highest points in a ranking block
Challenges	Getting harder through the exponential increase in experience points required to level up
Competition	On the leaderboard, students compare their self-status with others and try to beat others.
Feedback	Displaying current leveling progress as visual feedback

3.6. Data Analysis

In this study, both pre-intervention and post-intervention data were gathered from Moodle's system for each student. In the first half of the semester, there were no game elements present in the online portion of the WITC. In the second half of the semester, the same students used the online platform in which game elements were present. Thus, in the first half of the study, students were considered as the control group, while in the second half same students were considered as the experiment group. The same students took part in the whole semester, making this study dependent sample design.

At the end of the semester, data were gathered from the plugin integrated into Moodle named "Timestat" (see Appendix D & E). These durations are the sum of the time from the moment students log in to the Moodle system with their student ID and password information until they log out or close the browser. The time-spent by the students in the system each time they log in and out of the system during the day was added to each other, and the total time was calculated. This quantitative data, the time they spent during a semester in the online portion of the WITC, was analyzed after the semester. These durations were the main elements of comparison. However, before comparing the durations individually, weekly means were computed for each student during pre-intervention and post-intervention. It was because if daily durations were compared, the difference would be much more between weekdays as there were quiz days and lab homework days which increased the online participation into the online part of the WITC. In order to reduce these variations, each student's durations converted to weekly means, which gave us more accurate data. In the end, students' duration in the online class was compared with their previous data by using SPSS statistical analysis software. In order to make these statistical comparisons, paired-samples *t*-test was used to determine if there is a significant difference between pre-intervention and post-intervention durations (Green & Salkind, 2009).

3.6.1. Assumptions

It is assumed in this study that

- Participants could easily use the online portion of the WITC with game elements without further instruction.
- The data collected is accurate and complete as the software provides it.
- The collected data analyzed accurately.
- The participants do not differ significantly from each other regarding accessing and using the online portion of the WITC.

3.6.2. Limitations

There were a few limitations in this study. In experimental studies, it is expected that there should be a minimum of 30 participants for each group (Fraenkel & Wallen, 2009). There were only 22 participants available for this study. Thus, the inability to reach the desired sample size in this study is a significant limitation.

Secondly, one of the limitations of this study is the use of convenience sampling. The disadvantage of using convenience sampling is that the study results with this sample are not suitable for generalization (Fraenkel & Wallen, 2009).

Another limitation is that because it is a one-group pre-test post-test design, it is uncontrolled against internal validity threats. The fact that as these threats are not easily controlled might explain the results obtained in the post-intervention (Fraenkel & Wallen, 2009).

Finally, course contents in the online portion of the WITC were not checked for this study. The results might have been affected because the load and scope of the course contents might not be evenly distributed over the weeks.

3.6.3. Delimitations

First and foremost, the delimitation of this study is that the course in which game elements were added was specific to the area in the research study that took place. It was also important to consider that the game elements used in the online portion of the WITC, limited to the available plugins on Moodle's plugin database. Lastly, this study neither focused on cosmetics nor the usability of the online portion of the WITC. These aspects of the online part of the course and its effects were ignored.

CHAPTER 4

RESULTS

This chapter consists of parts that data obtained as a result of the study, which was conducted to examine the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at Computer Education and Instructional Technology (CEIT) department, are analyzed and presented systematically.

4.1. Descriptive Statistics

In this section, descriptive statistics regarding time-spent by the students on the online part of the WITC are presented. The minimum, maximum, average, and standard deviation values of the overall weekly average time-spent (WATS), pre-intervention WATS, post-intervention WATS by each student are specified.

The overall WATS was calculated from the time that the participants spent on the online part of the WITC from the beginning to the end of the study. The pre-intervention WATS was calculated from the time they spent before the game elements were added. The post-intervention WATS was calculated from the time they spent after the intervention (see Table 4.1). One student's data from the data set is removed due to being an outlier.

Table 4.1 *Descriptive Statistics of WATS in Minutes During Pre-Intervention, Post-Intervention, and Overall*

Group	*N*	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
1 Control WATS (Pre-Intervention)	21	1.75	24.78	9.10	5.83
2 Experimental WATS (Post-Intervention)	21	2.98	39.87	17.93	10.60
Overall WATS (Pre- and Post-Intervention)	21	4.61	29.71	14.66	6.56

As shown in the Table 4.1, there are values of the weekly average of the time students spent during a semester on the online portion of the WITC. These durations are the weekly average of the sum of the time from the moment students log in to the online part with their student ID and password information until they log out or close the browser. These times are collected with the help of a plugin called “Timestat.” Time-spent by the students in the system each time they log in and out of the system during the day was added to each other, and the total time was calculated. In the table, minimum, maximum, mean, and standard deviation values of the weekly average are

given by grouping before and after the intervention. Values are calculated in minutes. Decimal values are calculated as a result of converting seconds to minutes.

The mean value before intervention was determined as 9.10 (SD = 5.83) for the control group and 17.93 (SD = 10.60) for the experimental group, and 14.96 (SD = 6.56) for the whole period. While the minimum WATS by the control group in the online part of WITC was 1.75 minutes, it is seen that the minimum WATS by the experimental group was 2.98 minutes. Additionally, the minimum overall WATS on the online part is 4.61 minutes. On the other hand, the maximum WATS by the control group on the online part is 24.78 minutes, and the maximum WATS by the experimental group is 39.87 minutes. Moreover, the maximum overall WATS on the online part is 29.71 minutes.

