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Impact of Gamification on Individual's Motivation and Behavior

Charlotte Hufnagel

Impact of Gamification on Individual's Motivation and Behavior

Inauguraldissertation zur Erlangung des akademischen Grades eines Doktors der Wirtschaftswissenschaften durch die Wirtschaftswissenschaftliche Fakultät der Westfälischen Wilhelms-Universität Münster

vorgelegt von

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Charlotte Hufnagel

Foreword

Gamification has become a major trend over the last few years. Organizations use the motivational potential of games in several non-gaming contexts (i.e., with customers as well as employees) to stimulate user engagement. They choose gaming elements such as points or leader-boards to motivate users to continuously use the services. Thereby, organizations face the challenge to evaluate the effectiveness of gamification in such non-gaming contexts. In doing so, they first have to assess whether gamification represents an effective marketing tool at all. Thus, organizations have to evaluate whether gamification generates a value to the customer by creating gameful experiences that evoke a feeling of competence and enjoyment. In addition, gamification should generate a value to the organization by increasing retention rates and customer lifetime value. Second, organizations have to evaluate what types of gamification are most effective in which specific context and for what type of customer or employee. Consequently, when organizations understand which game element primarily evokes a specific type of gameful experience in a particular context, they can implement game elements in a targeted manner.

Hence, this dissertation, titled “Impact of Gamification on Individual’s Motivation and Behavior”, by Charlotte Hufnagel aims to examine the effectiveness of specific game elements on psychological and behavioral outcomes as well as the moderating effect of individual characteristics. Hereby, the self-determination theory serves as a theoretical foundation. After an extensive literature review on the topic of gamification, Charlotte’s dissertation contributes to reach that aim by conducting two field studies in the context of education as well as market research.

The first study was conducted in the context of education. In general, building interpersonal relationships by providing positive feedback and creating a supportive learning climate should increase learning motivation. However, in online learning environments as well as courses with a high number of students, educators’ face-to-face interactions are restricted. Thus, providing a prompt guidance and instant feedback is difficult in these situations. Gamification can help to overcome motivational problems in the educational context. Even in courses where personal interaction is restricted (i.e., bachelor's program with more than 600 students), gamification can be an appropriate way

to provide immediate feedback and guidance. In the first study, the influence of specific game elements (i.e., badges, points, and leaderboard) on the learning motivation and learning performance of students was investigated using data from a field experiment that was conducted as part of a university bachelor course. The final dataset contains data from six different sources and hence is impressive. Charlotte's results show that, in contrast to expectations, the selected game elements have neither a direct effect on motivation nor an indirect effect on learning performance. Therefore, the implications are that points and leaderboards neither harm nor support the motivation and behavior of students. Badges can be used to improve student performance. In addition, the results show that the effects of game elements are not universal and can be ineffective in certain contexts. The investigated individual characteristics do not show a moderating effect.

In the second study in the context of market research, an influence on motivation of the study participants and their subsequent behavior was observed. In general, organizations rely on the results of market research for their strategic and operational decisions. In contrast, the participants feel a high effort when answering questions as well as a high emotional and cognitive load when responding to questions. This often results in a negative respondent behavior such as speeding up, random response, high dropout rates, and lack of attention in market research studies. Gamification can be a suitable way to make online market research more entertaining and reduce cognitive stress. For conducting an online experiment, a choice based conjoint analysis was gamified by implementing a memory-type game. Hereby, the scope of the previously examined game elements was extended. Based on the results, the gamified conjoint analysis is preferred to traditional conjoint methods without gamification. In addition to a better data quality, the implementation of the gamified method also increases the motivation of individuals to participate in the market research study.

Taken together, Charlotte's dissertation is dealing with a very fascinating, relevant and timely topic and is highly relevant for both academia and practice. Thereby, Charlotte offers many useful insights to the above mentioned main research question. This dissertation is one of the first to show consumers (students and market research study participants) behavior with respect to gamification in non-game context by using two impressive studies and datasets. As

such, it is a great piece of academic work that is very relevant to the business word. I can only applaud Charlotte for her great achievement and wish all readers a lot of fun and insights reading the dissertation.

Besides giving an outlook to the dissertation, I want to take the opportunity to thank Charlotte for her work at the Institute for Value-Based Marketing (IWM) at the Marketing Center Münster (MCM) at the University of Münster. Charlotte is the third PhD student Sonja and I supervised in Münster. As such, together with Simon and Sascha, Charlotte belongs to our first generation of PhD students. While Charlotte came in a bit later, she had as much influence on the culture and success of the IWM as the two boys had. Charlotte was always a very very nice person to go to and talk as well as work with. She was so engaging and caring not only for her fellow PhDs, but also for all other IWM employees and students – in Münster, Oslo and beyond. The huge success of the "Start Up" IWM would not have been possible without Charlotte's footprint. Her time with us had ups and downs and we all learned a lot during that time. However, at least I can say that I am happy that I have experienced it.

During that time, we developed a kind of theme that there are two things we would love students to take away with them from Münster: (1) Roots in terms of an excellent academic and practically relevant education and the being together at the IWM and (2) Wings in terms of free and critical thinking in an environment that allows making mistakes and where own creative ideas are more than welcome. This then hopefully leads to a long lasting relationship, true to the motto: "PhD Student for a few years, Alumnus for a life!"

Charlotte, thank you very, very much for the time together in Münster! We miss you!

Prof. Dr. Thorsten Wiesel

Münster / June 20, 2019

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List of Abbreviations

adj.	Adjusted
al.	Aliter
ANOVA	Analysis of variance
approx.	Approximately
b	Beta value (regression coefficient)
BIU	Bundesverband Interaktive Unterhaltungssoftware
CBC	Choice-Based Conjoint
CI	Condition Index
Coeff.	Coefficient
e.g.	Exempli gratia (for example)
F	F-value
GfK	Gesellschaft für Konsumforschung
GPA	Grade Point Average
HC	Heteroscedasticity-consistent
i.e.	Id est (that is to say)
IMI	Intrinisc Motivation Inventory
incl.	Including
INTUT	Internet tutorials
KMO	Kaiser-Meyer Olkin
LED	Light-emitting diode
LLCI	Lower Level Confidence Interval
max.	Maximum
min.	Minutes

n.s.	Not significant
OLS	Ordinary Least Squares
p	P-value
RBC	Rating-Based Conjoint
RCS	Restricted-Click-Stream
SE	Standard error
sig.	Significant
SJR	Scimago Journal Rank
SQL	Structured Query Language
ULCI	Upper Level Confidence Interval
VHB-JOURQUAL3	Verband der Hochschullehrer für Betriebswirtschaft (journal ranking)
VIF	Variance Inflation Factor

1 Introduction

The introduction of this thesis outlines the relevance of gamification for both research and practice. Moreover, the overall aim of the thesis is derived. The contribution to research and practice is discussed. The chapter ends with an overview of the structure of the thesis.

1.1 Relevance of Gamification

The popularity of computer and video games has rapidly grown over the last few years (Verband der Deutschen Games-Branche 2018). Nowadays, computer and video games are an essential part of individuals' daily lives for both children and adults (Entertainment Software Association 2017; Verband der Deutschen Games-Branche 2018). They represent a popular leisure entertainment throughout all social classes, independent of educational levels and income. Overall, 42% of the German population plays computer and video games at least occasionally (Bundesverband Interaktive Unterhaltungssoftware (BIU) 2017; Verband der Deutschen Games-Branche 2018). The average gamer is 36 years old (BIU 2017; Verband der Deutschen Games-Branche 2018). This contradicts the prejudice that computer and video games are exclusively the domain of children and young people. The preconception that solely men play computer and video games is also not tenable. Approximately half of the gaming population is female (Verband der Deutschen Games-Branche 2018).

Professionals in different industries have recognized this trend by using game elements such as awarding points, badges, and leaderboards to motivate user activity and retention (Deterding et al. 2011; Mekler et al. 2017). They try to apply the motivational potential of games to various non-gaming contexts in order to encourage user engagement (Deterding et al. 2011; Kankanhalli et al. 2012). This industry practice is known under the term *gamification*. The term gamification is often defined as the use of game elements in non-game contexts (Deterding et al. 2011). The idea of gamification is to use the power of games in order to support users in performing desired activities (e.g., studying and exercising) and achieving personal goals linked to these activities (Deterding et al. 2011; Kappen, Mirza-Babaei, and Nacke 2018; Tsay, Kofinas, and Luo

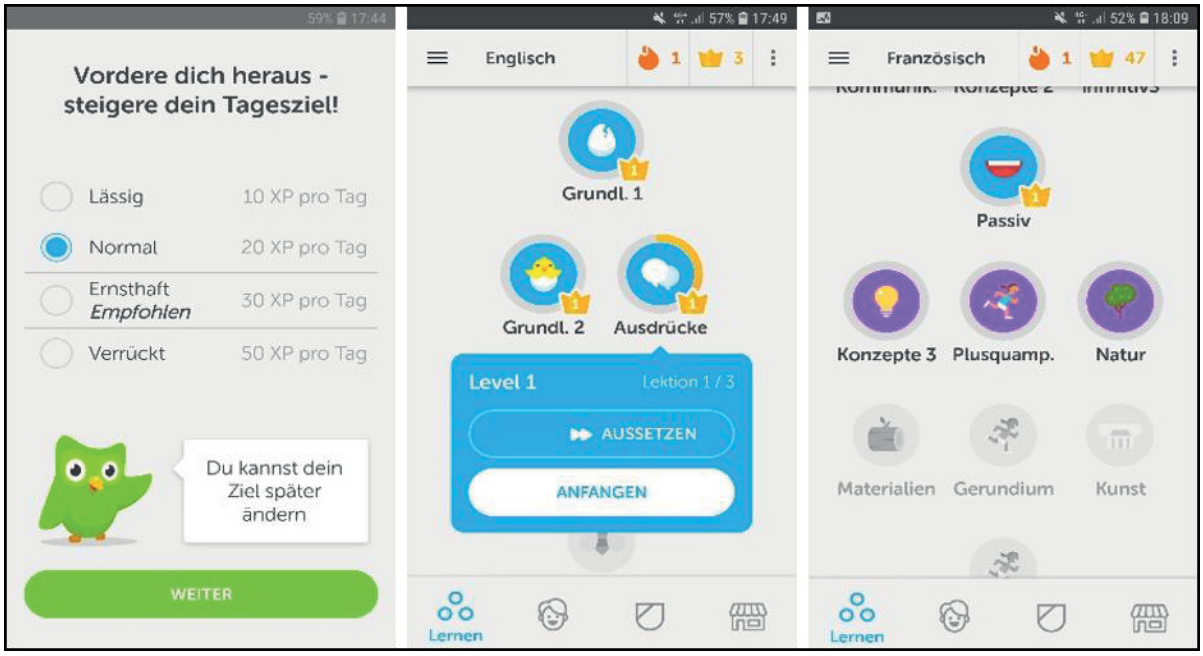
2018). User activities and retention are enhanced by implementing game elements (e.g., points, badges, and leaderboards) in order to evoke gameful experiences like competition and achievement (Deterding et al. 2011; Huotari and Hamari 2017; Seaborn and Fels 2015; Wolf, Weiger, and Hammerschmidt 2018).

Today, gamification can be considered to be an established practice and is predicted to achieve even greater importance over the next years (Markets and Markets 2016). Accordingly, gamification has been named one of the marketing trends of 2018 (Schmeling 2017). Gamification is supposed to capture individuals' attention as well as create and deepen the relationship between an individual and a company (Schmeling 2017). Technologies such as smartphones and wearables are important enablers of the increasing relevance of gamification as they can track and process every step of the individual. Thus, they can turn individuals' lives into a digital game (Deloitte 2018; Gesellschaft für Konsumforschung (GfK) 2017; Nacke and Deterding 2017). In parallel, post-material values such as self-expression and experience become more important for individuals (Deterding 2015; Inglehart 2008; Nacke and Deterding 2017).

So far, several companies have already implemented gamification to motivate their customers to continuously use their services and increase customers' retention. For instance, Nike uses gamification to transform endurance sport activities into a playful game for millions of users (Kuo 2015; Nike+ Run Club 2018). With the implementation of the social running application Nike+ users can compete with friends on a leaderboard, set personal goals, or earn achievement badges for the accomplishment of certain milestones (e.g., running three times in a week) (Google Play Store 2018a; Nike+ Run Club 2018).

With more than 100 million installations Duolingo represents a popular language learning application using gamification (Google Play Store 2018b). With the help of this application, individuals can learn a wide range of different languages (Duolingo 2018). Each language can be learned in a set of lessons addressing different topics. Individuals can earn both experience points and achievement badges by successfully completing lessons. Individuals can change the level of difficulty by setting daily goals (see Figure 1).

Figure 1: Sample screenshots of the Duolingo app



Source: Sample screenshots of Duolingo app (2018)[1].

Taken together, Nike and Duolingo attempt to motivate user activity and user retention. With the implementation of gamification, companies aim to bind their customers to the company in the long-term and increase the customer lifetime value.

The underlying psychological mechanisms that account for these outcomes can be explained using the motivation theory of Deci and Ryan (i.e., self-determination theory). Based on the self-determination theory, the implementation of game elements may enhance an individuals' competence and subsequently the enjoyment of actively participating in the service (e.g., Deci and Ryan 1985a, pp. 62-64; Intrinsic Motivation Inventory (IMI) 2018). Thus, game elements may increase individual's motivation to use the service. An increase in motivation may then result in enhanced customer retention.

While popular, companies face the challenge of assessing the effectiveness of gamification. First of all, they need to evaluate whether gamification represents an effective marketing tool at all. They have to analyze whether the implementation of gamification generates value to the customer. Besides the value to the customer, gamification has to generate value for the company such as higher retention rates and higher customer lifetime values. Second, it

[1] App was downloaded from the Google Play Store (Google Play Store 2018b).

is necessary for companies to assess what types of gamification are most effective in a specific context, for what type of customer, and why. The why implies knowledge about the underlying psychological mechanisms. If companies understand which game elements primarily evoke a specific kind of gameful experience in a specific context, they can implement game elements in a goal-oriented way (i.e., in order to increase user motivation and retention). If companies understand the underlying psychological mechanisms, they can easily implement new game elements and anticipate their effects.

Due to the fact that companies often use a set of different game elements, it is hard to disentangle the effects of gamification on customer motivation and retention. In sum, companies still lack a profound understanding of if, how, and under which conditions game elements are suitable and effective to implement in order to enable gameful experiences and subsequently motivate individuals to continuously participate and increase customer retention.

1.2 Aim of the Thesis

The discussion about gamification started as an industry-driven trend (Deterding et al. 2011; Nacke and Deterding 2017; Seaborn and Fels 2015). Academia has shown a great interest in the topic as well, resulting in an increasing number of research studies on gamification (Deterding et al. 2011; Nacke and Deterding 2017; Seaborn and Fels 2015). Today, gamification has exceeded the status of simply being the newest buzzword and is frequently represented at academic conferences and published in peer-reviewed papers (Hamari, Koivisto, and Sarsa 2014; Liu, Santhanam, and Webster 2017; Schlagenhaufer and Amberg 2015).

Gamification has already been empirically researched in several contexts such as physical exercise (e.g., Hamari and Koivisto 2015a; Suh, Wagner, and Liu 2015), education (e.g., Denny 2013; Hakulinen, Auvinen, and Korhonen 2013), crowdsourcing (e.g., Eickhoff et al. 2012; Feng et al. 2018), and market research (e.g., Guin et al. 2012; Harms et al. 2015). Throughout contexts, studies empirically investigating gamification demonstrate the potential to increase user activity. Gamification seems to influence behavioral outcome measures positively (Buckley and Doyle 2017).

The majority of empirical studies concentrates on direct effects of game elements on behavioral outcomes (e.g., Denny 2013; Thom, Millen, and DiMicco 2012). These studies do not aim to investigate the underlying psychological mechanisms that potentially account for these outcomes (Mekler et al. 2017). Previous research especially lacks a theoretical foundation to justify the motivational effect as the question of how gamification motivates individuals has not yet been sufficiently investigated (Sailer et al. 2017; Seaborn and Fels 2015). In order to both answer this question and develop gamification research, studies need to apply psychological theories of motivation (Sailer et al. 2017). Research has recently started to empirically investigate the underlying motivational mechanisms by using the self-determination theory (e.g., Hanus and Fox 2015; Mekler et al. 2017). Yet, studies that analyze both psychological mediators and behavioral outcomes are still scarce. More future research is needed to fill this research gap (Huotari and Hamari 2017; Nacke and Deterding 2017). Authors call for the investigation of these effects using long-term studies to extend the findings of short-term laboratory experiments (Nacke and Deterding 2017).

The treatment of gamification as a uniform concept represents an additional shortcoming (e.g., Fitz-Walter et al. 2017; Zainuddin 2018). Studies primarily investigate the effect of gamification as a whole, containing several game elements without focusing on the effects of specific game elements. In practice, there is a great diversity of designs and realizations of gamification environments (Sailer et al. 2017). Due to the fact that gamification can be applied in many forms and that game elements can be combined in various ways, it does not seem to be appropriate to examine the motivational impact of gamification as an overarching concept (Nacke and Deterding 2017; Sailer et al. 2017). Treating gamification as a uniform concept makes it difficult to disentangle how and to what extent each game element influences individuals' motivation and behavior (Mekler et al. 2017; Seaborn and Fels 2015). This leads to the question of which game element is more effective (Kankanhalli et al. 2012).

Especially the comparison of effects of game elements as well as an investigation of the effects of game elements beyond badges, leaderboards, and points provide a promising opportunity to enrich current research (Nacke and Deterding 2017; Seaborn and Fels 2015). Consequently, there is a research gap regarding the effects of specific game elements on both psychological and behavioral outcomes.

The influence of individual characteristics represents a further shortcoming in gamification research (Kankanhalli et al. 2012). The majority of current research assumes homogenous effects of gamification on behavior across individuals. These studies do not consider individual characteristics (e.g., Eickhoff et al. 2012; Thom, Millen, and DiMicco 2012). However, the same game element may be experienced differently by different individuals (Bui, Veit, and Webster 2015). For instance, women perceive competitive elements in games to be less appealing than men do (Hartmann and Klimmt 2006; Lucas and Sherry 2004). But also other individual characteristics may influence the effectiveness of gamification (Bui, Veit, and Webster 2015). These observations highlight the importance of integrating potential moderating individual characteristics into gamification studies. Existing studies underline the importance of investigating individual characteristics without explicitly examining them (e.g., Hanus and Fox 2015; Wolf, Weiger, and Hammerschmidt 2018).

In order to address the aforementioned research gaps the overall aim of the thesis is to *investigate the effectiveness of gamification on psychological and behavioral outcomes and the moderating effect of individual characteristics.*

More precisely, the thesis examines the effects of different game elements on (i) individuals' motivation of active participation moderated by individual characteristics and subsequently (ii) the short-term as well as long-term behavioral outcomes in two studies.

The contribution to research is threefold. First, the thesis contributes to current research by investigating the effectiveness of specific game elements (instead of a general concept of gamification) in two studies. The first study compares the effectiveness of established game elements (i.e., points, badges, and leaderboards) in the context of higher education. The second study extends the scope of previously examined game elements by investigating the effects using

a memory-type game in market research. The insights resulting from the application of the self-determination theory represent a second contribution. Based on this theoretical foundation, the examination of the effects of gamification on psychological outcomes enriches current research. Insights into short- as well as long-term effects of gamification on mediating psychological and behavioral outcomes are provided. Third, the thesis enriches existing research by investigating the moderating influence of individual characteristics in both studies. Due to the lack of studies considering the moderating effect of individual characteristics, characteristics are chosen that are most suitable in the corresponding context.

Besides a theoretical contribution, the thesis also provides insights for managers concerning the effectiveness of gamification. Based on the results, implications with respect to an effective implementation of specific game elements are derived. Designers benefit from a better understanding of the underlying psychological mechanisms. They receive more detailed information about if, how, and under what circumstances specific game elements increase user motivation. By ameliorating the evocation of gameful experiences through these specific game elements, the quantity and quality of continuous participation may be enhanced. An increased user motivation to continuously and actively participate may result in a solid foundation of a long-term relationship between customer and company and increase the customer lifetime value. In contrast to cost-intensive implementations of full-fledged games, the integration of specific game elements evoking gameful experiences may re-present a more efficient alternative. The investigation of individual characteristics provides companies with insights into how to better target their customer segments with design initiatives.

The thesis provides insights into two different contexts: education and market research.[2] These contexts are suitable because both face motivational problems and gamification may help to increase individuals' motivation for continuous participation. In education, students may often be demotivated and lectures do not represent an engaging learning atmosphere. A lot of students perceive traditional education as boring and ineffective (Attali and Arieli-

[2] A detailed derivation of the relevance of each context is provided at the beginning of the corresponding chapter (i.e., chapter 4 and chapter 5).

Attali 2015; De-Marcos et al. 2014; Mann 2009; McGonigal 2012, pp. 159, 166, 170, and 171). The introduction of game elements enabling gameful experiences in education can make learning activities more pleasant (Attali and Arieli-Attali 2015; McGonigal, 2012, pp. 159, 166, 170, and 171). Apart from a substantial body of knowledge on gamified learning, empirical studies about the effects of gamification on student motivation and performance are still scarce (Barata et al. 2017). In the literature, there is a widespread call for further empirical research implementing game elements in the learning environment (Attali and Arieli-Attali 2015; Buckley and Doyle 2017; Dicheva et al. 2015).

