

**Gender Differences in the Impact of Gamification Elements on Performance  
and Anxiety**

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### **Abstract**

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*Keywords:* Gamification, Gender

## **Gender Differences in the Impact of Gamification Elements on Performance and Anxiety**

### **Theoretical Background**

#### **Gamified learning environments**

Intelligent Tutoring Systems (ITS) can be referred to as "any computer program that can be used in learning and that contains intelligence" (Freedman et al., 2000). Therefore, ITS accompany a student on his or her learning experience of a specific domain of knowledge by creating tasks that appeal to the students needs (González et al., 2014). ITS can range from simple instructive texts to simulations and virtual realities, as a model imitating and abstracting certain aspects of the real world to reduce complexity for machine and user (Psotka et al., 1988). Modern ITS are split into three intertwined models: student, domain and tutor model. The student model holds the information about the user. The user is characterized from different angles the information is updated as the user advances within the ITS. The domain model contains the knowledge and structure of the learning material. It supplies the tutor model with tasks based on the input from the student model. At last the tutor model controls the interaction with the student and contains the information which tasks are shown to the user in accord with the learning objectives from the domain model (González et al., 2014; Freedman et al., 2000).

With the rising interest in Gamification ITS also grow in importance as they can be used together. The use of gamified elements enhances the ITS and Gamification require some sort of progress tracking model for the gamified elements (e.g. Content unlocking to work). González et al. (2014) suggest adding more models as Gamification requires additional systems for visualization and feedback. Additionally, new studies created a connection between emotions and learning, other studies connected relationships between teachers and students and an increase in student motivation (Woolf et al., 2010). Both results were linked in a study by Woolf et al. (2010) showing how digital learning

companions improved the overall learning ability and self-concept of all students, especially low achieving students. For the context of this thesis it is also important that the ITS version with a male learning companion was muted twice as much as the female version, resulting in a lower effect. The study showed differences between gender, in discussion Woolf et al. (2010) suggested considering gender within the student domain could further advance its predictive power.

## **Gamification**

Gamification can be defined as "the idea of using game design elements in non-game contexts" (Deterding et al., 2011) to further increase motivation and user activity within interaction design (Deterding et al., 2011). These game-design elements "gamified elements" are elements often found in classical games. Often used elements are points, badges, leaderboards and avatars, other mechanisms include content unlocking, storytelling and memes (Zainuddin et al., 2020). Often those elements are used specific constellations like the PBL triad described by Werbach and Hunter, 2012, which contains points, badges and leaderboards, a system that is not only known from games, but also everyday enterprise features like loyalty programs and employee competitions (Werbach & Hunter, 2012). Points because they add an absolute scale, badges because they represent a status symbol and work like a temporary goal to strive toward and leaderboards to compare yourself to peers (Werbach & Hunter, 2012). One of the positive effects of gamification is brought by the feedback in different forms (task, process, self-regulation, self) either immediate or delayed. Feedback is one of the most important factors in the relation between education and learning Sailer and Homner, 2020. The use of gamified elements showed positive outcomes in multiple studies, in general (Hamari et al., 2014) as well as in education specific contexts (Sailer & Homner, 2020). But gamification, especially some elements like leaderboards, can also lead to negative outcomes. Leaderboards, while motivating through comparison, have been reported to demotivate participants (Almeida

et al., 2021). "Pavlovication" as Klabbers, 2018 calls it, Gamification, as it is often a short question-answer-reward-cycle, conditions the user to learn conditional and narrows the possible ways to solve a problem down (Klabbers, 2018). Some studies also suggested that gamified learning platforms also lack individualism regarding choice and display of gamification elements, resulting in discomfort and negative emotions (Santos et al., 2023).

## **Gender and Stereotype threat**

Gender, as a concept within social sciences, refers to more than the binary categorization of male and female. It encompasses a range of identities and experiences that are shaped by a complex interplay of biological, psychological, and social factors. Gender is not solely determined by biological characteristics; instead, it is increasingly recognized as a spectrum, acknowledging the presence of diverse gender identities beyond the traditional binary understanding (Lindqvist et al., 2021). Socialization plays a critical role in shaping gender identity. It influences how individuals perceive themselves and interact with their surroundings based on the gender norms prevalent within their society. These norms dictate behaviors, roles, and expectations, which are often internalized from an early age through various socialization agents like family, media, educational institutions, and peer groups (Kampshoff & Wiepcke, 2012). While acknowledging the spectrum of gender identities, this thesis will focus primarily on the binary categorization of gender—male and female. This approach does not negate the validity of non-binary or genderqueer identities but rather limits the scope of investigation to traditional gender roles within the binary framework.

Stereotype threat occurs when "one can be judged by, treated in terms of, or self-fulfill negative stereotypes about one's group". Although this study does not aim to eliminate stereotype threat it is an important factor as it can explain at least some of the differences different genders experience while studying computer science (Cheryan et al., 2011), especially regarding math (Spencer et al., 1999). Stereotype threat even leads to

lower identification with academics and specific subjects (Christy & Fox, 2014).

### Hypotheses

Wie in dem ersten Kapitel zu erkennen, gibt es offene Fragen zu der Effizienz verschiedener gamifizierter Elemente und dem Bezug verschiedener Geschlechter zu diesen gamifizierten Elementen. Generell ist die Frage nach der Effizienz bestimmter Elemente und Elementkombinationen noch zu klären (Dehghanzadeh et al., 2024). Um die Verbindung von Geschlecht und Gamification-Elementen zu untersuchen, haben wir folgendes Modell erstellt: \*\*Modell einfügen\*\*