4.2. Inferential Statistics

The purpose of this research study was to investigate the effect of game elements on time-spent by first-year students on the online portion of the web-supported IT course at the Computer Education and Instructional Technology (CEIT) department at a large state university. Inferential statistics regarding both pre-intervention and post-intervention will be represented in this section.

4.2.1. Assumptions of Paired-Samples *t*-Test

To examine the impact of game elements on the time-spent by students on the online portion of the WITC, a paired-samples *t*-test was performed. According to Pallant (2010) before conducting the *t*-test, the assumptions of the paired-samples *t*-test should be verified. Thus, the level of measurement, independence of observations, and normality assumptions were checked in this section.

4.2.1.1. Level of Measurement

The level of measurement was assumed as satisfied since the dependent variable was continuous because it was individual time-spent for each student in the online part of WITC.

4.2.1.2. Independence of Observations

In order to satisfy independence of observation, "observation or measurement must not be influenced by any other observation or measurement" (Pallant, 2010, p. 203). In this study, the time durations for both pre- and post-intervention were measured at the end of the semester. Thereby, the independence of observations assumption was assured since measurements were not affected by each other.

4.2.1.3. Normality

In order to assess the assumption of normality for paired-samples *t*-test, the difference between pre-intervention and post-intervention WATS was calculated for each student. Before conducting tests for normality, 1 student's data was removed since it was an outlier. Normality tests, then conducted with SPSS statistical analysis software on the difference of these values.

Examining normality assumption test results produced by SPSS statistical analysis software, Kolmogorov-Smirnov Test, skewness, and kurtosis values, and histogram are shown below.

Table 4.2 *Result of Kolmogorov-Smirnov Test for Assumption of Normality*

	Statistic	df	Sig.
Pre-Intervention – Post-Intervention	0.095	21	0.200

As seen from Table *4.2*, the assumption of normality is satisfied since the significance value of 0.200 greater than the 0.05 alpha value, indicates that the data has no significant difference from a normal distribution (Pallant, 2010). Thus, it is confident to say that normality assumption is satisfied.

In small sample sizes, it might also be necessary to look at the skewness and kurtosis values (Pallant, 2010). The skewness value gives an indicator of the distribution symmetry of the data, while the Kurtosis value shows that how peaked the data distribution is (Pallant, 2010). Further calculations were made for skewness and kurtosis values which shows the distribution of WATS values. To further assess the normality of data results shown below.

Table 4.3 *Result of Skewness and Kurtosis Values of WATS Pre- and Post-Intervention*

Weekly Average Time-Spent	Std. Deviation	Skewness	Kurtosis
Pre-Intervention – Post-Intervention	11.57	0.475	0.583

Skewness and kurtosis values should be between +2.0 and -2.0 for the evidence of normal distribution (Pallant, 2010). As shown in Table 4.3, the skewness value is 0.475, and the kurtosis value is 0.583. When skewness and kurtosis values are 0, it is assumed that data is distributed perfectly normal. Having values between 0 and 1, it could be assumed that the distribution is close to the standard normal distribution (Pallant, 2010).

In the results, SPSS provides histograms for further assessing the normality of distribution. It can be seen from Figure 4.1 normal curve supports the normality assumption for WATS pre- and post-intervention values.

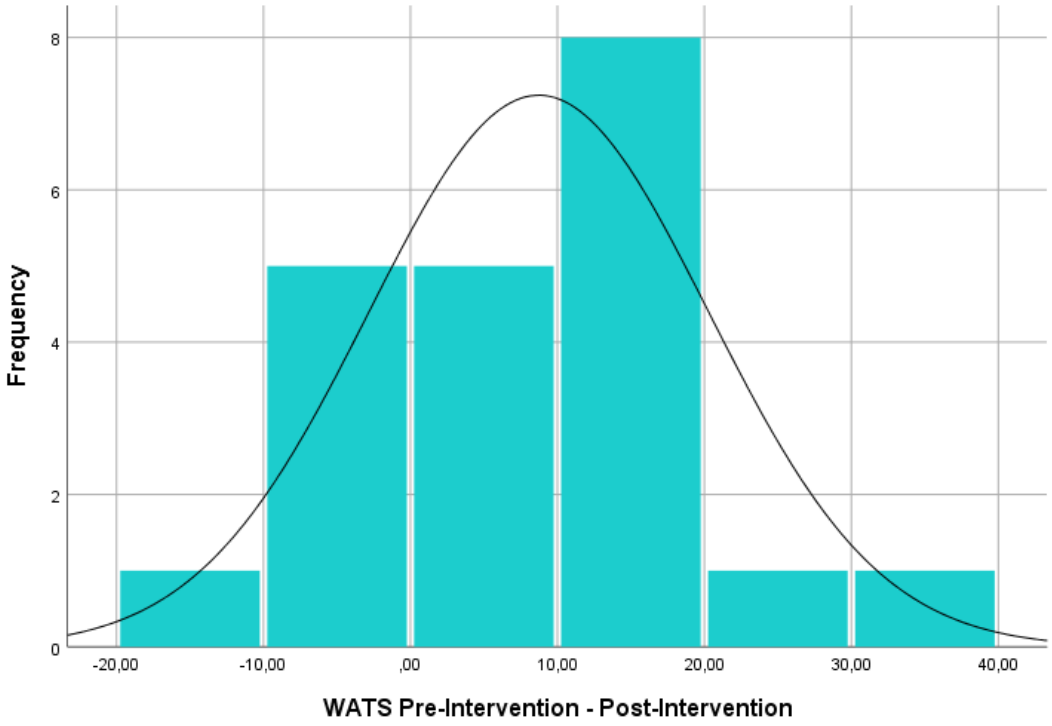


Figure 4.1 Histogram of Pre-/Post-Intervention for WATS

4.2.2. The Results of Paired-Samples *t*-Test for WATS

In this section, after testing and assessing the assumptions, a paired-samples *t*-test conducted using SPSS statistical analysis software to investigate whether game elements increased the time-spent by students on the online portion of the web-supported IT course.