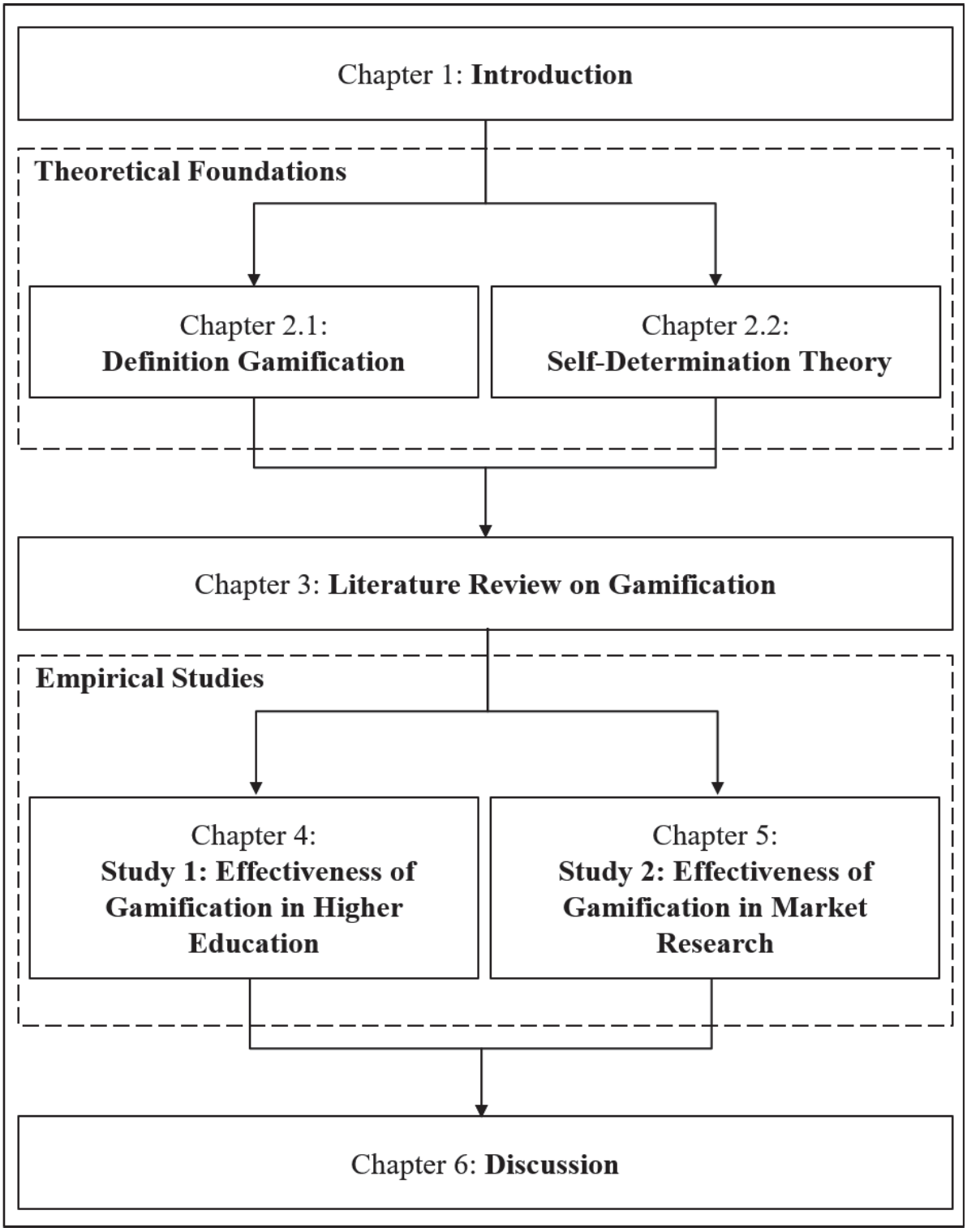
Market research represents a second context that faces motivational problems. Companies conducting market research are confronted with negative respondent behavior such as speeding, random responding, high break-off rates, and lack of attention in market research studies (Guin et al. 2012; Harms et al. 2015). This negative respondent behavior may occur because market research participants perceive a high amount of effort responding to questions as well as a high amount of emotional and cognitive load related to the responses (Bradburn 1978; Sharp and Frankel 1983). The implementation of gamification may help companies to provide participants with a more engaging, relevant, involving, rewarding, and consequently, a more positive survey experience (Harms et al. 2015; Schacht et al. 2017). However, research is still scarce. Besides a few studies, current research neglects the empirical investigation of gamification in market research beyond the interpretation of descriptive statistics (Keusch and Zhang 2017). There is a need to investigate the influence of single game elements on psychological and behavioral outcomes in market research.

Taken together, investigating the effectiveness of gamification on psychological and behavioral outcomes moderated by individual characteristics in two contexts provides insights from different perspectives.

1.3 Structure of the Thesis

Figure 2 illustrates the structure of the thesis. *Chapter 1* provides an introduction to the general topic of the thesis highlighting the relevance of the topic.

Figure 2: Structure of the thesis



Source: Author's own illustration.

Chapter 2 describes the theoretical foundations of the thesis. In section 2.1, the term gamification is defined. Section 2.2 encompasses a description of the self-determination theory. Subsequently, in *Chapter 3*, an extensive literature review about gamification is provided and an evaluation of prior research in the field of interest is conducted. The search strategy and concept matrix are described in section 3.1. Research on gamification can be divided into two different streams: studies using gamification as a uniform concept (section 3.2) and studies focusing on single game elements (section 3.3). Both research streams are reviewed and gaps in existing studies are highlighted.

Chapter 4 describes the conceptual framework, design, and results of the first empirical study that investigates the effectiveness of gamification in higher education. *Chapter 5* describes the conceptual framework, design, and results of the second empirical study that investigates the effectiveness of gamification in market research studies. Finally, *Chapter* 6 provides a discussion of the key findings from both studies. Moreover, theoretical and managerial implications are derived. Besides limitations of the thesis, potential areas for future research are pointed out.

2 Theoretical Foundations

This chapter provides the theoretical underpinnings of the thesis. In section 2.1, a definition of the term gamification is derived. In section 2.2, the self-determination theory is described.

2.1 Gamification

Most studies related to gamification use one of the three definitions provided in Table 1.

Table 1: Overview of most popular gamification definitions

Author(s)	Definition	Citations*
Deterding et al. (2011)	"Gamification as the use of game design elements in non-game contexts." (p. 9)	4,268
Huotari and Hamari (2012, 2017)**	Gamification refers to a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation." (2012, p. 19, 2017, p. 25)	1,018
Werbach (2014)	"Gamification should be understood as a process. Specifically, it is the process of making activities more game-like." (p. 266)	111

* Based on Google Scholar (last update: November 20, 2018).
** The authors first established the definition in 2012 and slightly revised it in 2017.

Source: Author's own illustration.

The authors of these definitions share the view that gamification is related to non-game contexts. However, to some extent, the authors differ in their perspective on how gamification can be implemented. Deterding et al. (2011) focus on employing game design elements. Game design elements are characteristic for games, i.e., elements that are part of most but not necessarily of all games that can be associated with games, and have a significant role in gameplay (Deterding et al. 2011). Examples for game design elements are leaderboards and badges. Instead, the definitions of Werbach (2014) and Huotari and Hamari (2012, 2017) do not focus on game design elements. They rather refer to affordances. Affordances are not only game design elements but can

be any stimuli that evoke gameful experiences (Huotari and Hamari 2012, 2017; Werbach 2014). However, the authors are not explicit what affordances other than game design elements can be implemented. Therefore, this thesis follows Deterding et al. (2011) and considers only game design elements as affordances (in the following: *game elements*).[3]

Huotari and Hamari (2012, 2017) further mention that gamification evokes gameful experiences. According to Wolf, Weiger, and Hammerschmidt (2018), gameful experiences can be classified into four types (see Table 2): skill development, social connectedness, expressive freedom, and social comparison.

Table 2: Classification of gameful experiences

Gameful experience	Description
Skill development	Experience of reaching own goals, being claimed by a task and advancing own capabilities
Social connectedness	Experience of interacting with one another and working together on tasks within the service community
Expressive freedom	Experience of the possibility to act on their free will or to realize their individual personalities
Social comparison	Experience of rivaling with other users when performing an activity supported by a digital service

Source: Author's own illustration adapted from Wolf, Weiger, and Hammerschmidt (2018).

These gameful experiences help users to fulfill motivational needs which in turn create value for them (Huotari and Hamari 2012, 2017). Thus, gamification not only serves the purpose of making an activity more game-like but also to impact users' psychological states and ultimately behaviors (Hamari 2013; Huotari and Hamari 2012; Jung, Schneider, and Valacich 2010; Zhang 2008).

[3] Studies investigating gamification use different terms such as game mechanics (e.g., Wolf, Weiger, and Hammerschmidt 2018), game (design) elements (e.g., Sailer et al. 2017) or motivational affordances (e.g., Hamari, Koivisto, and Sarsa 2014). In the following, the thesis does not differentiate between the terms and follows Eppmann, Bekk, and Klein (2018) who use the term game elements and describe them as affordances for gameful experiences.

This aspect is important since it highlights that gamification should not only provide value to the users but also to the firm or organization that implements gamification by influencing users' behavior.

Based on these considerations, this thesis uses the following definition of gamification:

Gamification refers to a process of using game elements in non-game contexts to support gameful experiences in order to encourage individuals' motivation and behavior.

2.2 Self-Determination Theory

The self-determination theory serves as a macro theory for human motivation and comprises several mini-theories.[4] Each mini-theory arose from field and laboratory research and explains a set of motivationally based phenomena (Self-Determination Theory 2018).

The concept of motivation plays a central role in this thesis as gamification aims to influence users' motivation towards several activities (Hamari 2017; Hamari and Koivisto 2015a; b). The self-determination theory seems especially suitable because it provides an understanding of motivation and behavioral change encompassing the psychological process operating within the individual (Ryan and Deci 2017, pp. 7-8). Moreover, the self-determination theory represents one of the most established theoretical foundations in gamification research (Mekler et al. 2017; Seaborn and Fels 2015).

In the following, the different constructs and the basic idea of self-determination theory are explained first. Subsequently, the mini-theories are described by emphasizing the specific relationships among the constructs they focus on.

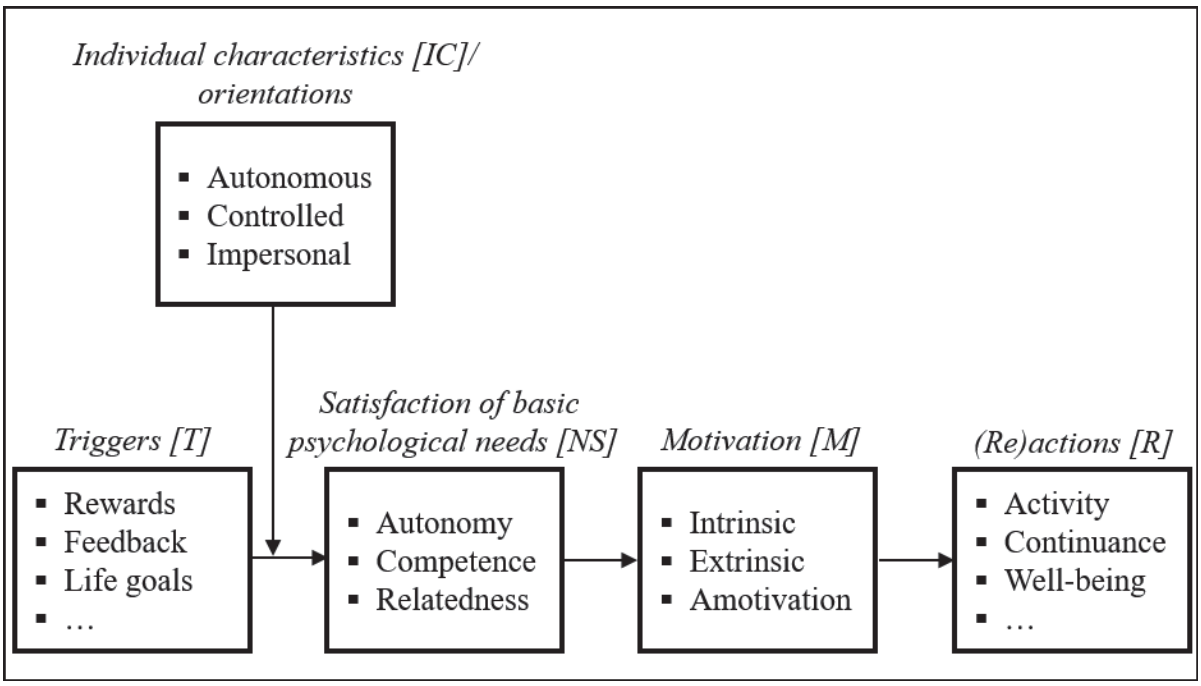
2.2.1 Basic Idea of Self-Determination Theory

The self-determination theory is an empirically based psychological theory developed by Deci and Ryan in the 1970s (Vansteenkiste, Niemiec, and Soenens 2010, p. 105). The self-determination theory particularly considers how *trig-*

[4] Ryan and Deci use the term mini-theories in their publications (e.g., Ryan and Deci 2017).

gers (e.g., rewards and feedback) facilitate or undermine an individual's *motivation* through satisfying the *basic psychological needs* for autonomy, competence, and relatedness (see Figure 3; Ryan and Deci 2017, p. 3 and p. 7). Researchers empirically investigated the self-determination theory within different domains and various contexts for more than 40 years (Deci, Koestner, and Ryan 1999; Lepper, Greene, and Nisbett 1973; Ryan and Deci 2017, p. 3; Vansteenkiste, Niemiec, and Soenens 2010, p. 105).

Figure 3: Outline of self-determination theory



Source: Author's own illustration.

Triggers (T)

Triggers can be, among others, rewards, feedback, as well as intrinsic and extrinsic life goals (e.g., wealth and personal goals) (Ryan and Deci 2017, p. 123 and p. 272). As such, game elements can also serve as triggers. Generally, triggers can be perceived as being either controlling or supportive by the individual. For instance, positive and informational feedback is perceived as supportive and enhances the satisfaction of the basic psychological needs. Instead, triggers that are perceived as controlling such as the avoidance of punishment undermine the satisfaction of the basic psychological needs (Ryan and Deci 2000a; b; Ryan and Deci 2017, p. 247).

Basic psychological needs (NS)

The self-determination theory differentiates between three basic psychological needs: *autonomy*, *competence*, and *relatedness* (Ryan and Deci 2017, p. 3).

The need for *autonomy* implies the perceptions of willingness and volition while accomplishing a certain action. Individuals make decisions based on their own merits, interests, and goals without external constraints (Gagné and Deci 2005). A feeling of autonomy includes both perceived decision freedom and meaningfulness of the given activity. The former entails having the choice between different actions. The latter presumes the action to be consistent with individuals' goals and merits (Sailer et al. 2017). Individuals perform an action because it is in line with their own interests. They act in a self-determined manner (Gagné and Deci 2005; Ryan and Deci 2000b). Individuals can agree with certain constraints and act accordingly, while still feeling autonomous. For instance, individuals perceive a traffic light as restricting. However, if they perceive that traffic laws are useful and legitimate for assuring their own safety, they might agree to stop for the light without a loss of autonomy (Dworkin 1988, pp. 14-15; Ryan and Deci 2017, p. 55). Triggers that enhance the feeling of autonomy imply for example the affordance of choice and the encouragement of self-regulation (Ryan and Deci 2017, p. 12; Zuckerman et al. 1978).

The perception of *competence* includes an individual's feeling of efficiency, success, and a need for challenges while consciously interacting with the environment (Deci and Ryan 1985a, p. 58; Ryan and Deci 2000a; b; White 1959). Individuals experience their actions as being self-organized or initiated. They have a feeling of ownership of their actions (Deci and Ryan 1985a, pp. 58-59; Fisher 1978; Ryan and Deci 2017, p. 95). Triggers such as direct and positive (i.e., informational) feedback are supposed to promote the perception of competence (Deci, Koestner, and Ryan 1999).

The need for *relatedness* encompasses a feeling of belonging and connectedness to other individuals (Baumeister and Leary 1995; Ryan and Deci 2017, p. 96). Individuals strive for experiencing mutual care and feeling significant among others (Baumeister and Leary 1995; Ryan and Deci 2000b; Ryan and Deci 2017, p. 11; Vansteenkiste, Niemiec, and Soenens 2010, p. 120). Most typically, individuals have a sense of relatedness when they feel cared for by others (Ryan and Deci 2017, p. 11).

Summarizing, autonomy has a specific status as a need. Autonomy actualizes the needs for competence and relatedness by initiating and regulating behavior through which these needs are easier to realize. For instance, there is an increase in full satisfaction of competence when autonomy is collaterally satisfied (Ryan and Deci 2017, p. 97 and p. 250). The satisfaction of the basic psychological needs has an influence on motivation (Deci and Ryan 1985a, pp. 62-63).

Individual characteristics (IC) / orientations

Moreover, the relationship between triggers and basic psychological need satisfaction is moderated by individual characteristics (IC) and orientations (e.g., autonomous, controlled, and impersonal causality orientations) (Ryan and Deci 2017, pp. 219-221 and p. 225).

Motivation (M)

The self-determination theory distinguishes between situations in which individuals are motivated for a certain action and those in which a lack of motivation exists. More precisely, it distinguishes between *motivation* and *amotivation* (Gagné and Deci 2005; Vansteenkiste, Niemiec, and Soenens 2010, p. 115 and p. 118). Motivation can be differentiated between *intrinsic* and *extrinsic motivation* (Ryan and Deci 2000a). The term intrinsic motivation refers to “the doing of an activity for its inherent satisfaction rather than for some separable consequences” (Ryan and Deci 2000a, p. 56). Individuals are intrinsically motivated if they perform a certain action out of interest. Intrinsic motivation comprises the inherent tendency of individuals to learn, improve their skills and capabilities, overcome challenges, and experience new stimuli (Ryan and Deci 2000a; b). Intrinsic motivation can be seen as a prototype of self-determination as individuals act highly autonomous (Ryan and Deci 2000b).

Besides intrinsic motivation, extrinsic motivation implies activities that individuals execute with the goal of obtaining separable outcomes that serve as triggers of their actions. Triggers can be rewards in form of money, social approval, or avoidance of punishment (Deci, Koestner, and Ryan 1999; Ryan and Deci 2000a). There are several different forms of extrinsic motivation[5] that vary in the extent of self-determination, thus the degree to which individuals are able to act autonomously (Ryan and Deci 2000b). An individual participating in a certain task in order to avoid punishment best represents an example of an extrinsically motivated individual. On the contrary, intrinsic motivation illustrates an individual participating in a task because (s)he perceives the activity (i.e., sport and learning) itself as being inherently interesting and enjoyable (Deci, Koestner, and Ryan 2001; Ryan and Deci 2000a; b). Intrinsic and types of extrinsic motivations can often influence individuals' actions simultaneously (Ryan and Deci 2017, p. 16). Both types of motivation represent intentional or personally caused actions (Ryan and Deci 2000a; Ryan and Deci 2017, p. 16). Thus, individuals have an internal locus of control (Ryan and Deci 2017, p. 226).

In contrast to motivation, *amotivation* implies a concept wherein an individual has neither the intention nor the motivation to execute a particular action. Individuals act without a purpose or in a passive and ineffective way (Deci and Ryan 1985a, p. 150; Pelletier et al. 1999; Ryan and Deci 2017, p. 190). Amotivation can be differentiated into three forms. The first form is based on a lack of competence and control. Individuals do not act because they feel unable to effectively achieve a particular outcome. Subsequently, they feel helpless or perceive that they cannot effectively attain the required outcome. A second form of amotivation implies a lack of interest, relevance, or value. Individuals experience an action as meaningless, especially when it is not aligned with the fulfillment of needs. This type of amotivation can be present, even though individuals have the efficacy and competence to attain a particular outcome. The third form contains defiance or resistance to influence (Deci and Ryan 1985a, p. 150; Ryan 1995; Ryan and Deci 2017, p. 16; Petegem et al. 2015). In sum, amotivation is linked to an external locus of control.

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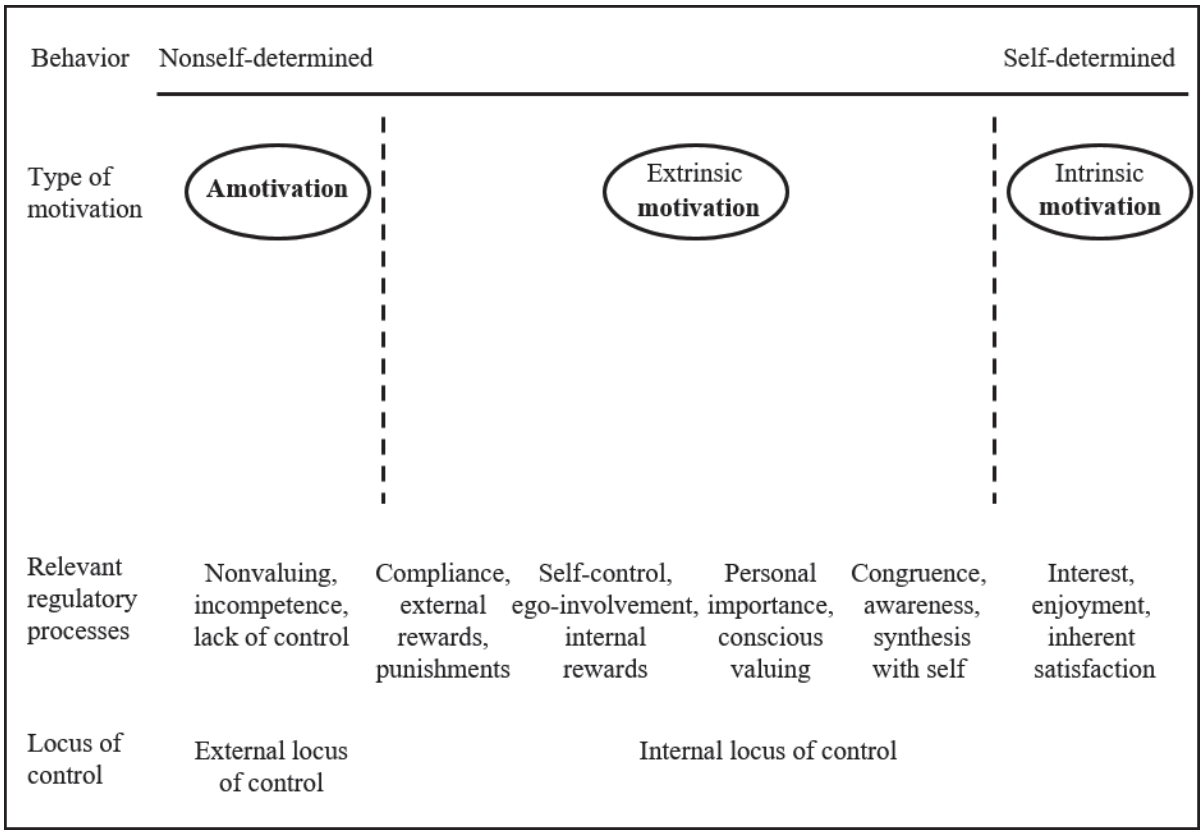
[5] The different types of extrinsic motivation are discussed in more detail in section 2.2.3.