Table 4.4 *The Results of Paired-Samples t-Test for WATS*

Weekly Average Time-Spent	Mean	SD	t	df	Sig.
Pre-Intervention – Post-Intervention	8.73	11.57	3.459	21	0.002

The null hypothesis of this study; there is no statistically significant difference between the control (without game elements) and experimental group (with game elements) in terms of time-spent by students on the online portion of a WITC. As seen in Table *4.4*, there was a statistically significant increase in WATS from pre-intervention (M=9.10 SD=5.83) to post-intervention (M=17.93, SD=10.60), $t(21)=3.459$, $p < 0.05$. The statistical results showed that the null hypothesis was rejected.

This significant increase might be because of the added game elements into the online part of WITC in the second half of the semester. The mean increase in WATS by students on the online part was 8.73, with a 95% confidence interval ranging from 3.46 to 13.10. Although the results presented showed that the difference obtained in the two sets of durations was unlikely to occur by chance, it does not tell much regarding the magnitude of the treatment's effect. Thereby, the effect size was calculated to see how much difference occurred between pre- and post-intervention WATS. The eta squared statistic (0.37) indicated a large effect size.

This section was examined the effect of game elements on time-spent by first-year students on an online portion of a web-supported IT course. Statistical analyses based on all variables in the study showed a statistically significant increase in weekly average time-spent by students in an online part from pre-intervention to post-intervention. In other words, post-intervention time-spent by students showed a significant increase compared to pre-intervention time-spent by students.

CHAPTER 5

DISCUSSION AND CONCLUSION

This chapter consists of parts about the conclusion and discussion of the study, which was conducted to examine the effect of game elements on time-spent by students on the online portion of a web-supported information technology course (WITC) at Computer Education and Instructional Technology (CEIT).

5.1. Conclusion

The research question of this study was whether game elements effective in increasing time-spent by students on the online portion of a web-supported information technology course (WITC). In order to find an answer to this question, an online portion of the WITC was given to the same group of students, first without game elements and then by adding game elements to the online portion. The type of teaching approach was independent in both parts of this study, and the time-spent by students on the online portion of the WITC was the dependent variable.

The effects of game elements on the time-spent of CEIT first-year students on an online portion of a WITC were examined. When the *t*-test results were examined, it was observed that there was a significant increase in the weekly average time-spent (WATS) by students in the online part. The main reason for this increase could be thought to be due to game elements such as leaderboard, levels, and scoring added to the online part of the WITC.

The reason for the increase might be that these students took the same course in the first half, and their time-spent was low compared to the second half. In the second half, game elements were added, and it was observed that there was a statistically

significant increase in time-spent by students in the online portion of the WITC. In addition to this increase, the effect size was also calculated in order to understand how much increase there was. As a result of these calculations, it was found that the effect size was large.

5.2. Discussion

With the developing technology and the change in today's educational conditions, the use of new education models has become widespread (Liber, 2004). E-learning has become more widely used with the help of these emerging technologies. Today, online learning platforms such as Moodle are actively used both independently and to help the school at primary, secondary, and university levels. Apart from the convenience provided by e-learning, it also brought problems caused by the distance between the students and the teacher or the absence of the school environment during education. (Al Zumor et al., 2013; Ramakrisnan et al., 2013). One of these problems is the low level of participation of students in classes. (Bartlett, 2016). As Al Zumor et al. (2013) stated that engagement is one of the biggest problems in terms of e-learning, especially at the high school level.

Mainly when the content or subject of the education provided by e-learning is boring for the student, the engagement period of the students might decrease. Gamification can be used to increase engagement in these boring lessons or activities. Kapp (2012, p. 66) states that "Gamification uses game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems." Therefore, there have been some studies for the effective use of game elements in the online learning platform in order to increase the engagement levels of students in e-learning (Abdulaziz Alsubhi et al., 2020; James, 2016; Gudoniene et al., 2016; Landers, 2014; Monterrat et al., 2015; Wongso et al., 2015). Many studies in the literature showed results that adding game elements increases engagement in e-

learning environments (Bouchrika et al., 2019; Dembicki, 2016; Lee & Doh, 2012; Katsigiannakis et al., 2017; Khan et al., 2017; Krause et al., 2015; Poondej & Lerdpornkulrat, 2019). These studies, which show that gamification increases the engagement level of students in the online learning platform, have been carried out at different educational levels and by using different game design elements. As a result, it is seen that adding game elements is an effective way of increasing the engagement levels of students in online learning platforms at different educational levels. The current study conducted at the university level also showed a statistically significant increase in time-spent by students in the online portion of a web-supported IT course.

In the study conducted by Smiderle et al. (2020), it was observed that introvert students had higher engagement levels in the gamified environment compared to extrovert students. In the present study, no test was conducted to determine whether students are introverted or extroverted. Consequently, when using game elements to increase the level of engagement in the online learning environment, it might be helpful to consider whether students are introverted or extroverted to achieve more accurate results.

5.3. Recommendations for Future Research

The results obtained in this study showed a positive increase in time-spent by students on the online portion of a WITC. Although the main reason for this increase might be game elements, a more detailed examination of the variables not taken into account in this study will give more accurate results. For example, the changes in the weekly online part of the web-supported IT course content, the quality of the weekly online laboratory assignments, the number of questions, and the qualifications of the weekly online quizzes could be the factors that might affect the students' time-spent on the online platform. In addition, between the pre-intervention and post-intervention periods, students' leisure time according to the status of other courses they take should

be considered a possible factor that might affect the time they spend in the online part of the WITC.

As another factor, the students used this online part of the WITC in the laboratory classes together at the school on certain days of the week. In the current context, since it is not possible to determine the time-spent by students on the online part at home or outside of school, all the time is calculated. Thus, when the time-spent by the students on the online education platform on their initiative is taken into account, it will be possible to obtain more accurate results.

REFERENCES

Abdulaziz Alsubhi, M., Sahari, N., & Tengku Wook, T. S. M. (2020). A Conceptual Engagement Framework for Gamified E-Learning Platform Activities. *International Journal of Emerging Technologies in Learning (IJET)*, *15*(22), 4. https://doi.org/10.3991/ijet.v15i22.15443

Akıllı, G. K. (2007). Games and Simulations: A New Approach in Education? In *Games and Simulations in Online Learning: Research and Development Frameworks* (pp. 1–20). IGI Global. https://doi.org/10.4018/978-1-59904-304-3.ch001

Al Zumor, A. W. Q., Al Refaai, I. K., Bader Eddin, E. A., & Aziz Al-Rahman, F. H. (2013). EFL students' perceptions of a blended learning environment: Advantages, limitations and suggestions for improvement. *English Language Teaching*, *6*(10), 95–110. https://doi.org/10.5539/elt.v6n10p95

Bartlett, S. (2016). *Online Student Engagement: Problems and Potential Solutions*. 1–9. https://smartech.gatech.edu/handle/1853/54525

Berkup, S. B. (2014). Working With Generations X and Y in Generation Z Period: Management of Different Generations in Business Life. *Mediterranean Journal of Social Sciences*, *5*(19), 218–229. https://doi.org/10.5901/mjss.2014.v5n19p218

Bouchrika, I., Harrati, N., Wanick, V., & Wills, G. (2019). Exploring the Impact of Gamification on Student Engagement and Involvement With E-Learning Systems. *Interactive Learning Environments*, *0*(0), 1–14. https://doi.org/10.1080/10494820.2019.1623267

Caillois, R. (1961). The Definition of Play: Man, Play, and Games. In *The Definition of Play* (pp. 3–10). Free Press of Glencoe.

Caponetto, I., Earp, J., & Ott, M. (2014). Gamification and education: A literature review. *Computers in Human Behavior*, *3*(4), 1–4. https://doi.org/10.1006/ceps.1999.1020

Cechanowicz, J., Gutwin, C., Brownell, B., & Goodfellow, L. (2013). Effects of Gamification on Participation and Data Quality in a Real-World Market Research Domain. *ACM International Conference Proceeding Series*, 58–65. https://doi.org/10.1145/2583008.2583016

Creswell, J. W. (2014). Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research. In *Educational Research* (4th ed.). Pearson Education Limited.

Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. Harper and Row.

De-Marcos, L., Domínguez, A., Saenz-De-Navarrete, J., & Pagés, C. (2014). An empirical study comparing gamification and social networking on e-learning. *Computers and Education*, *75*, 82–91. https://doi.org/10.1016/j.compedu.2014.01.012

Dembicki, D. (2016). Next Practice in Online Nutrition Education - Gamification - An Inquiry Into the Process of Improving Student Engagement. *Journal of Nutrition Education and Behavior*, *48*(7, Supplement), S53. https://doi.org/https://doi.org/10.1016/j.jneb.2016.04.143

Deterding, S., Dixon, D., Khale, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification." *In Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9–15. https://doi.org/10.1145/2181037.2181040.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). Gamification: Toward a Definition. *Proceedings of CHI 2011 Workshop Gamification*, 7–12. https://doi.org/10.1145/2181037.2181040

Ehlers, U. D. (2009). Web 2.0 - E-Learning 2.0 - Quality 2.0? Quality for New Learning Cultures. *Quality Assurance in Education*, *17*(3), 296–314. https://doi.org/10.1108/09684880910970687

Fotaris, P., Mastoras, T., Leinfellner, R., & Rosunally, Y. (2016). Climbing up the leaderboard: An empirical study of applying gamification techniques to a computer programming class. *Electronic Journal of E-Learning*, *14*(2), 94–110. http://ezproxy.georgetowncollege.edu:2048/login?URL=http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=115880713

Fraenkel, J. R., & Wallen, N. E. (2009). *How to design and evaluate research in education* (7th ed.). McGraw-hill.