This means that actions and outcomes are independent of one another and thus, individuals are unable to attain a desired outcome (Deci and Ryan 1985a, pp. 159-160; Ryan and Deci 2017, pp. 225-226).

Taken together, motivation does not represent a unitary phenomenon. Instead of a dichotomous concept, the self-determination theory conceptualizes the three different types of motivation as a self-determination continuum bounded by amotivation and intrinsic motivation with extrinsic motivation situated between amotivation and intrinsic motivation (see Figure 4).

Figure 4: Types of motivation



Source: Author's own illustration, adapted from Ryan and Deci (2000b).

(Re)actions (R)

Finally, the different forms of motivation affect individuals (re)actions differently. (Re)actions vary from specific outcomes such as learning performance or continued participation in an action to a more general (re)action such as individual's perceived well-being (e.g., Benware and Deci 1984; Ryan, Rigby, and Przybylski 2006; Sheldon 2014).

While Figure 3 illustrates the self-determination theory as a unified framework, the theory actually consists of six mini-theories which focus on specific relationships among the different constructs. Table 3 describes the different mini-theories and the relationships they examine. Whereas the *cognitive evaluation theory* and the *organismic integration theory* focus on triggers that influence intrinsic motivation as well as the internalization of extrinsic motivation, the *causality orientations theory* concentrates on individual differences in motivational styles (Ryan and Deci 2017, p. 216). The *basic psychological needs theory* and *goal contents theory* deal with the relationship between basic psychological need satisfaction and triggers (i.e., extrinsic and intrinsic life goals) on well-being (Ryan and Deci 2017, p. 239 and p. 272). The *relationships motivation theory* focuses on the triggers of close relationships and their resulting actions (Ryan and Deci 2017, p. 293).

Table 3: Overview of motivational focus of mini-theories

Mini-Theory	Motivational focus
(1) Cognitive Evaluation Theory T ⟶ NS ⟶ M	Effect of triggers (e.g., rewards and feedback) on **intrinsic motivation** mediated by satisfaction of basic psychological needs.
(2) Organismic Integration Theory T ⟶ NS ⟶ M ⟶ R	Effect of triggers on **extrinsic motivation** (i.e., external, introjected, identified, and integrated) mediated by satisfaction of basic psychological needs and the effects of extrinsic motivation on (re)actions.
(3) Causality Orientations Theory IC ↓ T ⟶ NS	Effect of individual characteristics (e.g., **autonomous, controlled, and impersonal causality orientations**) on the relationship of triggers on satisfaction of basic psychological needs.
(4) Basic Psychological Needs Theory NS ⟶ R	Effects of **basic psychological need** satisfactions and frustrations on (re)actions such as well-being.
(5) Goal Contents Theory T ⟶ NS ⟶ R	Effects of triggers (i.e., **extrinsic and intrinsic life goals**) on (re)actions such as well-being mediated by satisfaction of basic psychological needs.
(6) Relationships Motivation Theory T ⟶ NS ⟶ R	Effect of triggers (i.e., **close relationships**) on re(actions) mediated by satisfaction of basic psychological needs.

T = Triggers
IC = Individual characteristics / orientations
NS = Satisfaction of basic psychological needs
M = Motivations
R = (Re)actions

Source: Author's own illustration.

In the following, mini-theories (1) to (4) are described in detail. The mini-theories (5) and (6) are not further discussed because the aim of the thesis is not related to the investigation of life goals or close relationships.

2.2.2 Cognitive Evaluation Theory

The cognitive evaluation theory focuses on the following process chain:

Triggers → *Satisfaction of basic psychological needs* → *Motivation*

The focus of this theory lies on intrinsic motivation. The main concern is how triggers facilitate or undermine intrinsic motivation (Deci and Ryan 1985a, pp. 62-63; Ryan and Deci 2017, pp. 123-124). The theory focuses on the mediating role of the basic psychological needs for competence and autonomy (Ryan and Deci 2000a; b).

In general, triggers that have a negative effect on an individual's perception of autonomy or competence will subsequently decrease intrinsic motivation. Triggers that support the feeling of autonomy and competence lead to an increase in intrinsic motivation (Deci and Ryan 1985a, pp. 62-63). The effect of triggers such as rewards is dependent on the meaning or interpretation of the recipient. Each trigger has a particular functional significance (Deci and Ryan 1985a, pp. 63-64). This functional significance can be informational such as facilitating a feeling of autonomy and competence or it can be controlling, i.e., the trigger is perceived as externally pressuring toward a specific outcome (Deci 1975, pp. 142-144; Ryan 1982; Ryan and Deci 2017, p. 130). For instance, incentives such as financial rewards or deadlines might diminish intrinsic motivation since they might cause a shift from internal reasons to act to external pressures. The enjoyment of doing the task might be reduced when rewards evoke the feeling of being controlled and the need for autonomy is thwarted (Deci 1971; Garaus, Furtmüller, and Güttel 2016; Ryan and Deci 2000a; b). Contrarily, when a reward is experienced as informational feedback and as competence supporting, intrinsic motivation might increase even in the presence of extrinsic factors. This effect will only take place if individuals have the perception of being self-determined, i.e., of behaving in an autonomous way (Cerasoli, Nicklin, and Ford 2014; Deci 1975, p. 142; Gagné and Deci 2005; Ryan and Deci 2000a; b).

In sum, the need for autonomy and competence are invariably important in maintaining intrinsic motivation for a certain activity (Ryan and Deci 2017, p. 119). The need for relatedness also plays a role in conducing intrinsic motivation in specific situations (Ryan and Deci 2017, p. 124). Research states that for activities without a social element, it might be less important for facilitating intrinsic motivation compared to autonomy and competence (Deci and Ryan 2000; Ryan and Deci 2017, p. 124).

2.2.3 Organismic Integration Theory

The organismic integration theory concerns the following process chain:

Triggers → *Satisfaction of basic psychological needs* → *Motivation* → *(Re)cations*

While the cognitive evaluation theory concentrates on intrinsic motivation, the organismic integration theory addresses several forms of extrinsic motivation (Ryan and Deci 2000a; b; Ryan and Deci 2002, p. 17). The four forms of extrinsic motivation (i.e., external regulation, introjected regulation, identified regulation, and integrated regulation) can be arranged on a continuum of internalization (Self-Determination Theory 2018) (see Figure 5). A support of the basic psychological needs facilitates internalization, while need thwarting inhibits internalization (Gagné and Deci 2005; Ryan and Deci 2000b; Ryan and Deci 2017, p. 179).

External regulation is the prototype of extrinsic motivation (Gagné and Deci 2005; Ryan and Deci 2000a). This form reflects an action that is solely motivated by an external contingency like a reward or punishment avoidance (Ryan and Deci 2017, p. 184). For instance, an individual is doing his/her homework in order to avoid punishment from his/her parents.

Introjected regulation is based on internal controls like affective or self-esteem contingencies (Ryan and Deci 2000b; Ryan and Deci 2017, p. 185 and p. 191). Individuals perform a certain action primarily to avoid guilt and shame or to reach ego enhancements and feelings of worth (Ryan and Deci 2002, p. 17). Accordingly, an individual acts in an introjected way when (s)he is doing his/her homework because (s)he feels bad about himself/herself if (s)he does not.

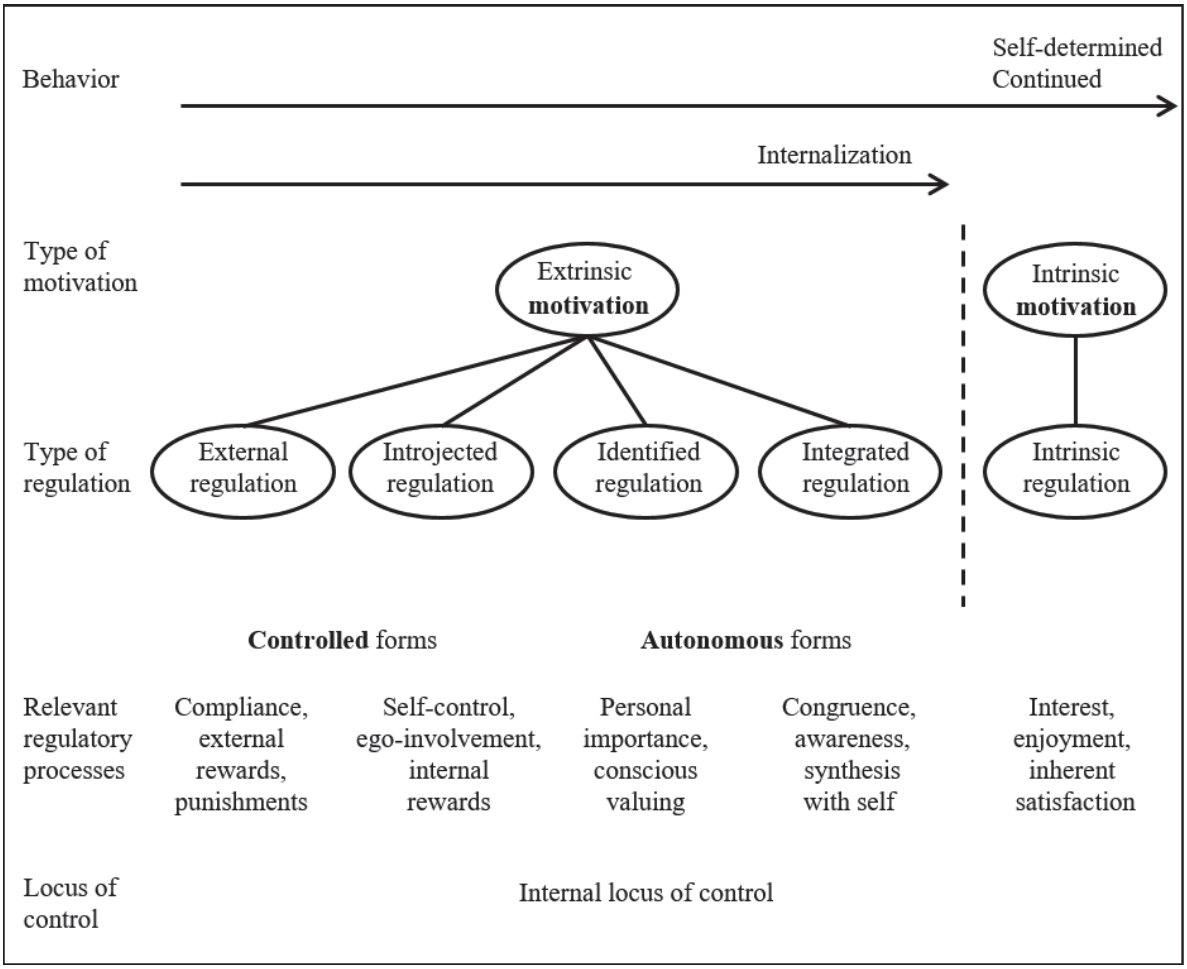
The concept of identification entails the acceptance of a behavior's value as being consistent with one's own personal identity and values (Gagné and Deci 2005; Ryan and Deci 2000a). Individuals identify themselves with the value and importance of an action. Thus, it is personally important to them (Gagné and Deci 2005; Ryan and Deci 2002, p. 17; Ryan and Deci 2017, p. 187). For instance, the individual is doing his/her homework because (s)he wants to understand the subject.

The fullest form of internalization represents integrated regulation (Ryan and Deci 2002, p. 17). An individual perceives the action as an integral part of who (s)he is. (S)he integrates value or regulation in coherence with other aspects of himself/herself (Gagné and Deci 2005; Ryan and Deci 2017, p. 188). For instance, an individual is doing his/her homework not solely because (s)he identifies with the importance of doing homework but also to appreciate the importance of doing uninteresting activities.

Integrated regulation is similar to intrinsic motivation (Ryan and Deci 2002, p. 17). Actions are still classified as extrinsically motivated because they are done in order to achieve a separable outcome (Ryan and Deci 2000b).

Taken together, internalization of extrinsic motivation is a continuum that ranges from mainly heteronomous or controlled regulation to relatively autonomous self-regulation, representing an order in their degree of autonomy (Ryan and Connell 1989; Ryan and Deci 2017, p. 15 and p. 191). External and introjected regulation represent controlled forms of regulation. Extrinsically motivated behavior that is personally valued or important represents autonomous forms of regulation (Ryan and Deci 2017, pp. 14-15). Internalized and integrated regulation indicate highly autonomous or self-determined forms of behavior (Gagné and Deci 2005; Ryan and Deci 2000a; Ryan and Deci 2017, p. 198).

Figure 5: Continuum of extrinsic motivation



Source: Author's own illustration, adapted from Ryan and Deci (2000b).

Besides the degree of autonomy, the forms of extrinsic motivation vary in the degree of continuance of behavior, i.e., external regulation represents the least persistent while integrated regulation demonstrates the most persistent form of extrinsic motivation (Ryan and Deci 2000a; b; Ryan and Deci 2002, p. 17; Ryan and Deci 2017, p. 185, pp. 188-189). Rewards and punishments can control individuals' actions in the short-term. The outcome of integration is highly stable and a mature type of self-regulation (Deci and Ryan 2008; Ryan and Deci 2017, p. 184 and p. 189).

The internalization of extrinsic motivation can be facilitated by supporting the satisfaction of the basic psychological needs for competence, autonomy, and relatedness (Gagné and Deci 2005; Ryan and Deci 2017, pp. 179, 214, and 239). All types of intentional regulation (autonomous or controlled) require at least a minimum of competence (Ryan and Deci 2017, p. 203). Introjected

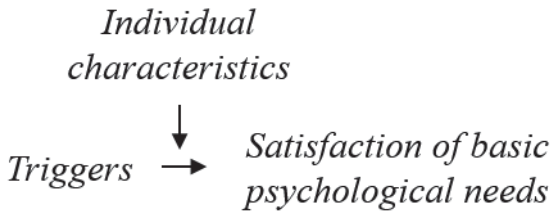
regulation depends on some basic support from both competence and relatedness while autonomy-supporting factors are crucial to facilitate identification and integration (Gagné and Deci 2005; Ryan and Deci 2017, p. 203).

Regarding the consequences of internalization, it can be stated that when individuals' behavior is regulated through more autonomous forms of internalization, they will show greater continuance, a higher quality of behavior, and more effective performance. In addition, the individuals will gain more positive experiences and greater psychological health and well-being (Ryan and Deci 2017, p. 208).

Summarizing the above, the four different forms of extrinsic motivation vary in the degree of autonomy and continuance of behavior. A support of the basic psychological needs facilitates internalization, while need thwarting inhibits internalization (Gagné and Deci 2005; Ryan and Deci 2000b; Ryan and Deci 2017, p. 179).

2.2.4 Causality Orientations Theory

The cognitive evaluation theory and the organismic integration theory focus on triggers that influence intrinsic motivation as well as the internalization of extrinsic motivation. The causality orientations theory concentrates on individual differences in motivational styles, thus focusing on the following process chain:



The main individual characteristics are autonomous (i.e., acting out of interest), controlled (i.e., focus on rewards), and impersonal causality orientations (i.e., anxiety concerning competence) (Ryan and Deci 2017, p. 216; Self-Determination Theory 2018).

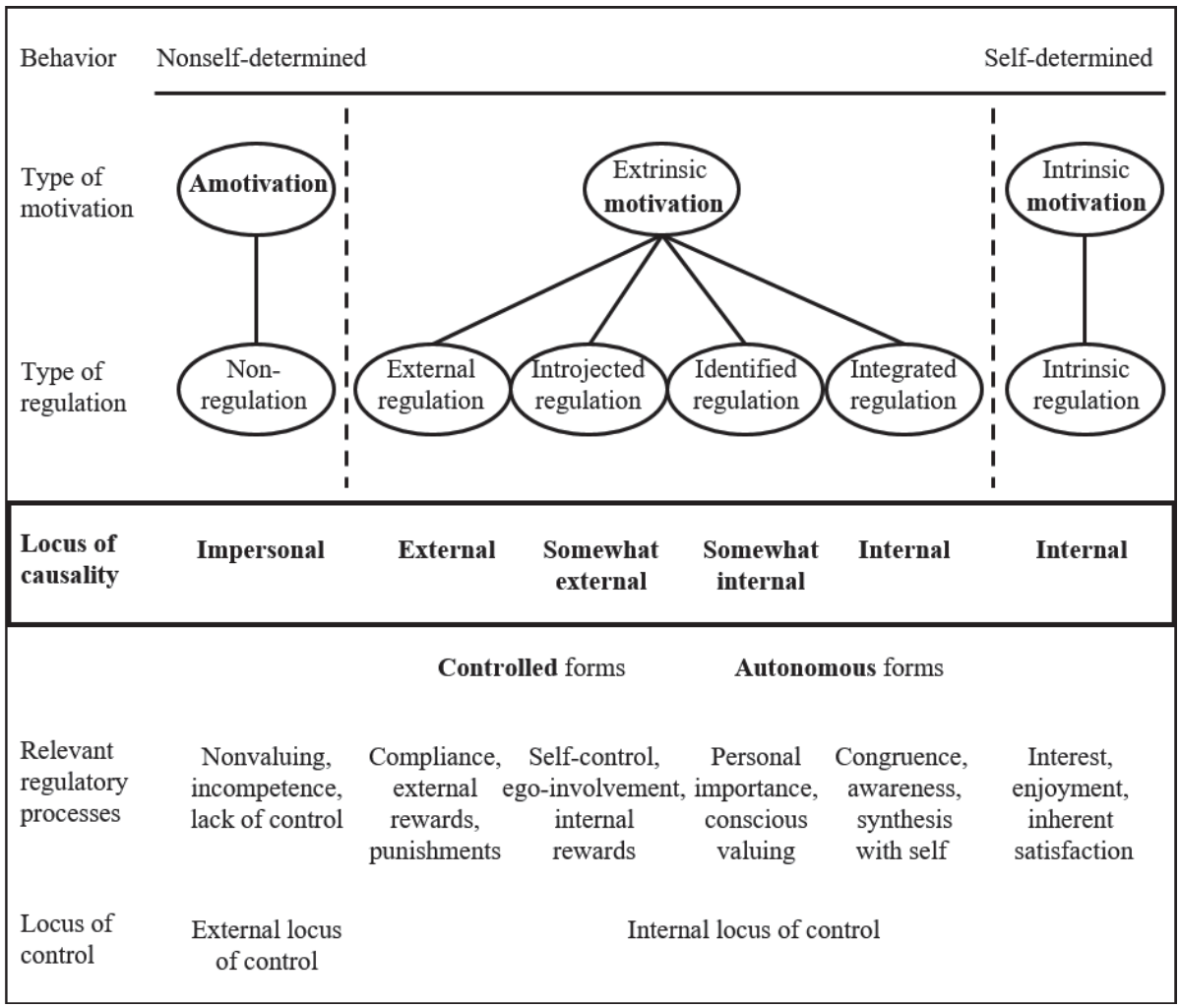
Based on the theory, individuals differ with regard to the relative strengths of these orientations, as they inherently possess some degree of each orientation (Deci and Ryan 1985a, p. 153; Ryan and Deci 2017, p. 218).

On the one hand, individuals with a high autonomy orientation tend to attribute informational significance to triggers. They recognize possibilities of choice and self-determination with regard to their activities (Ryan and Deci 2017, p. 216). Autonomy-oriented individuals have an internal perceived locus of causality. This means that individuals consider themselves as being the initiators of actions and perceive a sense of volition and endorsement (Deci and Ryan 1985a, p. 153; Ryan and Deci 2017, p. 226). This orientation mitigates the negative effect of external rewards. Individuals with a high level of autonomy orientation do not show a decrease in intrinsic motivation after receiving a controlled contingent reward (Hagger and Chatzisarantis 2011; Ryan and Deci 2017, p. 218). Autonomy-oriented individuals likely use the identified and integrated style of regulation and have a high level of intrinsic motivation (Ryan and Deci 2017, p. 217) (see Figure 6).

On the other hand, other individuals are more control-oriented. Their behavior is initiated primarily by triggers such as rewards and social pressures that are experienced as controlling (Deci and Ryan 1985a, p. 153; Ryan and Deci 2017, pp. 216-217). Individuals do not perceive a real sense of choice and experience an external locus of causality (Deci and Ryan 1985a, p. 157; Ryan and Deci 2017, pp. 216-217 and p. 226). Individuals with a high degree of control orientation are more likely to use the external and introjected styles of regulation, including a low level of intrinsic motivation (see Figure 6). They worry about what others might think and/or about external judgments or contingencies that might attend their activities (Ryan and Deci 2017, p. 217).

Individuals with an impersonal orientation perceive their environment as uncontrollable or amotivating (Deci and Ryan 1985a, p. 159; Ryan and Deci 2017, p. 216). Impersonal orientation represents the degree to which indivi-duals have an orientation towards barriers of goal attainment, experience of anxiety, and incompetence (Deci and Ryan 1985a, p. 159; Ryan and Deci 2017, p. 218).