Green, S. B., & Salkind, N. J. (2009). Using SPSS for Windows and Macintosh: Aanalyzing and understanding data. In L. Jewell (Ed.), *Pearson Prentice Hall* (4th ed.). https://doi.org/10.1198/tas.2005.s139

Gudoniene, D., Bartkute, R., Rutkauskiene, D., & Blazauskas, T. (2016). Technological Aspects of the Gamification Model for e-Learning Participant's Engagement. *Baltic Journal of Modern Computing*, *4*(4), 1008–1015. https://doi.org/10.22364/bjmc.2016.4.4.25

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? A Literature Review of Empirical Studies on Gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers and Education*, *80*, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019

Hogle, J. G. (1996). Considering Games as Cognitive Tools: In Search of Effective "Edutainment." *University of Georgia Department of Instructional Technology*, *August*, 1–27. http://twinpinefarm.com/pdfs/games.pdf

James, L. (2016). A Psychobiological Model for Managing Student Engagement in Online Courses Using Gamification Principles. *Webology*, *13*(1), 1–23.

Kapp, K. M. (2012a). Games, Gamification, and the Quest for Learner Engagement. *American Society for Training & Development*, *June*.

Kapp, K. M. (2012b). *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. John Wiley & Sons.

Katsigiannakis, E., Karagiannidis, C., & Zaranis, N. (2017). Gamification and Game Mechanics-Based E-Learning: A Moodle Implementation and Its Effect on User Engagement. In *Research on e-Learning and ICT in Education* (pp. 147–159). Springer.

Khan, A., Ahmad, F. H., & Malik, M. M. (2017). Use of Digital Game Based Learning and Gamification in Secondary School Science: The Effect on Student Engagement, Learning and Gender Difference. *Education and Information Technologies*, *22*(6), 2767–2804. https://doi.org/10.1007/s10639-017-9622-1

Klopfer, E., Osterweil, S., Salen, K., Groff, J. S., & Roy, D. (2009). Moving Learning Games Forward: Obstacles, Opportunities & Openness. *Flora*, *3*(December), 58. https://doi.org/10.1207/S15327825MCS0301_02

Koivisto, J., & Hamari, J. (2014). Demographic Differences in Perceived Benefits From Gamification. *Computers in Human Behavior*, *35*, 179–188. https://doi.org/10.1016/j.chb.2014.03.007

Landers, R. N. (2014). Developing a Theory of Gamified Learning: Linking Serious Games and Gamification of Learning. *Simulation and Gaming*, *45*(6), 752–768. https://doi.org/10.1177/1046878114563660

Lee, H., & Doh, Y. Y. (2012). A Study on the Relationship Between Educational Achievement and Emotional Engagement in a Gameful Interface for Video Lecture Systems. *Proceedings - 2012 International Symposium on Ubiquitous Virtual Reality, ISUVR 2012*, 34–37. https://doi.org/10.1109/ISUVR.2012.21

Lei, H., Cui, Y., & Zhou, W. (2018). Relationships between student engagement and academic achievement: A meta-analysis. *Social Behavior and Personality*, *46*(3), 517–528. https://doi.org/10.2224/sbp.7054

Liber, O. (2004). Cybernetics, e-learning and the education system. *International Journal of Learning Technology*, *1*(1), 127. https://doi.org/10.1504/ijlt.2004.003686

McGonigal, J. (2011). Reality Is Broken: Why Games Make Us Better and How They Can Change the World. In *The Penguin Press* (Vol. 10, Issue 1). https://doi.org/10.1075/ni.10.1.03bro

Mizam, N. (2019). *The Effect of Gamified Instruction About Computer Technology Terms On Undergraduate Students' Achievement* (Issue August). Middle East Technical University.

Monterrat, B., Desmarais, M., Lavoué, É., & George, S. (2015). A Player Model for Adaptive Gamification in Learning Environments. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *9112*, 297–306. https://doi.org/10.1007/978-3-319-19773-9_30

Pallant, J. (2010). *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows* (4th ed.). The McGraw Hill.

Poondej, C., & Lerdpornkulrat, T. (2019). Gamification in E-Learning: A Moodle Implementation and Its Effect on Student Engagement and Performance. *Interactive Technology and Smart Education*, *17*(1), 56–66. https://doi.org/10.1108/ITSE-06-2019-0030

Prensky, M. (2001). Fun, Play and Games: What Makes Games Engaging. In *Digital Game-Based Learning*. McGraw-Hill.

Prensky, M. (2002). The Motivation of Gameplay or, The Real 21st Century Learning Revolution. *On the Horizon*, *10*(1), 5–11. https://doi.org/10.1108/10748120210431349

Prensky, M. (2005). Teaching Digital Natives: Partnering for Real Learning. In *Corwin Press*.

Ramakrisnan, P., Yahya, Y. B., Hasrol, M. N. H., & Aziz, A. A. (2013). Blended Learning: A Suitable Framework For E-Learning In Higher Education. *Procedia - Social and Behavioral Sciences*, *67*, 513–526. https://doi.org/10.1016/j.sbspro.2012.11.356

Rothman, D. (2016). *A Tsunami of Learners Called Generation Z*. https://mdle.net/journal/A_Tsunami_of_Learners_Called_Generation_Z.pdf

Salen, K., Zimmerman, E., & Tekinbaş, K. (2004). Rules of Play: Game Design Fundamentals. In *MIT press* (pp. 39–44). https://doi.org/10.4324/9781315203621-6

Salomon, G. (2003). E-Learning: How Not to Repeat Past Mistakes. *Invited Address to the ITU Conference in Oslo, January 2003*.