Figure 6: Causality orientation



Source: Author's own illustration, adapted from Ryan and Deci (2000b).

There is a possibility to prime individuals' motivational orientations (Ryan and Deci 2017, p. 234). Factors that influence the satisfaction of the three basic psychological needs affect causality orientations over time. Persistently, an autonomy-supporting environment leads to strong autonomy orientations and respectively controlled-supporting ones lead to controlled orientations (Ryan and Deci 2017, p. 221 and p. 239).

Individuals with continuous experiences in a controlling environment tend to perceive new environments as being controlling even if the context is actually primarily autonomy-supporting (Ryan and Deci 2017, p. 219). In contrast, individuals who experience a highly autonomous environment develop a strong autonomy orientation.

This development leads individuals to participate in new situations more congruently and openly. Individuals respond less defensively and attribute greater informational significance to triggers. These effects lead to a further development of autonomy (e.g., Koestner and Losier 1996; Ryan and Deci 2017, p. 220; Weinstein and Hodgins 2009).

Taken together, the causality orientations theory encompasses individual characteristics: autonomy, controlled, and impersonal orientation. The theory provides an explanation for why individuals facing the same trigger are differentially effective, healthy, and happy (Ryan and Deci 2017, p. 238). Individual characteristics moderate the effects of triggers (Mekler et al. 2017; Ryan and Deci 2017, p. 220). The most positive outcomes are associated with autonomy orientation, whereas impersonal orientation is related to the poorest well-being (Ryan and Deci 2017, p. 238).

2.2.5 Basic Psychological Needs Theory

The concept of basic psychological needs is woven throughout the self-determination theory (Vansteenkiste, Niemiec, and Soenens 2010, p. 131). Triggers that support the satisfaction of the basic psychological needs foster intrinsic motivation, internalization of extrinsic motivation, and more autonomous causality orientations (Ryan and Deci 2017, p. 239; Vansteenkiste, Niemiec, and Soenens 2010, p. 131).

The fourth mini-theory – the basic psychological needs theory – outlines the association of the basic psychological need satisfaction and frustration to well-being and ill-being. More precisely, it specifies the basic needs as key elements for wellness and flourishing (Ryan and Deci 2017, p. 239; Vansteenkiste, Niemiec, and Soenens 2010, p. 131) and concentrates on the following process chain:

Satisfaction of basic psychological needs → *(Re)actions*

All individuals have basic needs for autonomy, competence, and relatedness (Ryan and Deci 2017, p. 242). The needs are positively related to one another, meaning each need facilitates the satisfaction of the others (Ryan and Deci 2017, p. 248). Satisfaction of these needs is necessary for individuals' psychological well-being and ideal functioning. Need frustration is injurious to well-being as it diminishes growth, integrity, and wellness (Ryan and Deci

2017, p. 242). Need satisfaction as well as frustration can be apparent, independent of whether individuals explicitly value the needs or of their sociocultural context (Ryan and Deci 2017, p. 248). Need satisfaction and frustration can change over time, between contexts and social interactions (Ryan and Deci 2017, p. 243). Autonomy support facilitates the satisfaction of the three needs while controlling triggers impair it (Ryan and Deci 2017, p. 247).

2.2.6 Summary of Self-Determination Theory

The self-determination theory serves as a broad framework for investigating human motivation and comprises six mini-theories. Each mini-theory arose from field and laboratory research and accounts for a set of motivationally based phenomena (Self-Determination Theory 2018).

All six mini-theories deal with the satisfaction of the basic psychological needs for autonomy, competence, and relatedness. Whereas some of the mini-theories concentrate more on the triggers that influence basic psychological needs and subsequently motivation, others primarily focus on the re(actions) resulting from the satisfaction of basic psychological needs. In general, triggers that support individuals' experience of autonomy, competence, and relatedness facilitate the most volitional forms of motivation (i.e., intrinsic motivation and autonomous forms of extrinsic motivation) and re(actions) (i.e., enhanced performance and continuance) (Self-Determination Theory 2018). For instance, positive and informational feedback is experienced as supportive and increases the satisfaction of the basic psychological needs. In contrast, triggers that are perceived as controlling such as the avoidance of punishment undermine the satisfaction of the basic psychological needs (Ryan and Deci 2000a; b; Ryan and Deci 2017, p. 247). The moderating influence of individual characteristics such as autonomy, controlled, and impersonal orientation explains why individuals facing the same trigger are differently effective, healthy, and happy (Ryan and Deci 2017, p. 220 and p. 238).

3 Literature Review on Gamification

The following chapter provides an overview of the current gamification literature. The overview includes papers published in journals and conference proceedings that concentrate on the influence of game elements on psychological and/or behavioral outcomes[6]. After describing the literature search strategy, the selected papers are reviewed. The review is divided in two sections regarding the focus with which game elements are analyzed in the papers: (i) gamification as a uniform concept or (ii) specific game elements.

3.1 Literature Search Strategy and Concept Matrix

The literature review of Hamari, Koivisto, and Sarsa (2014) represents the most frequently cited literature review of gamification with 1,964 citations[7]. Thus, the procedure of selecting papers that focus on investigating the influence of game elements on individuals' psychological and/or behavioral outcomes follows their four-step approach: general database search, focused searches, additional searches through references, and analysis.

In step 1, the literature search started with a general database search, indicating search databases and search terms. In this thesis, searches for the literature review were conducted in *EBSCOHost* and *Google Scholar.* The term gamification first arose in 2008 and was not widely diffused until the second half of 2010 (Thiebes, Lins, and Basten 2014). Hence, the literature search was limited to publications from 2009 to 2018. In order to cover a wide set of studies, papers that were potentially relevant had to contain at least one of the following search terms in the title, abstract, or key words (Bui, Veit, and Webster 2015; Thiebes, Lins, and Basten 2014): *gamification*, *gamif**, *gameful*, or *motivational affordance* (Hamari, Koivisto, and Sarsa 2014).

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[6] In the following, "paper" and "conference proceeding" are subsumed under the term "paper".

[7] Based on Google Scholar (last update: November 20, 2018).

In step 2, more focused searches were conducted by determining further search criteria. These were based on the initial database findings (Hamari, Koivisto, and Sarsa 2014). One criterion of the more focused searches represented the concentration on peer-reviewed full papers with a VHB-JOURQUAL3 ranking of *A, B,* or *C*. Papers from the journals *Computers & Education* (Scimago Journal Rank (SJR) = 2.6) and *Computers in Human Behavior* (SJR = 1.6) were considered as well. They contain studies that are specific to gamified learning (Hamari, Koivisto, and Sarsa 2014). Papers from the literature review of Hamari, Koivisto, and Sarsa (2014) were included as well. Although some papers are not ranked A, B, or C, Hamari, Koivisto, and Sarsa (2014) classify them as peer-reviewed. Moreover, these papers are often cited in the peer-reviewed papers.

Following Hamari, Sarsa, and Koivisto (2014), an additional criterion is the focus on gamification rather than full games. This is in line with the recent literature review of Subhash and Cudney (2018). In their review, they differentiate between gamification in higher education and game-based learning. The difference lies in the fact that studies investigating gamification in higher education focus on a set of game elements and do not use actual (educational) games (Dicheva et al. 2015; Eppmann, Bekk, and Klein 2018; Subhash and Cudney 2018).

The search was further refined by reviewing the results of the papers. Solely quantitative empirical studies reporting significance levels with a sample size larger than 20 were included in the literature review. In addition, studies have to explain their research methods as well as define the investigated game elements (Hamari, Koivisto, and Sarsa 2014). An overview of the selection criteria is given in Table 4.

In step 3, the references of the initially detected papers were investigated as well as the references that are made to those papers using Google Scholar (Hamari, Koivisto, and Sarsa 2014). This is in line with the forward- and backward analysis of Webster and Watson (2002).

In sum, papers that are excluded from further literature review can be classified in the following seven categories: (1) conceptual papers, (2) qualitative studies, (3) papers that solely provide descriptive statistics, (4) papers with a sample size smaller than 21, (5) papers that mention gamification in the text,

however the actual content is not gamification-related, (6) papers that focus on games and not on gamification (7) papers that do not aim to investigate the influence of game elements on individuals' psychological and/or behavioral outcomes (e.g., focus on scale development, cluster analyses, and studies that investigate the evaluation of a gamified system from the perspective of an instructor and not an user). After conducting the three steps of literature research, 53 papers on gamification are identified as suitable for further investigation in the literature review.

Table 4: Overview of selection criteria for the literature review on gamification

Categories	Selection criteria
Searched databases	EBSCOHost, Google Scholar
Publication period	2009 – 2018
Journals and Conference Proceedings	Journal Ranking A, B, C Computer & Education (2.6 SJR) Computers in Human Behavior (1.6 SJR) Papers from the literature review of Hamari, Koivisto, and Sarsa (2014)
Search terms in title, abstract or key words	gamification gamif* gameful motivational affordance
Study focus	Game elements and gameful experiences rather than full games and game-based learning
Sample size	N > 20
Types of study	Quantitative empirical studies
Effects	Significance levels reported
Research method	Research design and process are described
Game elements	Defined

Source: Author's own illustration.

In step 4 – analysis – the concept matrix of Webster and Watson (2002) is used. The concept matrix systematically classifies and analyzes the different game elements and psychological and behavioral outcomes (Hamari, Koivisto, and

Sarsa 2014; Webster and Watson 2002) as well as the moderating influence of individual characteristics. The studies are categorized and analyzed using a modified framework on gamification of Hamari, Koivisto, and Sarsa (2014).

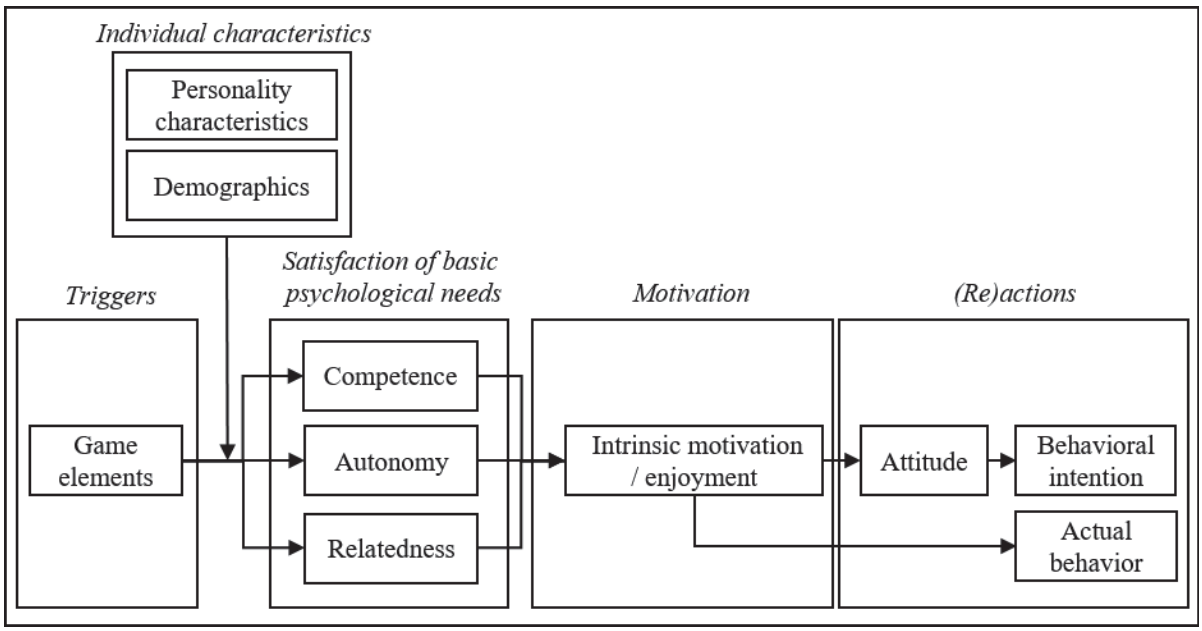
The literature is categorized along four aspects: (1) implemented game elements, (2) the resulting psychological, (3) and (subsequently) behavioral outcomes, as well as (4) the influence of individual characteristics on that relationship. When reviewing the literature, actual users and non-actual users of gamification are differentiated. Both groups may respond differently to game elements. Actual users are confronted with gamification in their everyday life. They experience gamification within activities they normally do. In contrast, non-actual users experience gamification solely once in the scope of the survey or experiment participation.

The four main aspects are further divided into subcategories (see Table 5). Based on the implemented game elements studies can be generally grouped in two categories. The first group of studies examines gamification as a uniform concept. These studies do not differentiate between specific game elements or focus on the design of single elements (e.g., Domínguez et al. 2013; Hamari and Koivisto 2013). For instance, individuals face a whole set of game elements such as trophies, badges, challenges, and leaderboard in a gamified learning intervention (De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). The second group of studies concentrates on specific game elements (e.g., points, badges, and leaderboards) or provides detailed insights into different ways of implementing these elements (e.g., Christy and Fox 2014; Denny 2013). For instance, students in one group have the possibility to earn up to 22 badges and students in the control group do not have the possibility to earn badges (Denny 2013).

The psychological outcomes are further divided regarding the components of the self-determination theory (i.e., satisfaction of basic psychological needs and motivation) since it represents the theoretical foundation of the study. Several studies investigating intentional behavior use the theory of planned behavior or theory of reasoned action (e.g., Hamari and Koivisto 2015b; Olsson et al. 2016). Consequently, behavior is subdivided into intentional and actual behavior. Attitude is added as a further category of psychological outcomes. In order to be more precise, studies investigating individual characteristics are further divided into demographic and personality characteristics

(see Table 5). This refinement leads to an adapted conceptual framework of Hamari, Koivisto, and Sarsa (2014) as illustrated in Figure 7. Yet, it is important to note that none of the reviewed papers has considered the complete framework.

Figure 7: Conceptual framework based on literature review



Source: Author's own illustration.

In the following, the literature is discussed based on whether gamification is considered as a uniform concept (section 3.2) or whether specific game elements are the focus of the studies (section 3.3).

3.2 Literature Considering Gamification as a Uniform Concept

The literature search identified 36 studies that investigate gamification as a uniform concept, and thus, do not differentiate between specific game elements (see Table 5).

Table 5: Studies focusing on gamification as a uniform concept

Study	Type of data	Actual users	Competence	Autonomy	Relatedness	Intrinsic motivation / enjoyment	Attitude gamification	Behavioral intention	Actual behavior	Demographics	Personality characteristics
Studies considering satisfaction of basic psychological needs											
Kappen, Mirza-Babaei, and Nacke 2018	E	X	X	X	X	X					
Sailer et al. 2017	E		X	X	X						
Suh, Wagner, and Liu 2015	S	X	X	X	X	X		X			
Zainuddin 2018	E	X	X	X	X				X		
Studies considering motivation											
Baxter, Holderness, and Wood 2016	E	X				X	X		X		
Fitz-Walter et al. 2017	E	X				X			X		
Guin et al. 2012	E	X				X	X		X		
Hamari and Koivisto 2015a	S	X				X	X	X			
Hanus and Fox 2015	E	X				X	X		X		
Harms et al. 2015	E	X				X		X	X		
Olsson et al. 2016	E	X				X	X	X			
Rodrigues, Oliveira, and Costa 2016a	S	X				X		X			
Rodrigues, Oliveira, and Costa 2016b	S	X				X		X			
Sigala 2015	E	X				X			X		
Suh and Wagner 2017	S	X				X			X		
Wolf, Weiger, and Hammerschmidt 2018	S	X				X		X			
Studies considering attitudinal (re)actions and behavioral intentions											
Alcivar and Abad 2016	E	X					X		X		
Hamari and Koivisto 2013	S	X					X	X			
Hamari and Koivisto 2015b	S	X					X	X			
Landers and Armstrong 2017	E	X					X				X
Rodrigues, Costa, and Oliveira 2017	S	X						X			
Suh et al. 2017	S	X						X			
Studies considering actual behavioral (re)actions (continued)											

Study	Type of data	Actual users	Competence Autonomy Relatedness	Intrinsic motivation / enjoyment	Attitude gamification Behavioral intention	Actual behavior	Demographics Personality characteristics
Studies considering actual behavioral (re)actions (continued)							
Çakıroğlu et al. 2017	E	X				X	
De-Marcos et al. 2014	E	X				X	
De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016	E	X				X	
Domínguez et al. 2013	E	X				X	
Eickhoff et al. 2012	E	X				X	
Hew et al. 2016	E	X				X	
Huang and Hew 2018	E	X				X	
Jang, Kitchen, and Kim 2018	T	X				X	
Lopez and Tucker 2017	E					X	
Müller-Stewens et al. 2017	E	X				X	
Steinberger, Schroeter, and Watling 2017	E					X	
Tenório et al. 2016	E	X				X	
Thom, Millen, and DiMicco 2012	E	X				X	
Tsay, Kofinas, and Luo 2018	E	X				X	

E = Experiment
S = Survey
T = Transactional data

Source: Author's own illustration.

The majority of studies either conducts a survey about a gamified service or runs experiments comparing the effects of a gamified group to a non-gamified control group or to other groups of game elements. Studies conducting a survey investigate gamified services in different contexts such as the workplace, physical exercise, and e-banking (e.g., Hamari and Koivisto 2015b; Rodrigues, Oliveira, and Costa 2016a; Suh et al. 2017). Users of these services face different game elements (e.g., points, badges, and leaderboards). The majority of these studies does not provide detailed descriptions of the number and scope of game elements that are offered on the gamified platform (e.g., Hamari and Koivisto 2013; Suh, Wagner, and Liu 2015). Moreover, due to the use of surveys, it is not possible to make a causal claim.

Most of the studies that use an experimental setting compare a gamified group to a non-gamified control group in an educational context (e.g., Hanus and

Fox 2015; Tsay, Kofinas, and Luo 2018). These studies also do not differentiate between game elements. For instance, students either face a whole set of game elements when participating in a course or they participate in a course without facing any game element at all (e.g., Hew et al. 2016; Huang and Hew 2018). A small number of studies compare groups of game elements (e.g., Lopez and Tucker 2017; Sailer et al. 2017). These studies do not differentiate between specific game elements as well. Most of these studies do not even provide a profound explanation why they combine a certain number of game elements to one group and compare them to another group of game elements.

Almost all studies use actual users of the gamified services in their studies (e.g., Alcivar and Abad 2016; Zainuddin 2018) (see Table 5). This is probably the reason why many studies (i.e., 23 out of 36 studies) consider the effects of gamification on actual behavior. Behavioral intentions are investigated by 11 studies (e.g., Hamari and Koivisto 2015b; Suh et al. 2017), whereas nine studies take attitude towards gamification into account (e.g., Baxter, Holderness, and Wood 2016; Hamari and Koivisto 2015a). Intrinsic motivation is examined by 14 studies (e.g., Kappen, Mirza-Babaei, and Nacke 2018; Olsson et al. 2016). Most of these studies actually do not measure users' intrinsic motivation but rather focus on enjoyment as a proxy[8] for it (e.g., Baxter, Holderness, and Wood 2016; Fitz-Walter et al. 2017). Only four out of the 36 studies consider the effect of gamification on users' satisfaction of basic psychological needs (Kappen, Mirza-Babaei, and Nacke 2018; Sailer et al. 2017; Suh, Wagner, and Liu 2015; Zainuddin 2018). A reason is that many studies do actually not rely on the self-determination theory in deriving their study's framework.

Figure 8 summarizes the findings of the 36 studies. Yet, no single study has examined the framework as a whole. The green arrows demonstrate significant relationships. The orange arrows emphasize that studies find significant well as insignificant results for these relationships. The positive and negative signs display the direction of the relationship. The results of the studies are discussed in the following.

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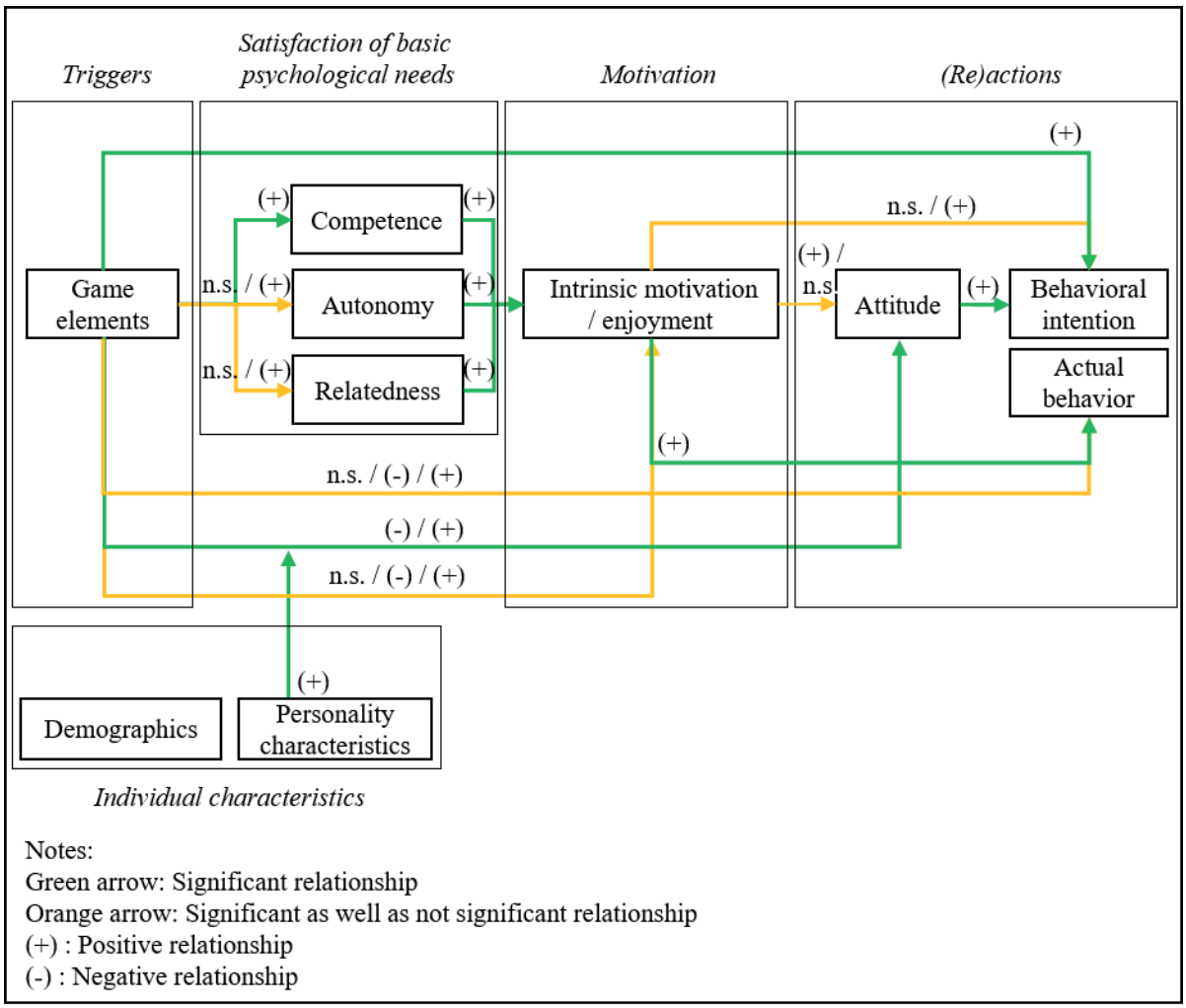
[8] Enjoyment represents the self-report measure of intrinsic motivation. It is the sole subscale that assess intrinsic motivation per se (IMI 2018).