Smiderle, R., Rigo, S. J., Marques, L. B., Peçanha de Miranda Coelho, J. A., & Jaques, P. A. (2020). The Impact of Gamification on Students' Learning, Engagement and Behavior Based on Their Personality Traits. *Smart Learning Environments*, *7*(1). https://doi.org/10.1186/s40561-019-0098-x

Tulgan, B. (2013). Meet Generation Z : The second generation within the giant " Millennial " cohort. *RainmakerThinking, Inc.*, 1–13. http://rainmakerthinking.com/assets/uploads/2013/10/Gen-Z-Whitepaper.pdf

Türkmen, G. P., & Soybaş, D. (2019). The Effect of Gamification Methodology on Students' Achievements and Attitudes Towards Mathematics. *Bartın Üniversitesi Eğitim Fakültesi Dergisi*, *8*, 258–298. https://doi.org/10.14686/buefad.424575

Tyler-Smith, K. (2006). Early Attrition Among First Time Elearners: A Review of Factors That Contribute to Drop-Out, Withdrawal and Non-Completion Rates of Adult Learners Undertaking eLearning Programmes. *Journal of Online Learning and Teaching*, *2*(2), 73–85.

Watson, W. R., Mong, C. J., & Harris, C. A. (2011). A Case Study of the in-Class Use of a Video Game for Teaching High School History. *Computers and Education*, *56*(2), 466–474. https://doi.org/10.1016/j.compedu.2010.09.007

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*.

Werbach, K., & Hunter, D. (2015). The Gamification Toolkit: Dynamics, Mechanics, And Components for The Win. In *Wharton School Press*. Wharton School Press.

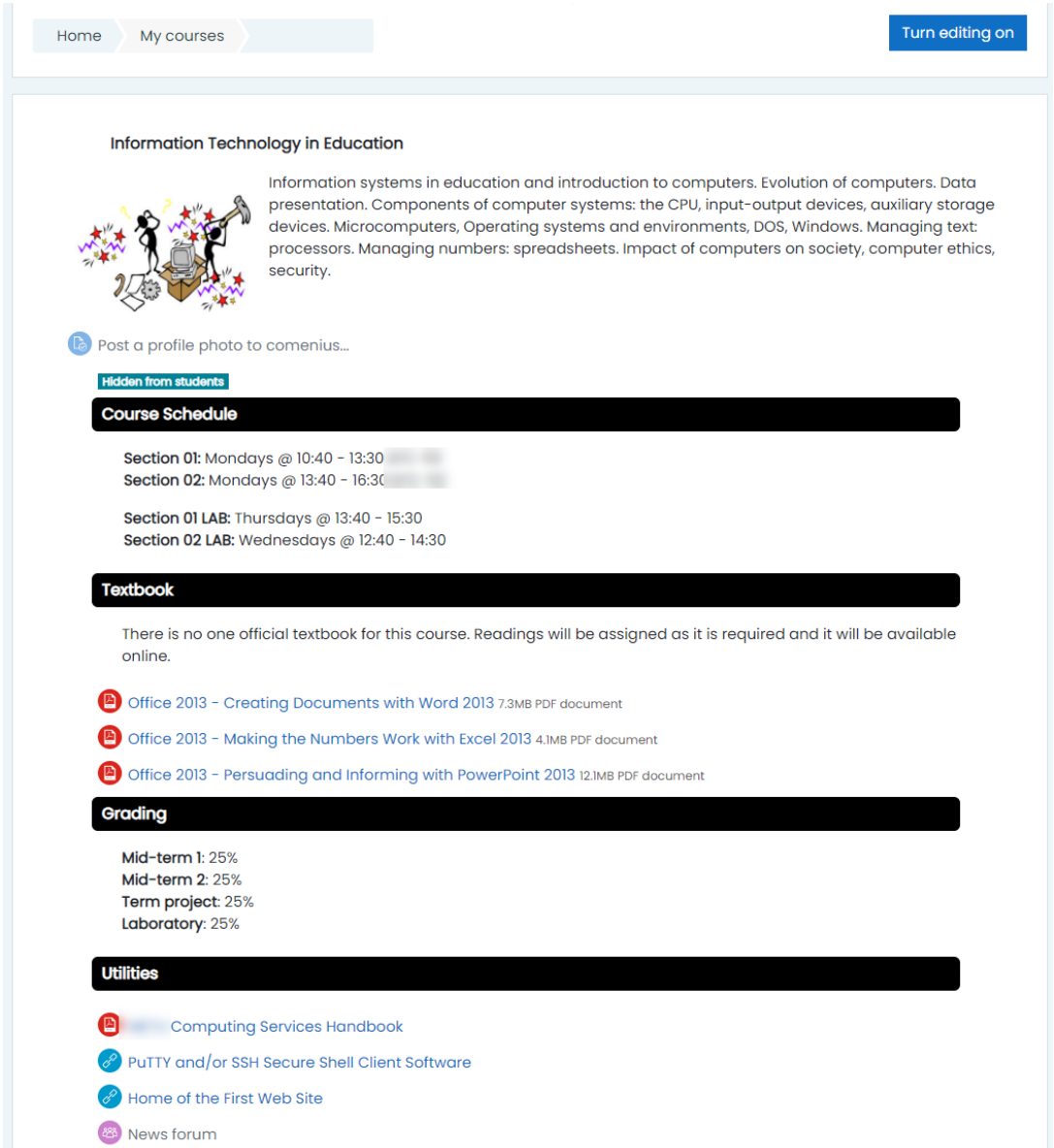
Wongso, O., Rosmansyah, Y., & Bandung, Y. (2015). Gamification Framework Model, Based on Social Engagement in E-Learning 2.0. *Proceedings of 2014 2nd International Conference on Technology, Informatics, Management, Engineering and Environment, TIME-E 2014*, 10–14. https://doi.org/10.1109/TIME-E.2014.7011583