Figure 8: Gamification as a uniform concept – results of the studies



Source: Author's own illustration.

The studies that investigate the effect of gamification on *satisfaction of basic psychological needs* show that gamification improves *competence* (Kappen, Mirza-Babaei, and Nacke 2018; Sailer et al. 2017; Suh, Wagner, and Liu 2015; Zainuddin 2018[9]). Yet, the influence of gamification on *autonomy* and *relatedness* is less clear, showing significant positive as well as insignificant results (Kappen, Mirza-Babaei, and Nacke 2018; Sailer et al. 2017; Suh, Wagner, and Liu 2015; Zainuddin 2018).

[9] The study does not combine the items of competence, autonomy, and relatedness to a corresponding factor. They investigate the items in isolation. Being more precise, four out of five items of competence show significant positive results as well as all items of autonomy, and one item of relatedness.

Suh, Wagner, and Liu (2015) further find that a positive perception of autonomy, competence, and relatedness leads to higher *enjoyment* of the gamified service.[10] However, the results of studies that examine the relationships between gamification and *intrinsic motivation/enjoyment* are mixed. Most studies find a significant positive effect of gamification on *enjoyment* (e.g., Baxter, Holderness, and Wood 2016; Fitz-Walter et al. 2017; Guin et al. 2012; Harms et al. 2015; Sigala 2015). Besides the positive effects of game elements, Wolf, Weiger, and Hammerschmidt (2018) reveal that gameful experiences of social connectedness, expressive freedom, and skill development have a significant positive effect on autonomous *motivation*. Social comparison significantly increase controlled *motivation* (Wolf, Weiger, and Hammerschmidt 2018). Rodrigues, Oliveira, and Costa (2016b) provide evidence that gamification has no significant influence on *enjoyment*. Moreover, Hanus and Fox (2015) reveal a significant negative direct effect of a gamified course on *intrinsic motivation* compared to a non-gamified one. In surveys, the positive effects of gamification mainly result from perceived ease of use (Rodrigues, Oliveira, and Costa 2016a; b), rewardability (Suh and Wagner 2017), visibility of achievement (Suh and Wagner 2017), and competition (Suh and Wagner 2017).

Two studies investigate the effect of enjoyment on *attitude* towards gamification. Olsson et al. (2016) demonstrate that intrinsic motivation (i.e., enjoyment) significantly increase the *attitude* towards gamification. In contrast, Hamari and Koivisto (2015a) do not find a significant effect. Studies investigating the effect of gamification on *attitude* towards gamification mostly find significant positive effects (e.g., Alcivar and Abad 2016; Baxter, Holderness, and Wood 2016; Guin et al. 2012; Landers and Armstrong 2017). Only Hanus and Fox (2015) find a significant negative effect of gamification on the *attitude* towards gamification.

[10] Besides the effects of game elements, the authors demonstrate that self-expression has a significant positive effect on autonomy and relatedness, competition shows a significant influence on relatedness and competence, and altruism positively affected relatedness. However, the authors do not provide arguments for the inclusion of these constructs to the model.

Studies demonstrate significant positive effects of attitude on the *intention* to continuously use the gamified system in the future (e.g., Hamari and Koivisto 2013, 2015a; b; Olsson et al. 2016). In addition, studies considering *behavioral intentions* find positive effects of gamification on future usage intentions (e.g., Harms et al. 2015; Rodrigues, Costa, and Oliveira 2017). The positive effects of gamification on either *attitude*, *behavioral intentions*, or both results from, for example, usefulness (Hamari and Koivisto 2015a; Rodrigues, Oliveira, and Costa 2016a), reciprocal benefits (Hamari and Koivisto 2013, 2015b), subjective norms (Hamari and Koivisto 2015b), and social influence (e.g., Hamari and Koivisto 2013, 2015a; Rodrigues, Oliveira, and Costa 2016b). In addition, autonomous as well as controlled motivation have a significant positive effect on individuals' *intention* for continuously use the service (Wolf, Weiger, and Hammerschmidt 2018). Considering the direct effect of enjoyment on the *intention* to continuously use an online service that gamifies physical exercises, a significant positive effect can be stated (Hamari and Koivisto 2015a; Suh, Wagner, and Liu 2015). However, the majority of studies investigating the intention to continuously use an e-banking application reveals that enjoyment has no significant influence (Rodrigues, Oliveira, and Costa 2016a; b). An explanation may be that sport activities are more fun than banking matters. Besides intentional behavior, *actual behavior* is influenced positively by intrinsic motivation as well (Hanus and Fox 2015; Suh and Wagner 2017).

Finally, there are studies that examine the direct effect of gamification on actual behavior. In general, there are two dimensions of actual behavior examined in the studies: *quantity of action* (e.g., engagement, task completion, adoption, and service usage) and *quality of action* (e.g., academic performance and non-academic performance).

The findings regarding the effect of gamification on the *quantity of action* are mixed (e.g., Domínguez et al. 2013; Fitz-Walter et al. 2017; Sigala 2015). The majority of studies shows a positive significant effect on individuals' engagement (e.g., Çakıroğlu et al. 2017; Huang and Hew 2018; Tenório et al. 2016). Significant positive effects on product adoption, on the likelihood to use the gamified service more frequently, and the likelihood to recommend it can be stated (Harms et al. 2015; Müller-Stewens et al. 2017).

Considering behavioral data from a gamified physical exercise application, results reveal that customer benefits (i.e., epistemic, social integrative, and personal integrative) of using the service have a significant positive effect on individuals' behavioral engagement (Jang, Kitchen, and Kim 2018). A removal of game elements leads to a significant negative effect on behavioral engagement (Thom, Millen, and DiMicco 2012). The effect of task completion is significant negative as well (Guin et al. 2012).

Regarding the *quality of action*, predominantly positive effects can be stated (e.g., Eickhoff et al. 2012; Huang and Hew 2018; Steinberger, Schroeter, and Watling 2017). For instance, students in a gamified course achieve significantly better outcomes in most of the assignments that they are supposed to do during the semester compared to individuals in a non-gamified course (De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016; Domínguez et al. 2013; Zainuddin 2018). Even better results than the gamified course alone can be achieved by implementing a social component. Students that participate in a social treatment group (i.e., venue where students have the possibility to interact or discuss about learning materials (e.g., commenting, liking, and chats)) or a combination with the gamified course demonstrate even better results than the gamified course alone (De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). A combination of a gamified course and social treatment does not significantly differ from the control group regarding the final exam (De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). However, the effect of a gamified course compared to a non-gamified course on the final exam is significant negative (De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016; Domínguez et al. 2013). The effects of a gamified course on the final grade are either significant positive or insignificant (e.g., Domínguez et al. 2013; Tsay, Kofinas, and Luo 2018). When comparing groups of game elements, results reveal that individuals facing a gamified application of win state, chance, and achievement show a significant higher physical performance than individuals using an application containing avatars, points, and content unlocking (Lopez and Tucker 2017). In summary, the positive effects on *quality of action* outweigh the negative effects (e.g., Alcivar and Abad 2016; Baxter, Holderness, and Wood 2016).

Solely one study investigates the moderating effect of individual characteristics (i.e., Landers and Armstrong 2017). Individuals with *video game experience* anticipate better results from gamified instructions. Thus, individuals who are uncomfortable with video games still prefer traditional instructions for a learning module (Landers and Armstrong 2017). This is in line with the moderating effect of *attitude towards game-based learning*. Individuals with positive attitudes toward game-based learning anticipate better outcomes from gamified instructions (Landers and Armstrong 2017).

In summary, the results of the studies suggest that gamification can positively affect satisfaction of basic psychological needs, motivation, attitudinal measure, behavioral intentions, and actual behavior. Yet, the ambiguity in findings for some relationships suggests that contingency factors exist that impact the influence of gamification on the different outcome measures. Moreover, the studies consider gamification as a uniform concept and do not differentiate between specific game elements. Thus, the results of these studies are actually difficult to compare and they deliver limited insights for designing effective implementations of gamification. It is not possible to disentangle the effects of game elements on psychological and behavioral outcomes. Moreover, the majority of studies investigates psychological outcomes independently from their subsequent influence on behavioral outcomes. No single study has examined the framework as a whole. Besides one study, a consideration of the moderating effect of individual characteristics is lacking.

These limitations point to the need for studies that allow for the differentiation between game elements and the use of a sound theoretical underpinning to explain the results.

3.3 Literature Considering Specific Game Elements

In contrast to investigating gamification as a uniform concept, the other group of studies focuses on the examination of specific game elements or have a more profound look into the configuration of certain elements (e.g., Denny 2013; Hamari 2013). The literature search revealed 17 studies that focus on specific game elements (see Table 6).

Table 6: Studies focusing on specific game elements

Study	Game element	Type of data	Actual users	Competence / Autonomy / Relatedness	Intrinsic motivation / enjoyment	Attitude gamification / Behavioral intention	Actual behavior	Demographics / Personality characteristics
Studies considering satisfaction of basic psychological needs								
Kim and Ahn 2017	graphical feedback (stars)	E	X	X	X			
Mekler et al. 2017	points leaderboard level	E		X	X		X	X
Studies considering motivation								
Feng et al. 2018	points feedback	S	X		X	X		
Kyewski and Krämer 2018	badges	E	X		X		X	
Poncin et al. 2017	challenge	E			X			
Santhanam, Liu, and Shen 2016	competition	E			X		X	
Studies considering actual behavioral (re)actions								
Albuquerque et al. 2017	avatar	E					X	
Attali and Arieli-Attali 2015	points	E	X				X	X
Christy and Fox 2014	leaderboard	E					X	
Denny 2013	badges	E	X				X	
Goes, Guo, and Lin 2016	rank	T	X				X	
Hakulinen, Auvinen, and Korhonen 2013	badges	E	X				X	
Hamari 2013	badges	E	X				X	
Hamari 2017	badges	E	X				X	
Jung, Schneider, and Valacich 2010	goal feedback	E					X	
Landers, Bauer, and Callan 2017	goal leaderboard	E					X	
Mutter and Kundisch 2014	badges	T	X				X	

E = Experiment
S = Survey
T = Transactional data

Source: Author's own illustration.

Most of the studies focusing on specific game elements use badges (e.g., Denny 2013; Kyewski and Krämer 2018). Besides badges, specific game elements such as ranks, feedback, and levels are investigated (e.g., Goes, Guo, and Lin 2016; Jung, Schneider, and Valacich 2010; Mekler et al. 2017).

The majority of studies either compares a specific game element to a control group without this game element or to other specific game elements (e.g., Denny 2013; Mekler et al. 2017).

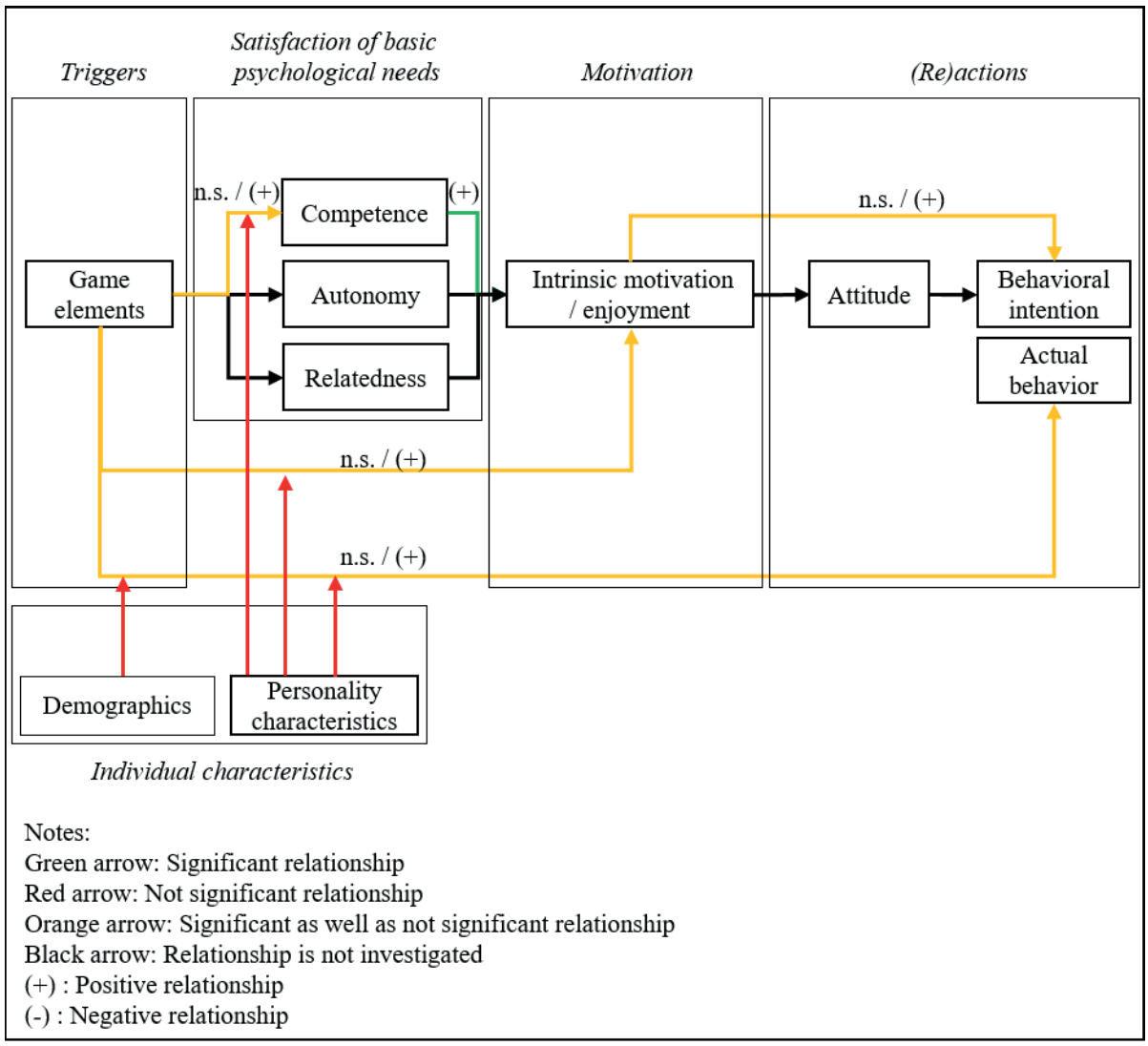
All studies investigating badges use actual users of gamification in their studies (e.g., Hakulinen, Auvinen, and Korhonen 2013; Hamari 2017). The other studies differ in whether they use actual users or non-actual users.

Almost all studies consider the effects of gamification on actual behavior (e.g., Denny 2013; Hamari 2017). One study investigates behavioral intention and two studies do not examine behavioral outcomes (Feng et al. 2018; Kim and Ahn 2017; Poncin et al. 2017). Intrinsic motivation is examined by six studies (e.g., Kyewski and Krämer 2018; Santhanam, Liu, and Shen 2016). Two of them investigate the effect of game elements on competence (Kim and Ahn 2017; Mekler et al. 2017).

Compared to the group of studies focusing on gamification as a uniform concept, less relationships have been investigated so far (see Figure 9). In general, the results of the investigated relationships are in line with the results of the group of studies concentrating on gamification as a uniform concept. However, important to note is that no negative effects of specific game elements on psychological and behavioral outcomes can be stated.

Figure 9 outlines the findings of the 17 studies. In line with the group of studies described in section 3.2, no single study has investigated the framework as a whole. The red arrows demonstrate that the relationship is not significant (n.s.). The green arrow indicates a significant relationship. The orange arrows display that studies find significant as well as insignificant results for these relationships. The positive and negative signs illustrates the direction of the relationship. The black arrows emphasize relationships that have not been investigated so far. The results of the studies are discussed in the following.

Figure 9: Specific game elements – results of the studies



Source: Author's own illustration.

Studies that investigate the effect of specific game elements on *satisfaction of basic psychological needs* focus on competence and reveal mixed results. Whereas the implementation of graphical feedback (i.e., stars) has a significant positive effect on competence, the game elements points, levels, and leaderboards do not significantly affect competence (Kim and Ahn 2017; Mekler et al. 2017). However, the positive effect of graphical feedback should be considered with caution.

Even if the authors cite the Intrinsic Motivation Inventory (IMI) Scale, they use different items to measure competence[11] than the original scale (see IMI 2018).

Moreover, it is questionable whether the sole visual illustration of stars is already gamification. Participants in the loyalty program (i.e., My Starbucks Rewards) can earn stars for their purchases at starbucks. These stars are displayed on a coffee mug when receiving a loyalty program message compared to a message with a completely different picture without stars. However, both groups can see the number of stars they have already earned (Kim and Ahn 2017). The sole difference lies in the graphical display of the feedback in the form of stars.

Both studies detect a significant positive effect of competence on *intrinsic motivation* (Kim and Ahn 2017; Mekler et al. 2017). Moreover, studies considering the direct effect of specific game elements on *intrinsic motivation* demonstrate mixed results (e.g., Kyewski and Krämer 2018; Mekler et al. 2017). Leaderboards, levels, competitive structures and badges do not significantly affect *intrinsic motivation* (Kyewski and Krämer 2018; Mekler et al. 2017; Santhanam, Liu, and Shen 2016). The direct effects of points on intrinsic motivation are mixed (Feng et al. 2018; Mekler et al. 2017). Whereas Mekler et al. (2017) do not find a significant effect of points on intrinsic motivation in an experiment, Feng et al. (2018) demonstrate a significant effect when conducting a survey. Yet, Feng et al. (2018) subsume the psychological outcomes of self-presentation, self-efficacy, social bonds, and playfulness under *intrinsic motivation*. In contrast, the study of Mekler et al. (2017) does not provide detailed information about its measurement of intrinsic motivation. They measure competence and intrinsic motivation with the IMI scale (Mekler et al. 2017). It does not become clear whether solely enjoyment represents intrinsic motivation or if further elements of the IMI scale are implemented. Thus, the results of both studies investigating points are not comparable due to the different measurement of intrinsic motivation.

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[11] 1. The design of My Starbucks Rewards would allow users to easily monitor their progress toward reward achievement.
2. The design of My Starbucks Rewards would encourage users to achieve rewards.
3. The design of My Starbucks Rewards would motivate users to put more effort into reward achievement.

The implementation of a challenge leads to a significant higher *enjoyment* (Poncin et al. 2017). The provision of feedback has a significant positive effect on three (i.e., self-presentation, self-efficacy, and playfulness) of four components of Feng et al.'s (2018) measurement of *intrinsic motivation*.

Solely the study of Feng et al. (2018) examines the influence of intrinsic motivation on *behavioral intention*. The components self-presentation, self-efficacy, and playfulness have a significant positive effect on behavioral intention (i.e., participation in crowdsourcing platforms). The effect of social bonds on behavioral intention is not significant (Feng et al. 2018).

The majority of studies focusing on specific game elements investigates the direct effect of game elements on *actual behavior* (i.e., quantity and quality of action). They examine the direct effects on actual behavior independently from psychological outcomes. Studies demonstrate significant positive effects of feedback, points, levels, and leaderboards on the *quantity of action* as well as significant positive and insignificant effects of badges (e.g., number of trade proposals, number of comments, number of submitted answers, idea quantity, and tag quantity) (e.g., Denny 2013; Hamari 2017; Jung, Schneider, and Valacich 2010). Participants who perceive performance feedback and can additionally link the performance information to each individual's pseudonym (compared to anonymous) achieve even a higher quantity of ideas. Moreover, combining performance feedback with an explicit goal leads to a higher quantity of ideas compared to performance feedback with the goal *do your best* (Jung, Schneider, and Valacich 2010).

When differentiating between the designs of the badge groups (i.e., visibility and clear goals) mixed results can be stated. Users that have the possibility to compare their number of earned badges with other users do not exhibit higher engagement rates than users that can exclusively see the badges they earned themselves (Hamari 2013). The same holds true for the comparison of users that are aware of the actions they have to perform to earn badges (i.e., clear goals) and those who do not know how to unlock badges. Solely the number of times a user views his/her own badges has a significant positive effect on users' engagement rates (Hamari 2013). In contrast, the number of times users view the badges of other users shows only a significant positive effect on the number of trade proposals. The other effects on further engagement are not

significant (Hamari 2013). The results emphasize that the possibility to compare badges and the provision of clear goals do not significantly affect users' behavioral patterns as long as users do not actively track them.

The comparison of the effects of points, leaderboard, and levels reveal that participants in the level and leaderboard condition significantly outperform participants in the points' condition. There is no difference between participants in the leaderboard and in the level condition (Mekler et al. 2017). When examining the effects of a leaderboard compared to four goal conditions (i.e., do-your-best, easy goal, difficult goal, and impossible goal), results indicate that individuals in a leaderboard condition reach a higher task performance (i.e., list uses of knifes) compared to individuals in the do-your-best and easy goal conditions. They reached a similar quantity of words to participants in the difficult or impossible goal conditions (Landers, Bauer, and Callan 2017).

Considering the effect of the proximity to the next badge or rank, results reveal that the quantity of contributions significantly increases in the days shortly before earning the next badge or achieving the next rank (Goes, Guo, and Lin 2016; Mutter and Kundisch 2014). There is a sharp drop in the number of contributions on the day after receiving the badge or reaching a certain rank (Goes, Guo, and Lin 2016; Mutter and Kundisch 2014). Subsequently, the quantity of contributions recovers slowly and then accelerates prior to the next rank (Goes, Guo, and Lin 2016).

Taken together, significant positive effects on the *quantity of action* can be stated for the game elements badges, leaderboards, feedback, levels, points, and ranks (e.g., Hamari 2017; Mekler et al. 2017). A leaderboard seems to be more effective than providing do-your best and easy goals as well as points. The implementation of levels leads to a higher quantity of action than points.

In contrast, levels and points do not have a significant positive effect on the *quality of action* (i.e., accuracy of response and tag quality) (e.g., Attali and Arieli-Attali 2015; Mekler et al. 2017). Moreover, no significant effect on solving a logic quiz can be demonstrated when comparing avatars in a stereotype condition compared to avatars in the non-stereotype condition. Women in the stereotype condition are solely able to choose female avatars, while men were exclusively able to choose a male avatar. In the non-stereotype group,

women and men are free to choose female as well as male avatars. A control group that do not contain an avatar is missing (Albuquerque et al. 2017). Thus, no statement about the general impact of avatars on behavioral outcomes can be made.

Besides the insignificant effects, the implementation of feedback has a significant positive effect on idea quality (Jung, Schneider, and Valacich 2010). As already mentioned for the effects on idea quantity, participants who receive performance feedback and are able to relate the performance information to each individual's pseudonym (compared to anonymous) achieve even a higher quality of ideas. In addition, the combination of performance feedback and explicit goal leads to better ideas than performance feedback with the goal do your best (Jung, Schneider, and Valacich 2010).

The effects of badges and leaderboards on the *quality of action* are significant positive as well as insignificant compared to a control group without the corresponding game element (e.g., Christy and Fox 2014; Hakulinen, Auvinen, and Korhonen 2013; Kyewski and Krämer 2018[12]; Mekler et al. 2017). Having a more profound look in the leaderboard condition, women in the male majority leaderboard condition show a better performance on the math test compared to those in the female condition (Christy and Fox 2014). Moreover, participants matched with lower-skilled competitors partially show significantly higher levels of learning outcomes (i.e., test results) compared to participants matched with an equally or higher-skilled competitor (Santhanam, Liu, and Shen 2016).

Solely two studies investigate the moderating effect of *individual characteristics* (Attali and Arieli-Attali 2015; Mekler et al. 2017). Both studies do not reveal significant moderating effects. There is an insignificant interaction effect of *gender* and points on the accuracy and speed of responses (Attali and Arieli-Attali 2015). The differentiation between *autonomy*- and *control-oriented* individuals' (i.e., personality characteristics) does not have a significant influence on the effectiveness of gamification.

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[12] Kyewski and Krämer (2018) compare the effect of three groups: badges are visible for others, badges are only visible for the individual herself/himself, and a control group without badges. The difference between the two badge groups is not significant as well (Kyewski and Krämer 2018).

The effect does not differ between individuals who act according to their own interest and values and interpret results as informational and individuals acting based on external demand and perceive external events as pressuring (Mekler et al. 2017).

Taken together, badges are the game elements that are investigated the most in isolation. Several specific game elements (i.e., badges, leaderboard, feedback, level, points, and ranks) demonstrate promising results regarding the quantity of action. The implementation of badges, feedback and leaderboards additionally leads to a significant better quality of action. In contrast to leaderboards, the provision of feedback has a significant positive effect on competence and intrinsic motivation. Thus, the provision of feedback seems to be a promising game element when investigating the effects on psychological as well as behavioral outcomes. When comparing game elements, leaderboards result in a higher quantity of action compared to points and do-your-best and easy goal conditions.

In summary, results of the studies suggest that specific game elements can positively influence satisfaction of basic psychological needs (i.e., competence), motivation, and actual behavior. None of the specific game elements influence psychological as well as behavioral outcomes in a significant negative way. The majority of the studies focuses on the direct effect of game elements on behavioral outcomes without examining the mediating effect of psychological outcomes (i.e., Kyewski and Krämer 2018; Santhanam, Liu, and Shen 2016). Hence, most of them do not focus on the application of the self-determination theory to justify the motivational effect. No single study has investigated the framework as a whole. Besides two studies, an examination of the moderating effect of individual characteristics is missing. Solely a small number of studies compare the effect of specific game elements (Feng et al. 2018; Jung, Schneider, and Valacich 2010; Landers, Bauer, and Callan 2017; Mekler et al. 2017).

These limitations emphasize the need for studies that focus on specific game elements beyond badges and the comparison of specific game elements, an application of the self-determination theory to explain the underlying motivational mechanisms as well as an extension of the examination of the moderating effects of individual characteristics.

3.4 Summary and Research Gaps

The literature review on gamification reveals two groups of studies: (i) gamification is considered as a uniform concept or (ii) studies focus on the effects of specific game elements. The majority of studies can be classified in the first group. These studies combine different game elements. They solely consider the effect of gamification on certain psychological and/or behavioral outcomes. Most of the studies do not explicitly reveal what kind of game elements are embedded or how game elements are implemented within the service. These studies consider gamification as a uniform concept. This prevents insights into how diverse game elements as well as concrete design features have led to the observed psychological and behavioral outcomes. Due to the consideration of gamification as a uniform concept, the different results are difficult to compare. These facts underline the importance of considering the effect of specific game elements on psychological and subsequently behavioral outcomes.

The second group of studies focuses on the analysis of specific game elements (e.g., avatar, badges, and leaderboards). The studies attempt to overcome the shortcoming of combining all game elements to one group. Badges are the game elements that are investigated the most in isolation. Especially research comparing specific game elements is still scarce. Hence, research comparing specific game elements as well as extending the scope of already investigated game elements is needed to overcome these shortcomings. Moreover, the majority of studies investigates psychological outcomes (i.e., motivation) independently from their influence on behavioral outcomes. Besides a small number of studies, studies neglect an investigation of the motivational mechanisms based on the self-determination theory. Solely two studies examine the effects of specific game elements (i.e., feedback, leaderboard, levels, and points) on satisfaction of competence and subsequently intrinsic motivation (Kim and Ahn 2017; Mekler et al. 2017). Whereas the positive effect of graphical feedback should be considered with caution, the insignificant effect of leaderboards, points, and levels may result from the use of non-actual users. Due to the fact that participants do not use the elements in their daily life (i.e., non-actual user), levels, points, and leaderboards may not offer enough meaningful and informational feedback. The experience of these elements seems not to be

intensive enough to influence their level of competence (Mekler et al. 2017). Hence, research is needed that compare the effect of specific game elements on motivation and subsequently behavior by using actual users.

There are only two studies that investigate the moderating effect of individual characteristics on the relationship between specific game elements and psychological or behavioral outcomes (Attali and Arieli-Attali 2015; Mekler et al. 2017). Hence, research regarding the moderating influence of individual characteristics is still scarce.

In summary, the contribution of the thesis is threefold to overcome the shortcomings discussed above:

(1) Investigation of specific game elements:

Study 1: A comparison of the effectiveness of established specific game elements (i.e., points, badges, and leaderboard) in a real life setting with actual users.

Study 2: The extension of the scope of previously investigated game elements by examining the effects using a memory-type game in a real life setting with actual users.

(2) Insights from the application of a theoretical foundation (i.e., self-determination theory) in order to understand the underlying motivational mechanisms:

The self-determination theory is used to provide a theoretical foundation. Intrinsic motivation (i.e., enjoyment) as well as the corresponding drivers are considered. Based on the theoretical foundation, the investigation of the effects of game elements on psychological outcomes enriches current research. Insights into the short- as well as long-term effects of gamification are examined in both studies.

(3) Investigation of moderating effects of individual characteristics:

The moderating effects of several individual characteristics (i.e., demographics and personality characteristics) on the effectiveness of gamification are analyzed in both studies.

4 Study 1: Effectiveness of Gamification in Higher Education

The first study investigates the effectiveness of different game elements in higher education. In a first step, the relevance of the topic is motivated. Subsequently, the aim of the first study is set up. Then, the conceptual framework and the hypotheses are derived. The design of the empirical study is outlined as well as the operationalization of variables. The descriptive statistics and results are provided. The chapter ends with a discussion of the results.

4.1 Improving Students' Motivation through Gamification in Higher Education

Learning represents an active process (Glover 2013). A basic requirement for all active processes is the motivation to start as well as to continue the process (Glover 2013). Consequently, an important goal of education is to get students motivated to pay attention and engage with learning materials (Deci and Ryan 2000; Gibbs 2014; Gottfried 1985; Hanus and Fox 2015; JoyTunes 2015).

Traditional courses are often not able to engage students in continuous learning activities (Gibbs 2014; Kapp 2012; Mann 2009). A high number of students perceive traditional schooling as ineffective (Attali and Arieli-Attali 2015; De-Marcos et al. 2014; Mann 2009; McGonigal 2012, pp. 159, 166, and 170-171). Some students do not possess an effective time management and procrastinate. They only start learning very close to deadlines and exams (Bondici 2014; Doughty 2014; Knezevic 2012). Moreover, students who are not aware of what to expect from a course and who are not familiar with the subject may not perceive themselves as very competent (e.g., in introductory classes) (Garaus, Furtmüller, and Güttel 2016).

Building interpersonal relationships for positive feedback provision and the creation of supportive learning climate represent ways that enhance the motivation to learn (Deci and Ryan 2000; Garaus, Furtmüller, and Güttel 2016; Gelderen 2010; Huang 2003).

In online learning environments as well as courses with a high number of students, educators' possibilities to interact face-to-face are limited. The provision of prompt guidance and immediate feedback is difficult in these settings.

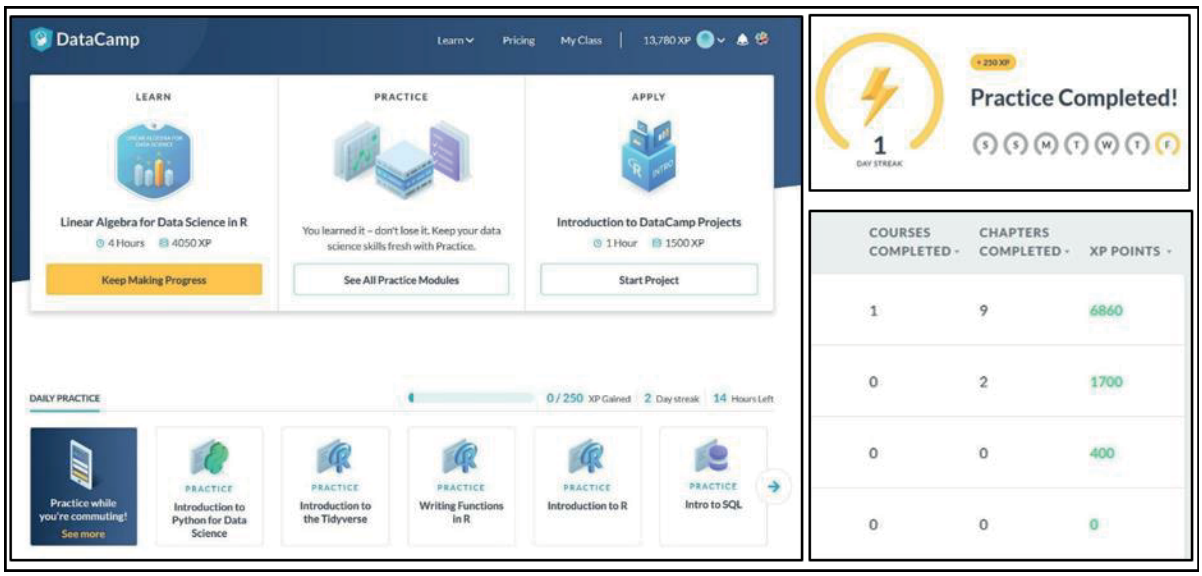
The introduction of educational games as learning tools seems to be a promising approach to enhance students' motivation (Baer 2017; Kapp 2012). A high number of students indicate that they would be more productive if it was more game-like (JoyTunes 2015). However, the creation of a full-fledged game that is highly engaging represents a difficult, time consuming, and costly task (Kapp 2012). A game may solely target a single set of learning objectives that are chosen by the game designer. An effective adaption to the specific course requests a technical infrastructure and reasonable pedagogical integration. In contrast to implementing complex games that require both high design and development efforts, the gamification approach proposes to implement game thinking and game elements to enhance individuals' motivation and engagement (Baer 2017; Dicheva et al. 2015; Kapp 2012). Gamification aims to take advantage of the beneficial effects of games in order to support individuals in performing desired activities (e.g., studying) and achieving personal goals linked to behave in a certain way (Barata et al. 2013, 2017; McGonigal 2012, pp. 159, 166, and 170-171). For instance, a high number of individuals stated that the implementation of a points system and leaderboards would enhance their motivation and engagement with a learning application (JoyTunes 2015). Gamification do not solely support learners to acquire knowledge and skills more effectively. It also helps them to retain information and commit the knowledge to long-term memory for using it in the future (JoyTunes 2015). The benefits of successful implemented gamification initiatives are to stimulate students to discover instrinsic motivators for learning (JoyTunes 2015).

In practice, many online higher education platforms have already implemented game elements to increase user engagement. For instance, Khan Academy is a nonprofit organization that provides free education to everyone (Khan Academy 2018a). They have nearly 12 million learners every month (Khan Academy 2017). Learners can choose from a wide range of courses such as math, science, finance, and economics (Khan Academy 2018a).

In order to increase user engagement and retention, users have the possibility to earn a high number of different badges in different categories. For instance, users earn the badge power hour if they answer 90 problems correctly and watch 15 minutes of video in one hour (Khan Academy 2018b). In addition, users receive points for answering questions correctly and can reach different levels within one particular course (Khan Academy 2018c).

DataCamp represents a platform where users can increase their skills in data science. Users have the possibility to choose from over 100 courses such as introduction to R, advanced Python, and Structured Query Language (SQL) (DataCamp 2018). Users can earn points for correctly answering questions, see their position on the leaderboard compared to other users as well as receive day streaks for completed practices (see Figure 10).

Figure 10: Sample screenshots of DataCamp platform



Source: Sample screenshots of DataCamp platform (2018).

Taken together, these higher education platforms attempt to motivate user activity and user retention. With the implementation of gamification, companies aim to motivate individuals for continuous learning. However, online higher education sites as well as educators at universities face the challenge of evaluating the effectiveness of gamification. First of all, they need to assess whether the implementation of gamification is an effective way of providing guidance and feedback in order to enhance individuals' learning performance. They have to analyze whether the implementation of gamification adds value to the learner and encourages him/her to continuous learning. Besides value to the

learner, gamification has to generate value to educators such as higher retention rates for online higher education. One value for educators at universities may represent the possibility to provide guidance and immediate feedback in situations where a face-to-face interaction is not feasible resulting in satisfied students who are attached to their alma mater.

So far, online higher education sites and educators in university courses use a set of several game elements. Thus, they cannot disentangle the influence of specific game elements on learning motivation and behavior. However, it is important for online higher education sites and educators at universities to evaluate what types of gamification are most effective in their specific context, for what type of learner and why. The resulting knowledge helps them to provide a gamification design that is most suitable to increase individuals' continuous learning motivation and behavioral (re)action.

Based on the literature review in chapter 3, three important research gaps are identified. First, an investigation of the effects of specific game elements is needed instead of considering gamification as a uniform concept. Second, existing research neglects examining psychological mediators (i.e., motivation) and behavioral outcomes. Hence, these studies do not aim to investigate the underlying motivational mechanisms by applying the self-determination theory. Third, current research considering the moderating effect of individual characteristics is scarce. Yet, the same trigger (i.e., game element) may be experienced differently by different individuals (Bui, Veit, and Webster 2015; Kankanhalli et al. 2012; Ryan and Deci 2017, p. 220 and p. 238).

In order to address the aforementioned three research gaps the aim of the first study is to *investigate the effectiveness of gamification in higher education.*

More specifically, the study examines the effects of the implementation of different game elements on (i) students' motivation to learn moderated by individual characteristics, (ii) their participation in the course (i.e., in online tutorials), and (iii) the exam results as the primary learning performance. The implementation of specific game elements may affect students' motivation by influencing competence and consequently their intrinsic motivation (i.e., enjoyment) to participate in the course. Intrinsic motivation (i.e., enjoyment) may influence the intensity of participation in the course and this subsequently may affect the course performance (i.e., exam result) at the end of the semester.

This study aims to enrich current research by comparing the effectiveness of established game elements (i.e., points, badges, and leaderboard) instead of investigating the effect of a gamified course as a whole. The study provides insights from applying the self-determination theory as a theoretical foundation in order to explain the underlying motivational mechanisms. The effects of specific game elements on the mediating psychological (i.e., motivation) and subsequently behavioral outcomes are examined. Finally, the study contributes to current research by examining the moderating effect of personality characteristics and gender.

Besides the theoretical contribution, practice gains fruitful insights as well. Based on the results, organizations such as educators at universities or online learning platforms can design their courses in a more effective way by making the learning process more interesting and enjoyable. By ameliorating the course design, the quantity and quality of both course participation and final exam may increase. Even in courses where personal interaction is limited (i.e., bachelor course with 600 students), gamification may be an appropriate way to provide immediate feedback and guidance. Compared to costly implementations of full-fledged games, the integration of specific game elements may be a more efficient alternative to reach comparable results.

4.2 Literature Review on Gamification in Education

Gamification designed for educational purposes is a relatively new phenomenon (De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). Besides a substantial body of knowledge on gamified learning, empirical studies about student motivation and performance are still scarce (Barata et al. 2017). There is a widespread call in the literature for further empirical research implementing game elements in the learning environment (Attali and Arieli-Attali 2015; Buckley and Doyle 2017; Dicheva et al. 2015). Based on the literature review in chapter 3, 18 studies were identified that investigate gamification in education (see Table 7).

Table 7: Studies focusing on gamification in education

Study	Gamification	Survey/ experiment	Actual users	Competence	Autonomy	Relatedness	Intrinsic motivation / enjoyment	Attitude gamification	Behavioral intention	Actual behavior	Demographics	Personality characteristics
Studies considering satisfaction of basic psychological needs												
Zainuddin 2018	U	E	X	X	X	X				X		
Studies considering motivation												
Hanus and Fox 2015	U	E	X				X	X		X		
Kyewski and Krämer 2018	S	E	X				X			X		
Santhanam, Liu, and Shen 2016	S	E					X			X		
Studies considering attitudinal (re)actions and behavioral intentions												
Landers and Armstrong 2017	U	E	X					X				X
Studies considering actual behavioral (re)actions												
Albuquerque et al. 2017	S	E								X		
Attali and Arieli-Attali 2015	S	E	X							X	X	
Çakıroğlu et al. 2017	U	E	X							X		
Christy and Fox 2014	S	E								X		
De-Marcos et al. 2014	U	E	X							X		
De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016	U	E	X							X		
Denny 2013	S	E	X							X		
Domínguez et al. 2013	U	E	X							X		
Hakulinen, Auvinen, and Korhonen 2013	S	E	X							X		
Hew et al. 2016	U	E	X							X		
Huang and Hew 2018	U	E	X							X		
Tenório et al. 2016	U	E	X							X		
Tsay, Kofinas, and Luo 2018	U	E	X							X		

S = Studies focusing on specific game elements
U = Studies considering gamification as a uniform concept
E = Experiment

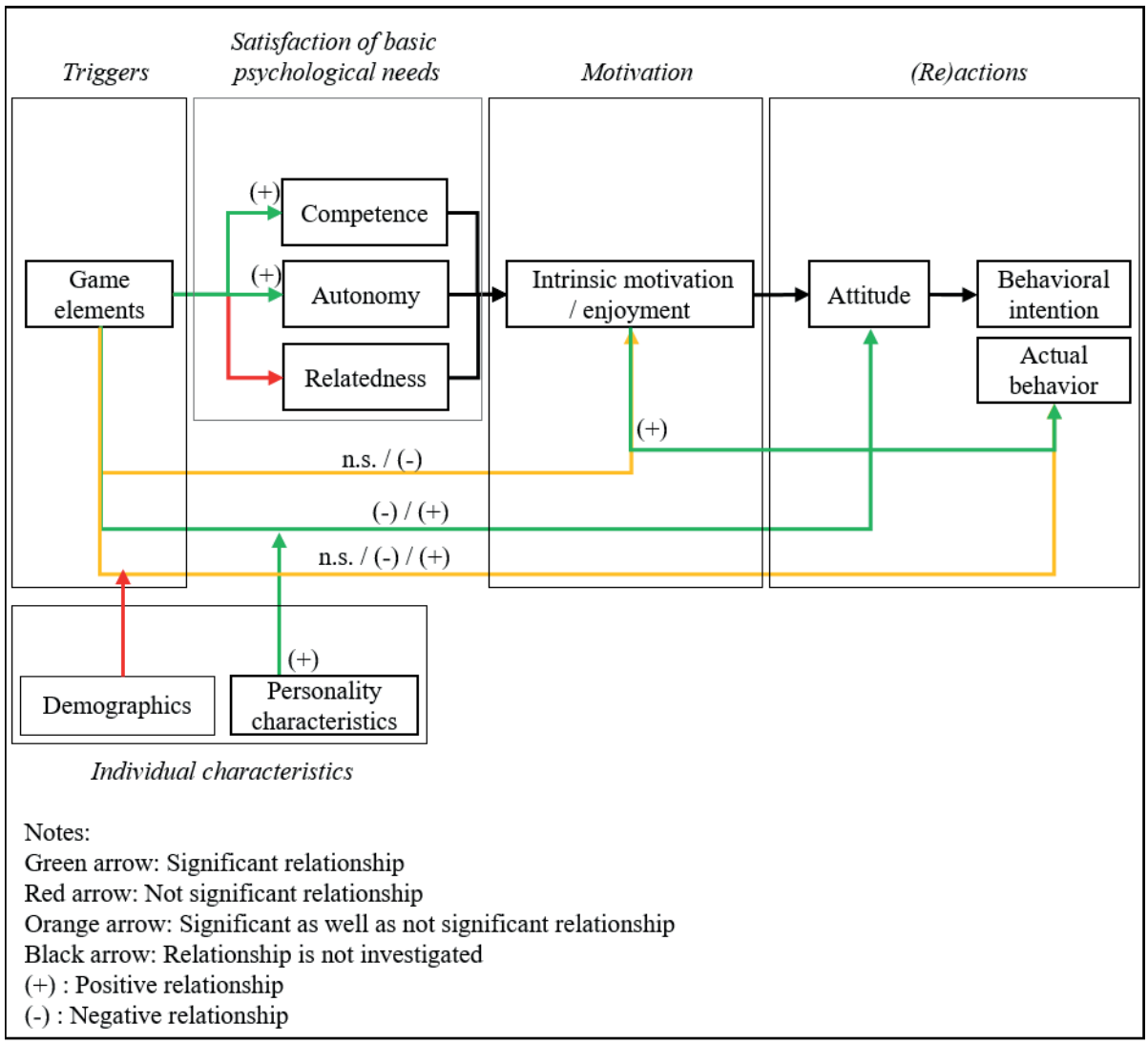
Source: Author's own illustration.