Wood, L. C., & Reiners, T. (2015). Gamification. *Encyclopedia of Information Science and Technology*, 3039–3047. https://doi.org/10.4018/978-1-4666-5888-2.ch297

APPENDICES

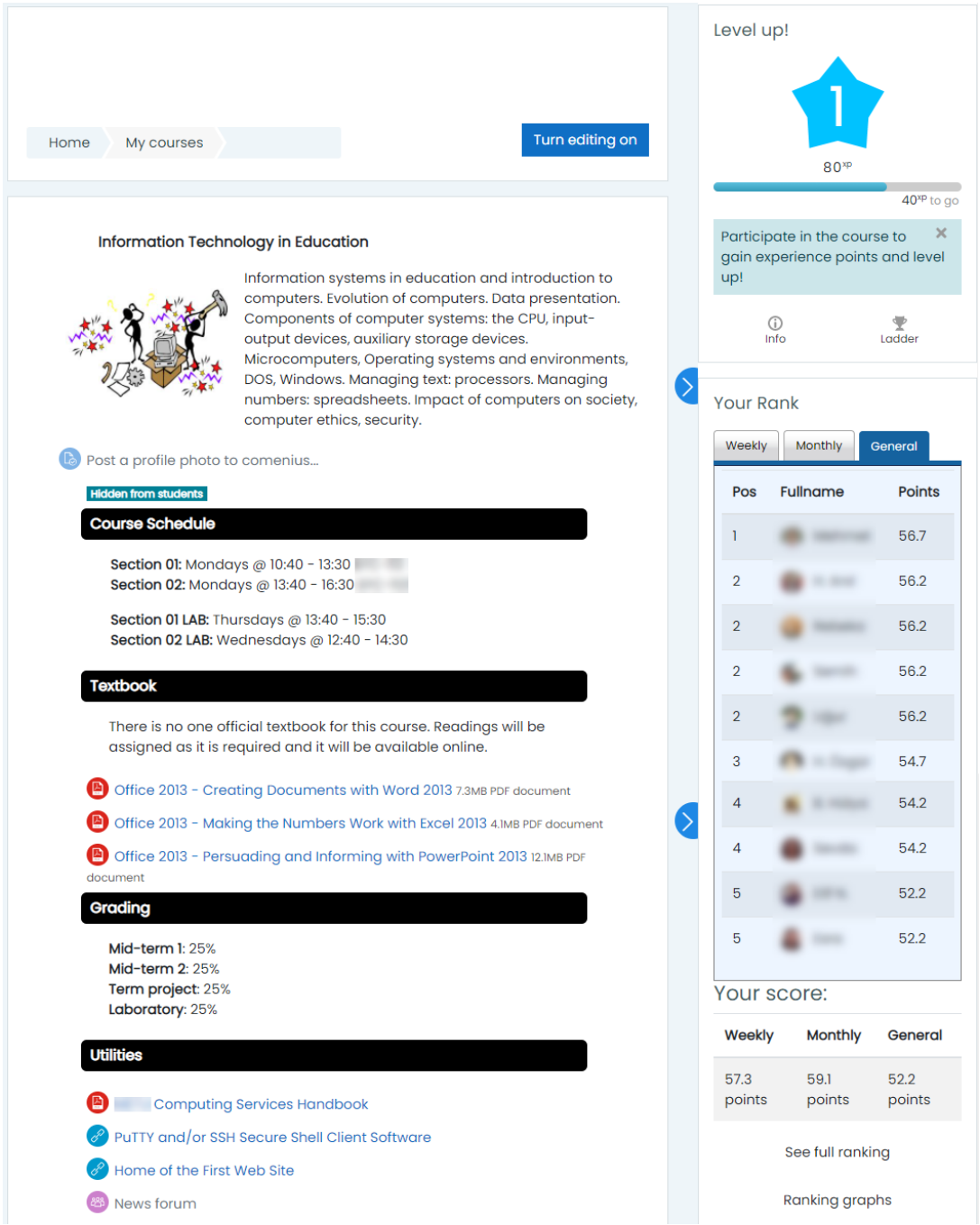
APPENDIX A

COURSE WEB PAGE WITHOUT GAME ELEMENTS



APPENDIX B

COURSE WEB PAGE WITH GAME ELEMENTS



APPENDIX C

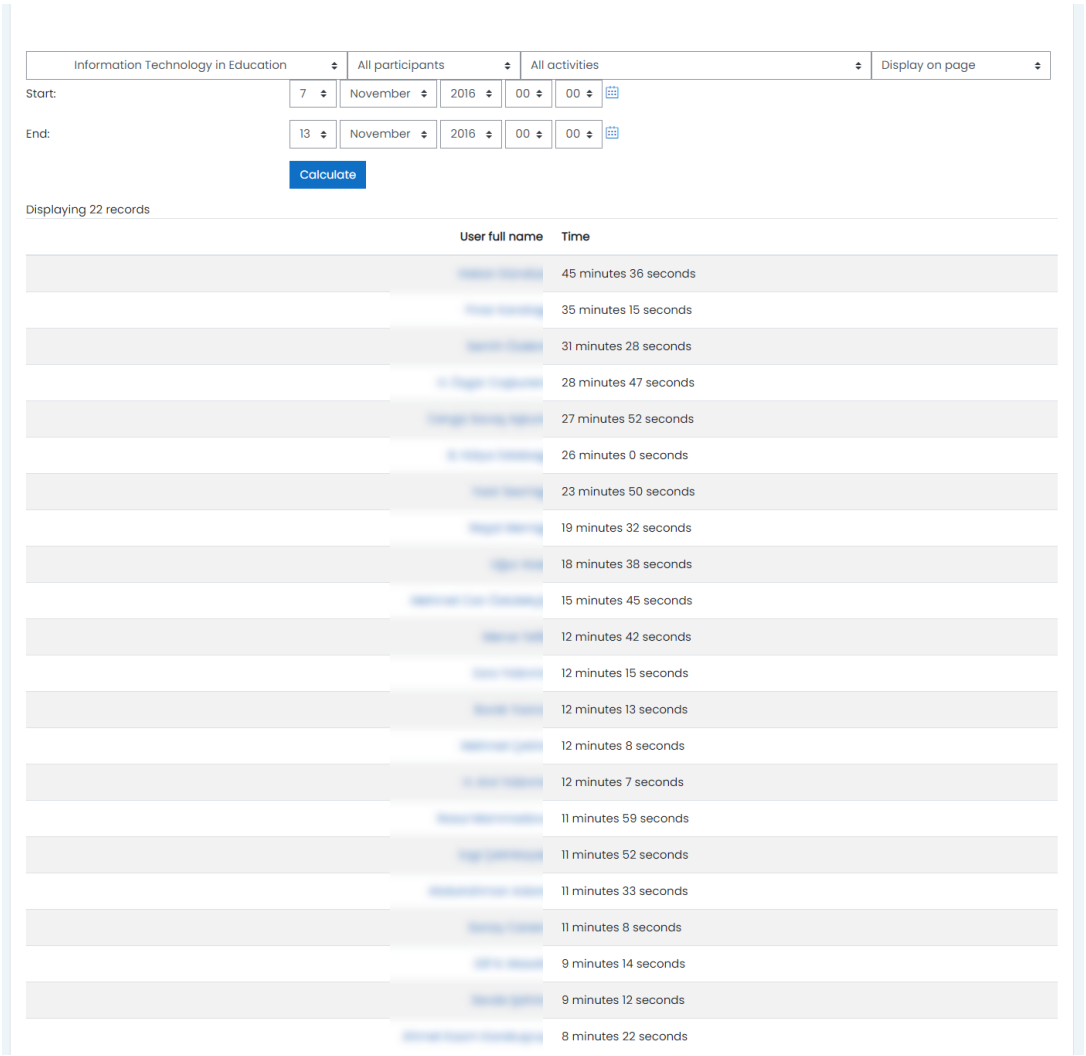
DETAILS OF RANKING BLOCK FOR LEADERBOARD

Ranking details: First 22 students

Position	Fullname	Points
1	[redacted]	56.7
2	[redacted]	56.2
2	[redacted]	56.2
2	[redacted]	56.2
2	[redacted]	56.2
3	[redacted]	54.7
4	[redacted]	54.2
4	[redacted]	54.2
5	[redacted]	52.2
5	[redacted]	52.2
5	[redacted]	52.2
5	[redacted]	52.2
6	[redacted]	45.5
6	[redacted]	45.5
6	[redacted]	45.5
6	[redacted]	45.5
7	[redacted]	45.1
8	[redacted]	44.6
9	[redacted]	44.2
10	[redacted]	43.5
11	[redacted]	43.0
12	[redacted]	42.2

APPENDIX D

EXAMPLE OF TIMESTAT PLUGIN CALCULATION OF TIME-SPENT DATA FOR ALL STUDENTS