The majority of studies (i.e., 11 out of 18) considers gamification as a uniform concept. Seven studies focus on the examination of specific game elements such as avatars, badges, competition, points and leaderboard (e.g., Attali and Arieli-Attali 2015; Denny 2013). Overall, badges represent the game element that is investigated the most in the educational context (e.g., Denny 2013; Hakulinen, Auvinen, and Korhonen 2013; Kyewski and Krämer 2018). The majority of studies in education focuses on behavioral outcomes and neglect

an investigation of motivation. One study investigates the three basic psychological needs and instrinsic motivation is examined by three studies (Hanus and Fox 2015; Kyewski and Krämer 2018; Santhanam, Liu, and Shen 2016; Zainuddin 2018). Moreover, two studies take attitude into account (Hanus and Fox 2015; Landers and Armstrong 2017). Besides one study, all studies investigate actual behavior.

Figure 11 summarizes the findings of the 18 studies. However, no single study has examined the framework as a whole. The red arrows demonstrate that the relationship is not significant (n.s.). The green arrows emphasize significant relationships. The orange arrows illustrate that studies find significant as well as insignificant results for these relationships. The positive and negative signs indicate the direction of the relationship. The black arrows display relationships that have not been investigated so far. The results of the studies are discussed in the following.

Figure 11: Gamification in education – results of the studies



Source: Author's own illustration.

The study of Zainuddin (2018) reveals a positive effect of gamification on the *basic psychological needs autonomy* and *competence*. The effect on relatedness is not significant besides of one item (Zainuddin 2018). The influence of the basic psychological needs on *intrinsic motivation* is not investigated so far.

The results of studies that examine the relationships between gamification and *intrinsic motivation/enjoyment* are mixed. Whereas Hanus and Fox (2015) reveal a significant negative direct effect of a gamified course on intrinsic motivation, the effects of competitive structures and badges are not significant (Kyewski and Krämer 2018; Santhanam, Liu, and Shen 2016).

Considering the studies of Hanus and Fox (2015) and Zainuddin (2018), it does not become clear what game elements are responsible for the positive effect on competence and autonomy as well as the negative effect on intrinsic motivation. Due to the fact that Hanus and Fox (2015) measure intrinsic motivation without further differentiation, it is not possible to differentiate the effect of the gamified course on the drivers of intrinsic motivation (i.e., basic psychological needs). Consequently, more profound research is needed to investigate the influence of specific game elements on basic psychological needs and intrinsic motivation e.g., by applying the self-determination theory as a theoretical foundation.

None of the studies investigates the effect of intrinsic motivation on *attitude*. Studies examining the effect of gamification on *attitude* detect significant positive as well as negative effects (Hanus and Fox 2015; Landers and Armstrong 2017). A further investigation of the influence of attitude on *behavioral intention* is lacking.

The effect of intrinsic motivation on *actual behavior* is solely investigated by Hanus and Fox (2015). They reveal a significant positive effect of intrinsic motivation on the quality of action (i.e., final exam) (Hanus and Fox 2015).

Finally, almost all studies investigate the effect of gamification on actual behavior. Regarding the *quantity of action*, the majority of studies that considers gamification as a uniform concept shows a positive significant effect on individuals' engagement (e.g., Çakıroğlu et al. 2017; Hew et al. 2016; Huang and Hew 2018; Tenório et al. 2016). The sole negative effect was demonstrated by the study of De-Marcos et al. (2014). Badges have a significant positive as well as insignificant effect on the *quantity of action* (Denny 2013; Kyewski and Krämer 2018). Points have a significant positive effect on the speed of responses (Attali and Arieli-Attali 2015).

Considering the *quality of action*, predominantly positive effects can be stated for gamified courses as well as leaderboards (e.g., Christy and Fox 2014; Huang and Hew 2018; Tsay, Kofinas, and Luo 2018; Zainuddin 2018). For instance, students in a gamified course achieve significantly better results in most of the assignments that they are supposed to do during the semester compared to individuals in a non-gamified course (De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016; Domínguez et al. 2013; Zainuddin 2018). By

implementing a social component, even better results than the gamified course alone can be demonstrated. Students facing a social treatment (i.e., venue where they have the possibility to interact or discuss about learning materials (e.g., commenting, liking, and chats)) or a combination with the gamified course indicate even better significant outcomes than the gamified course alone (De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). A gamified course combined with a social treatment does not reveal a significant difference from the control group regarding the final exam (De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016). However, the effect of a gamified course on the final exam is significant negative (e.g., De-Marcos et al. 2014; De-Marcos, Garcia-Lopez, and Garcia-Cabot 2016; Domínguez et al. 2013). The influence of a gamified course on the final grade is either significant positive or insignificant (e.g., Domínguez et al. 2013; Tsay, Kofinas, and Luo 2018). The influence of points on the quality of action is not significant, whereas the effect of badges is significant positive as well as insignificant (e.g., Attali and Arieli-Attali 2015; Hakulinen, Auvinen, and Korhonen 2013; Kyewski and Krämer 2018). Individuals matched with lower-skilled competitors partially show significant higher levels of learning outcomes compared to individuals matched with an equally or higher skilled competitor (Santhanam, Liu, and Shen 2016). Moreover, there is no significant effect on academic performance when comparing the effect of choosing an avatar in a stereotype version compared to a non-stereotype version (Albuquerque et al. 2017).

Individual characteristics are investigated by two studies (i.e., Attali and Arieli-Attali 2015; Landers and Armstrong 2017). The moderating effects of video game experience and of attitude towards game-based learning regarding the relationship of gamification on attitude towards gamification is significant positive (Landers and Armstrong 2017). Gender does not significantly moderate the effect of points on the accuracy and speed of responses (Attali and Arieli-Attali 2015). Besides these studies, further studies underline the importance of investigating personality characteristics and demographics without explicitly investigating the moderating effect (e.g., Denny 2013; Hanus and Fox 2015). It is widely acknowledged that personality characteristics significantly influence academic achievement. Individuals interact differently with educational material and react differently to behavioral triggers.

Information about how individual characteristics affect the experience of gamification provides important knowledge for designing gamified learning interventions and facilitates an effective implementation in the learning environment (Buckley and Doyle 2017).

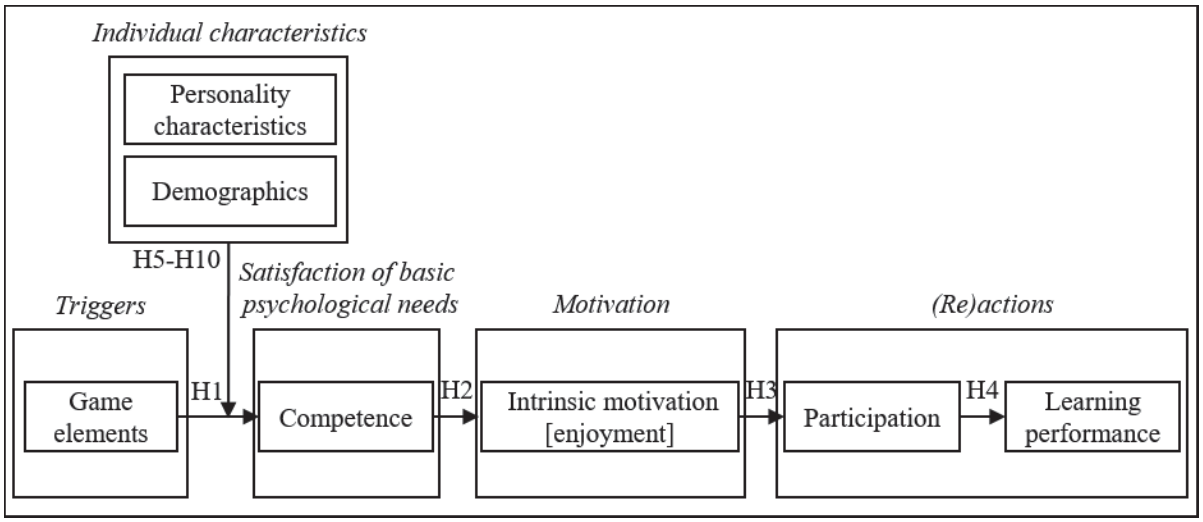
Overall, more profound research is needed that investigates specific game elements in order to compare their respective effectiveness (Hanus and Fox 2015). So far, specific game elements such as points, badges, leaderboards, avatars, and competition have been investigated (e.g., Albuquerque et al. 2017; Hakulinen, Auvinen, and Korhonen 2013). The effects of points, badges, and leaderboards have already been investigated compared to a control group that does not include these elements (e.g., Attali and Arieli-Attali 2015; Kyewski and Krämer 2018). However, a comparison of the effectiveness of these specific game elements in one study is lacking. Across all gamification studies (i.e., considering gamification as a uniform concept and focusing on specific game elements), points, badges, and leaderboards represent the game elements that have been investigated the most in current gamification research (Hamari, Koivisto, and Sarsa 2014). Due to the fact that the implementation of points, badges and leaderboards has a positive effect on learning outcomes, it seems intuitive to start with a comparison of the effectiveness of these three game elements. These elements primarily evoke a gameful experience of skill development or social comparison (Wolf, Weiger, and Hammerschmidt 2018).

Moreover, studies considering specific game elements do not focus on the investigation of mediating psychological (i.e., motivation) and behavioral outcomes and the moderating effect of personality characteristics. Hence, the following study addresses these research gaps.

4.3 Conceptual Framework and Hypotheses

The following section derives the conceptual framework as well as the hypotheses for the first study (see Figure 12). The aim of integrating specific game elements in higher education is to enhance students' competence and intrinsic motivation (i.e., enjoyment). An increase in motivation may has a positive effect on students' (re)actions (i.e., participation in online tutorials and learning performance).

Figure 12: Conceptual framework of study 1



Source: Author's own illustration.

Based on the self-determination theory, triggers (i.e., game elements) have a positive influence on competence when they are experienced as providing an informational functional significance (Deci and Ryan 1980, pp. 62-65). Competence reflects "a need for challenge and feelings of effectance" while consciously interacting with the environment (Ryan and Deci 2000b; Ryan, Rigby, and Przybylski 2006, p. 349; White 1959). Hence, triggers that reinforce a feeling of competence (i.e., achieving new skills, facing challenges, or obtain positive feedback) increase the perception of competence. This subsequently drives intrinsic motivation independently from other basic psychological needs (Deci and Ryan 1980, p. 42 and pp. 61-64; Deci and Ryan 2000a; Gagné and Deci 2005; IMI 2018; Ryan, Rigby, and Przybylski 2006; Sheldon and Filak 2008). For instance, feedback provided by game elements may inform individuals about their achievements and progress (i.e., rewards such as points or badges as well as achieving a certain rank on a leaderboard) (Sailer et al. 2017). Consequently, when game elements (i.e., points, badges, and leaderboards) are experienced as informational feedback and as competence supporting, intrinsic motivation may be enhanced even in the presence of extrinsic factors (Gagné and Deci 2005; Ryan and Deci 2000a; b). However, triggers (i.e., game elements) can also be perceived as controlling (Ryan and Deci 2000a; b; Ryan and Deci 2017, p. 247). In the following, a reasoning is provided why game elements (e.g., points and badges) represent small rewards that are not assumed to be perceived as controlling.

In line with the self-determination theory, the concept of justification (related to the theory of cognitive dissonance) provides an argumentation that the high informational aspect of small rewards (i.e., game elements) outweighs the controlling aspect (Aronson, Wilson, and Robin 2014, pp. 181-182; Deci 1975, pp. 161-165; Garaus, Furtmüller, and Güttel 2016). The theory basically assumes that individuals do not feel comfortable when they observe two or more conflicting cognitions (Festinger 1978, pp. 15-19). Hence, individuals that earn small rewards may experience their compensation as insufficient and perceive cognitive dissonance (Garaus, Furtmüller, and Güttel 2016; Weick 1964). In order to rebuild consonance, individuals may reconsider the situation. They end the insufficient rewarded behavior as soon as they detect that their effort does not account for the benefits. A reduction of dissonance can be achieved by stopping the behavior in question or by the development of interest as well as a detection of enjoyment in the activity (Festinger 1978, pp. 16-20; Festinger and Carlsmith 1959). The controlling aspect is restricted or even reversed. Individuals that are autonomously motivated (i.e., intrinsic motivation and autonomous forms of extrinsic motivation) acquire knowledge because they understand the importance of the task content (i.e., course) and justify their behavior internally (Aronson, Wilson, and Robin 2014, pp. 181-182; Garaus, Furtmüller, and Güttel 2016).

Hence, triggers such as small rewards are experienced as not sufficient enough to fully justify individuals' exerting effort and engagement in the task (Aronson, Wilson, and Robin 2014, pp. 181-182; Deci 1975, pp. 161-165; Garaus, Furtmüller, and Güttel 2016). This is in line with the argumentation of Ryan and Deci (2017, p. 145) that small rewards rather acknowledge or encourage behavior in contrast to externally motivate it. Small rewards are not powerful enough to regulate behavior in an external way. The functional significance is not controlling but informational (Ryan and Deci 2017, p. 145).

Consequently, triggers such as small rewards may increase competence and subsequently intrinsic motivation (i.e., enjoyment) for two reasons. Firstly, small rewards do not completely justify the effort to perform the task. Individuals do not attribute their behavior to the means of winning rewards (i.e., external justification of learning) (Garaus, Furtmüller, and Güttel 2016). They need to justify their behavior by internal justification such as liking (Garaus, Furtmüller, and Güttel 2016). Secondly, rewards serve as a feedback

mechanism for individuals because individuals' behavior is rewarded based on their performance. Performance rewards influence the individuals' reflection on their actual degree to which they have already mastered a certain task and subsequently enable them to detect areas for improvement. These rewards may have a high informational value.

In line with the self-determination theory, Wolf, Weiger, and Hammerschmidt (2018) presume that triggers (i.e., game elements) that satisfy the need for competence evoke a gameful experience of skill development. The reason behind this is that individuals experience their behavior as effective when attaining personal goals, make progress, or meet challenging tasks (Wolf, Weiger, and Hammerschmidt 2018). Perceptions of achievement, challenge, and progress are associated with the factor of skill development (Wolf, Weiger, and Hammerschmidt 2018).

Besides rewards (i.e., points, and badges) that do not provide the possibility to compare to others, further game elements (i.e., leaderboard) can provide feedback by enabling individuals to directly compare their performance (Sailer et al. 2017). Hence, a gameful experience of social comparison (i.e., feeling of competition and status) can be evoked (Wolf, Weiger, and Hammerschmidt 2018). According to the self-determination theory, triggers such as direct competition can have informational as well as controlling aspects (Ryan and Deci 2017, p. 488). The informational aspect refers to the idea that competitive environments provide optimal challenges and competence feedback. Joy in competition results from both immediate feedback and feedback in terms of scores. This feedback stems from individuals performing against opponents who also attempt to do their best. Competitions have controlling aspects when an individual has the feeling that (s)he has to win. This kind of pressure can either come from others (e.g., parents, coaches, and teammates) or from ego involvement (Ryan 1982; Ryan and Deci 2017, pp. 488-489; Ryan, Koestner, and Deci 1991). The more controlling the trigger is perceived by an individual, the more the situation turns into being instrumental to an outcome (i.e., winning). This changes an individuals' relation to the activity.

Whereas competitive settings that are experienced as pressure to win, are expected to reduce intrinsic motivation, settings that concentrate on task involvement and mastery are supposed to maintain or increase intrinsic motivation (Ryan and Deci 2017, p. 488).

The actual position an individual has on the leaderboard may provide opportunities for upward and downward comparisons. Research about upward and downward comparison lead to controversial outcomes, showing positive and negative effects of up- and downward comparisons (Blanton et al. 1999; Dijkstra et al. 2008). For instance, individuals having a high position on the leaderboard may have a feeling of being superior. One the other site, these individuals may perceive pressure to maintain position. They may suffer under that pressure (Wells and Skowronski 2012). Independent of individuals positioning, competition (e.g., leaderboards) may lead to positive outcomes.

In summary, while competition (i.e., leaderboard) may have positive as well as negative effects on individuals' competence, research shows that competition in an autonomous context makes individuals resilient to failure and rather affect a sense of self-efficacy by stimulating individuals to achieve higher scores (Suh and Wagner 2017).

Taken together, game elements that provide individuals with specific feedback on their performance may evoke a feeling of competence (Sailer et al. 2017). Hence, competence supportive rewards and competition that evoke gameful experiences of skill development and social comparison will have a positive effect on competence and subsequently intrinsic motivation (i.e., enjoyment).[13]

H1: Game elements evoking gameful experiences of skill development or social comparison have a positive influence on competence compared to the control condition.

H2: Competence has a positive influence on intrinsic motivation (i.e., enjoyment).

In line with the self-determination theory, individuals that are autonomously motivated (i.e., intrinsic motivation and autonomous forms of extrinsic motivation) are more likely to show a high level of engagement, higher quality of learning, and persistence (Deci and Ryan 2000; Grolnick and Ryan 1987; Huang and Hew 2018; Ryan and Deci 2000a; Vallerand and Bissonnette 1992). Individuals are becoming more engaged in an activity when they experience hedonic values while performing it (Deci and Ryan 1985b; Deci and

[13] There are no theoretical explanations regarding which game element has a stronger influence on competence compared to the others. This remains an open empirical question.

Ryan 2000). Enjoyment represents the degree to which an individual executes an activity because (s)he experiences it as providing joy in its own sake (Davis, Bagozzi, and Warshaw 1992; Deci 1971). Individuals' perceived enjoyment of using a system represent an important positive factor in influencing continuous use intention (e.g., Davis, Bagozzi, and Warshaw 1992; Hamari 2015; Heijden 2004; Lin and Lu 2011).

Besides its influence on intention, intrinsic motivation (i.e., enjoyment) also represents a moderate to strong antecedent of the quantity and quality of performance (Cerasoli, Nicklin, and Ford 2014). More specifically, the motivation to learn represents a robust antecedent of desirable learning outcomes among students such as declarative knowledge (i.e., grade) (Colquitt, LePine, and Noe 2000; Klein, Noe, and Wang 2006). Hence, there is a positive relationship between motivation to learn and learning outcomes (e.g., Martocchio and Webster 1992; Mathieu, Tannenbaum, and Salas 1992; Noe and Schmitt 1986; Quinones 1995). For instance, Gottfried (1985) shows that academic intrinsic motivation (measured as enjoyment of learning) is positively correlated with children's school achievements. Hanus and Fox (2015) demonstrate a positive effect of intrinsic motivation on students' final exam score. If individuals show interest and enjoyment in the subject of the course, they may spend more time and energy on doing their studies. Subsequently, they show a higher performance level (Harackiewicz, Barron, and Elliot 1998).

Moreover, individuals who practice and engage more often with a task show a higher performance than those who don't (Crede, Roch, and Kieszczynka 2010; Ericsson, Krampe, and Tesch-Römer 1993). Individuals' time spend on the task is the strongest antecedent of performance (Fisher and Ford 1998; Rodgers 2002; Romer 1993; Schmidt 1983; Thatcher, Fridjhon, and Cockcroft 2007).

Thus, a higher intrinsic motivation (i.e., enjoyment) in participating in higher education has a positive influence on students' re(actions). Individuals that perceive higher education as more enjoyable will engage more in the course and consequently achieve a better learning performance.

H3: Intrinsic motivation (i.e., enjoyment) has a positive influence on participation.

H4a: Participation has a positive influence on learning performance.

Besides considering the single direct effects of the conceptual framework, a mediation effect is postulated.

H4b: The positive effect of game elements evoking gameful experiences of skill development or social comparison on learning performance is fully, serially mediated by (a) an increase in competence, (b) an increase in intrinsic motivation (i.e., enjoyment), and (c) and an increase in participation.