Information Technology in Education | All participants | All activities | Display on page

Start: 7 November 2016 00 00

End: 13 November 2016 00 00

Calculate

Displaying 22 records

User full name	Time
[redacted]	45 minutes 36 seconds
[redacted]	35 minutes 15 seconds
[redacted]	31 minutes 28 seconds
[redacted]	28 minutes 47 seconds
[redacted]	27 minutes 52 seconds
[redacted]	26 minutes 0 seconds
[redacted]	23 minutes 50 seconds
[redacted]	19 minutes 32 seconds
[redacted]	18 minutes 38 seconds
[redacted]	15 minutes 45 seconds
[redacted]	12 minutes 42 seconds
[redacted]	12 minutes 15 seconds
[redacted]	12 minutes 13 seconds
[redacted]	12 minutes 8 seconds
[redacted]	12 minutes 7 seconds
[redacted]	11 minutes 59 seconds
[redacted]	11 minutes 52 seconds
[redacted]	11 minutes 33 seconds
[redacted]	11 minutes 8 seconds
[redacted]	9 minutes 14 seconds
[redacted]	9 minutes 12 seconds
[redacted]	8 minutes 22 seconds

APPENDIX E

EXAMPLE OF TIMESTAT CALCULATION FOR SELECTED PARTICIPANT