According to causality orientations theory, individuals differ in their extent to which they perceive triggers (i.e., game elements) as informational or controlling (Deci and Ryan 1985a, p. 153; Ryan and Deci 2017, pp. 216-220). Hence, individual characteristics may act as moderators of the effect of game elements on competence. The following individual characteristics that may influence the strength of the relationship between game elements evoking skill development or social comparison and competence are discussed: gender, extraversion, conscientiousness, competition, status, and expertise.

Several studies show that men report more game-related knowledge, play more frequently, and for longer durations than women do (e.g., Brown et al. 1997; Ivory 2006; Lucas and Sherry 2004; Wright et al. 2001). The study of Hartmann and Klimmt (2006) shows gender-specific game preferences. For instance, women find competitive elements less appealing than men (Hartmann and Klimmt 2006; Lucas and Sherry 2004). The underlying reason may be that men are supposed to be more achievement oriented (Williams, Yee, and Caplan 2008; Williams et al. 2009) and more competitive than women. In addition, men have a higher need for winning (Hartmann and Klimmt 2006). Women perceive competitive activities as less attractive than men do. They are sometimes even afraid to participate in competitive activities (e.g., Lucas and Sherry 2004).

Based on these different perceptions, it seems to be important to take gender into account in an examination of the effects of gamification (Attali and Arieli-Attali 2015). Transferred to the gamification context, this indicates that men may be more spurred by game elements that evoke gameful experiences of skill development and social comparison because of their higher achieve-

ment and competition orientation. Hence, they may perceive the game elements that evoke an experience of skill development or social comparison as less controlling and more informational than women do.

Consequently, the effects of skill development and social comparison on competence will be stronger for men. Therefore, the following hypotheses are stated:

H5a: The positive effect of game elements evoking a gameful experience of skill development on competence is stronger for men than for women.

H5b: The positive effect of game elements evoking a gameful experience of social comparison on competence is stronger for men than for women.

It has widely been investigated that personality traits significantly affect individuals' academic achievement (Poropat 2009). The knowledge about how personality traits affect the experience of gamification may provide information about the effectiveness of gamified learning interventions. This knowledge enables an effective implementation into the learning environment (Buckley and Doyle 2017). The Five Factor Model (i.e., extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience) is the most widely used model for providing a consistent taxonomy of personality traits (Buckley and Doyle 2017; Digman 1990; McCrae and Costa 1987).

Buckley and Doyle (2017) have already investigated the five personality traits in the context of a gamified learning intervention. They demonstrate a significant correlation between extraversion and conscientiousness on the perception of gamification (Buckley and Doyle 2017). Consequently, the focus of this study lies on the investigation of the moderating effect of these two personality traits.

Extraverted individuals are outgoing and energetic. Moreover, extraversion is connected with individuals that receive stimulation and satisfaction from outside the self. Individuals with low extraversion show a more solitary and reserved personality (Barrick, Mount, and Strauss 1993; Buckley and Doyle 2017). Extraverted individuals who derive satisfaction and energy from triggers (i.e., external stimuli) may perceive gamified learning interventions as rewarding (Buckley and Doyle 2017; Lucas et al. 2000). Hence, extraversion is positively correlated with the perception of gamification (Buckley and

Doyle 2017). With regard to the causality orientations theory, extraverted individuals are used to receive energy from triggers (i.e., game elements) and may perceive them as primarily informational and not controlling.

Orderliness, self-discipline, and the aim for achievement reflect the trait conscientiousness (Barrick, Mount, and Strauss 1993; Buckley and Doyle 2017; McCrae and Costa 1987). Individuals who favor structure and order may perceive cognitive dissonance when facing gamification. The utilization of gamification (i.e., association with play) in a pedagogical environment (i.e., association with work) produce cognitive dissonance (Buckley and Doyle 2017). Hence, conscientiousness is negatively correlated with the perception of gamification (Buckley and Doyle 2017). High conscientious individuals may perceive game elements as less informational.

Consequently, the personality traits conscientiousness and extraversion may weaken and respectively strengthen the effect of skill development and social comparison on competence. Therefore, the following hypotheses are derived:

H6a: The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's level of extraversion.

H6b: The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's level of extraversion.

H7a: The positive effect of game elements evoking a gameful experience of skill development on competence is weakened by individual's level of conscientiousness.

H7b: The positive effect of game elements evoking a gameful experience of social comparison on competence is weakened by individual's level of conscientiousness.

The gameful experience dimension of social comparison is strongly associated with competition and status (Wolf, Weiger, and Hammerschmidt 2018). It has been widely acknowledged that some individuals are more competitive than others. Thus, competition orientation represents a personality factor (Franken and Brown 1995; Hartmann and Klimmt 2006; McClintock 1972; Song et al. 2013). Competitive individuals are also known as other-referenced individuals

because they are motivated by social comparison. Their primary aim is to demonstrate better capacity and competence by performing better than other individuals (Albert 1977; Van de Vliert and Janssen 2002).

Individuals have either a general preference for competition in all life domains or they favor a competition solely in specific contexts, such as knowledge domains (e.g., Hartmann and Klimmt 2006; McClintock 1972). For instance, studies have already shown that competitive situations in games are experienced in a positive way for competitive individuals and harm less competitive participants (e.g., Song et al. 2013).

Besides a desire for competition, the desire for status is an important motivator of individuals' contributions to a group (Anderson et al. 2001; Anderson, Hildreth, and Howland 2015; Rheingold 1993, p. 37 and p. 54; Wang and Fesenmaier 2003). Status can be defined as the degree to which an individual is respected and highly regarded in the eyes of other individuals (Goldhamer and Shils 1939; Torelli et al. 2014). The factors of respect, admiration, and voluntary deference individuals receive from others represent characteristics of status (Anderson, Hildreth, and Howland 2015). Moreover, prestige is related to status. It refers to status that is giving to individuals by being recognized and respected regarding their skills, success, or knowledge (Cheng, Tracy, and Henrich 2010).

Individuals attend to the subtlest indicators of status and pay a high attention to status symbols. For achieving a higher status, individuals show a high engagement in several activities such as working in order to develop more expertise and competence. They primarily choose social environments that provide them with higher status (Anderson, Hildreth, and Howland 2015; Torelli et al. 2014). The ways through which individuals attempt to achieve higher status may be different and dependent on what is locally valued. Status seeking and the importance to well-being hold up across individuals. However, there are individual differences in the strength of the status motive (Anderson, Hildreth, and Howland 2015).

Both personality characteristics (i.e., desire for competition and status) seem to be important for investigation in the context of social comparison. The strength of the influence of game elements evoking social comparison may be influenced by the level of competition and the individual desire for status.

Individuals with a high competition level and a high desire for achieving status may value game elements that enable social comparison to a greater extent and experience them as informational rather than controlling. Based on these explanations, the following hypotheses are derived.

H8: The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's perceived importance of being in a competition.

H9: The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's desire for status.

Expertise can be defined as individuals' ability to successfully perform a product-related task (Alba and Hutchinson 1987). For instance, expertise helps individuals to interpret stimulus information in order to simplify the meaning of a message in an easy and accurate way. It provides individuals with knowledge to reject inappropriate pragmatic implications (Alba and Hutchinson 1987). Expertise helps individuals by comprehending the relationship of an assertion to another with a small amount of effort. As a result, expertise enhances individuals' accuracy in the generation of product beliefs by increasing the probability of analytic thought and by diminishing overgeneralization from known facts (Alba and Hutchinson 1987).

Individuals having a high expertise in a specific field may experience a high level of confidence in their ability to learn a topic, solve problems, and may be more persistent (e.g., Gupta, Bostrom, and Huber 2010; Johnson and Marakas 2000; Santhanam, Liu, and Shen 2016; Yi and Davis 2003). Individuals' belief of being able to successfully deal with a given task may motivate them to invest more energy to solve it. Individuals that feel incapable of handling the current situation because of a lack of expertise in the subject perceive themselves as less competent even if the gameful experience of skill development is high. They may not perceive game elements as supportive by providing informational feedback.

Consequently, individuals' expertise in studying in general (i.e., grade point average (GPA)) and the expertise in the specific course may strengthen the effect of skill development on competence.

H10a: The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise in studying (i.e., GPA).

H10b: The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise in the subject of the course (i.e., marketing).

4.4 Empirical Study

In this study, the design of the empirical study is described. The main variables for investigating the hypotheses are operationalized. The result section encompasses descriptive statistics as well as the analysis of hypotheses. The section ends with a discussion of the results.

4.4.1 Design of Empirical Study

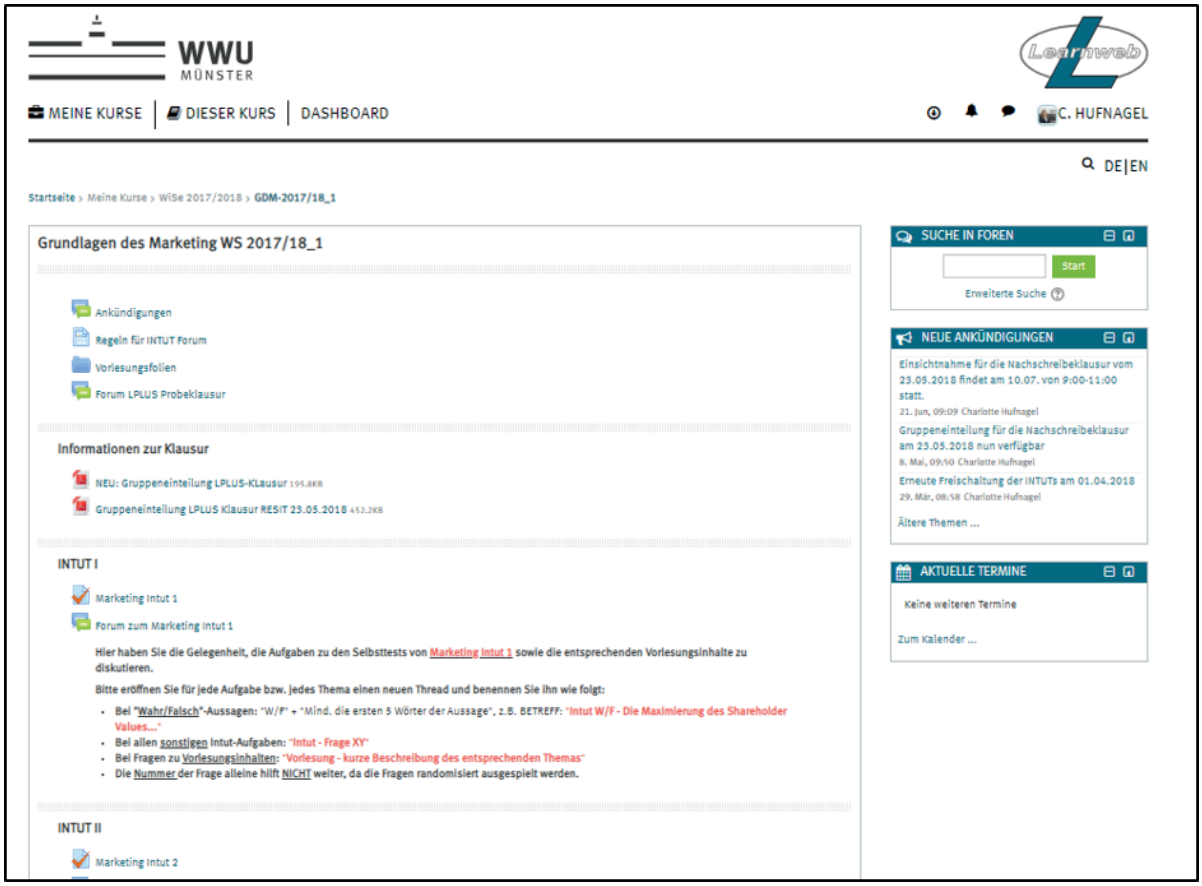
In line with the defined research aim – the examination of gamification effectiveness in higher education – a field experiment was conducted to test the proposed conceptual framework. The field experiment took place during the winter semester 2017/2018. Participants were second-year bachelor students enrolled in the core marketing course at the Westfälischen Wilhelms-University Münster. This course is mandatory for all students studying business administration, information systems, and economics. The course took place in a lecture hall once a week.

The course is appropriate for investigating the research aim because approximately 600 students participate in the course each year. Due to this high number of students, it is not feasible to provide each student with face-to-face feedback about their performance in order to encourage their learning motivation. The anonymous atmosphere in the large lecture hall additionally contributes to these difficulties of feedback provision and learning encouragement.

Complementary to the lecture, the online learning platform Learnweb (based on Moodle) was used. On Learnweb (see Figure 13), students had the possibility to download their lecture slides, receive announcements, and post questions concerning the course in corresponding forums.

Most importantly, they had the possibility to participate in online tutorials (INTUT[14]) related to the content of the lecture. These INTUTs represent a suitable tool for students to test their knowledge throughout the semester. Students could freely decide whether to participate in the INTUTs representing a high level of autonomy. Thus, these INTUTs are established within an autonomy-supportive learning climate.

Figure 13: Learnweb platform

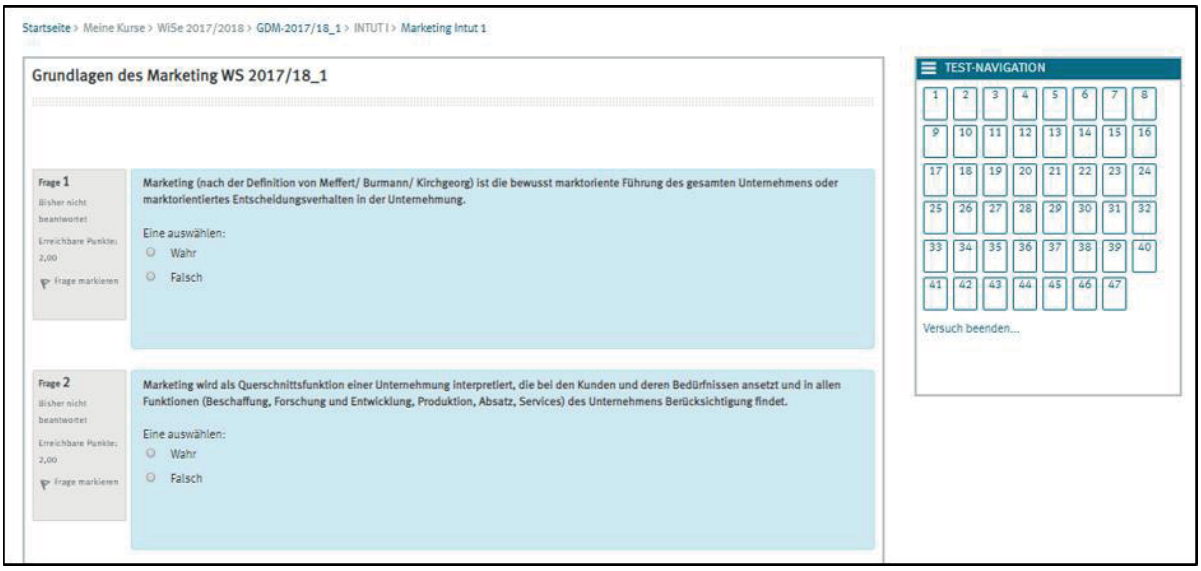


Source: Author's own illustration.

Over the course of the semester, there are four INTUTs, each consisting of 46 questions (i.e., multiple choice questions, computational tasks, and cloze). Each INTUT covers the content of the two lectures preceding the respective INTUT. These tasks were created in close coordination with the lecture content in order to ensure a good supplement to the lecture. An example of questions is shown in Figure 14.

[14] Actually, INTUT is the abbreviation for internet tutorials. In the following course of the thesis, INTUTs are considered to be a type of online tutorials.

Figure 14: Example of INTUT questions



Source: Author's own illustration.

The INTUTS were opened after the second lecture that was part of the corresponding INTUT. They remained open for two weeks (see Table 8 for the exact dates).

Table 8: Overview of INTUT dates

	Start	End
INTUT 1	23.10.2017	05.11.2017
INTUT 2	20.11.2017	03.12.2017
INTUT 3	11.12.2017	07.01.2018
INTUT 4	15.01.2018	27.01.2018

Source: Author's own illustration.

Students had the possibility to repeat the INTUTs as many times as they liked. If students answered a question incorrectly, they received a reference to where they would find the necessary information to answer the question correctly. The difficulty level was equal for all INTUTs. The INTUTs were opened again after the last lecture for two reasons. For maintaining a high level of autonomy, students had the choice to participate in the INTUTs continuously throughout the semester or alternatively at the end of the semester. In addition, students received the possibility to (re-)participate in answering the INTUT questions for exam preparation. However, the data from these two weeks were not taken

into account for investigating the conceptual framework. The focus of the study lies on stimulating participants' continuous learning motivation and behavior. Therefore, the inclusion of the data of the re-opened INTUTs would bias the results.

In order to make sure that the task instructions for the INTUTs as well as the INTUT itself is perceived as non-controlling as possible, words such "you must" and "you should" were explicitly avoided in all four Learnweb groups (Deci, Koestner, and Ryan 1999; Mekler et al. 2017; Ryan, Mims, and Koestner 1983).

These INTUTs can serve as important informational function by providing feedback to the students (i.e., through points, badges, and leaderboards). Based on the feedback, students are aware of how well they are doing during the semester. They realize where they may need to devote more or less attention in order to increase their learning outcome. Feedback is supposed to be informationally useful and should not be perceived as pressuring and judgmental (in line with recommendations of Ryan and Deci 2017, p. 372).

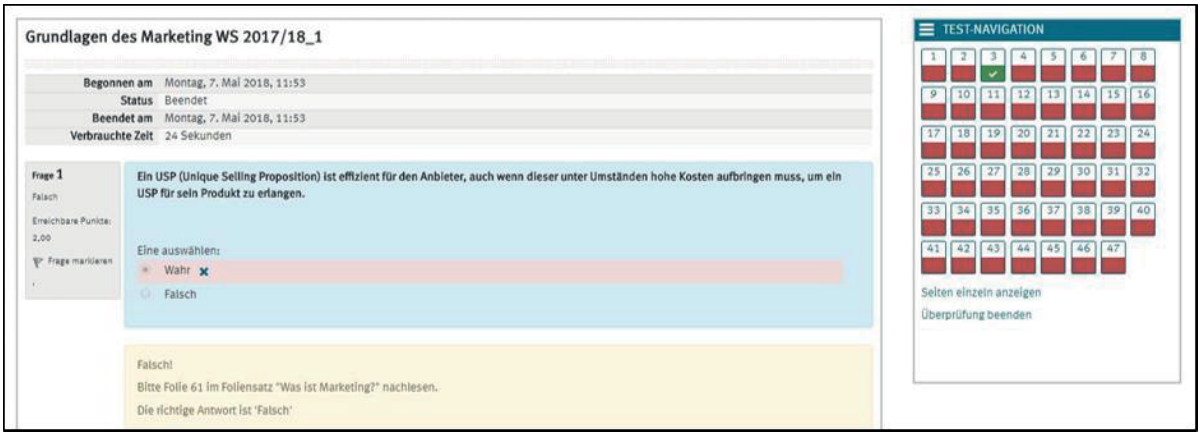
As feedback mechanisms for their performance, the game elements *points*, *badge*, and *leaderboard* were possible to be implemented on the Learnweb platform. In gamification research, these game elements represent the game elements that have been investigated the most (Hamari, Koivisto, and Sarsa 2014). Based on the results of the literature review in section 4.2, the implementation of points, badges and leaderboards has a positive effect on learning outcomes. Thus, it seems intuitive to start with a comparison of the effectiveness of these three game elements. These elements primarily evoke a gameful experience of skill development or social comparison (Wolf, Weiger, and Hammerschmidt 2018).

In the following, the control condition as well as the three game element conditions are explained in detail.

Control condition

The control condition does not contain points, badges or leaderboards. Before participating in the INTUTs, students had the possibility to read the same short introduction as in the game element condition. However, indications about points, badges, or a leaderboard were missing. After participating in the INTUT, they receive the following report (see Figure 15).

Figure 15: Report for control condition after participating in the INTUT



Source: Author's own illustration.

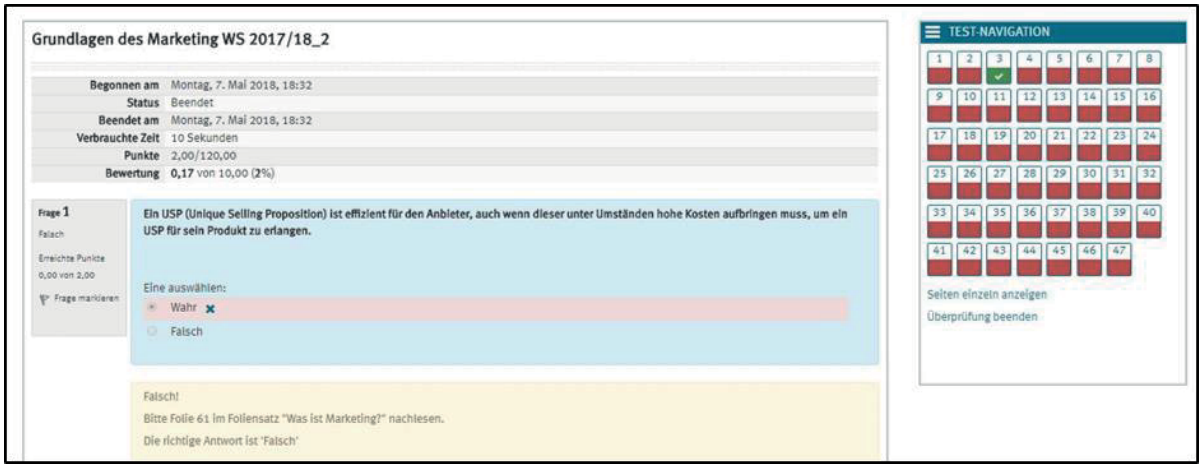
Points condition

In general, points reward successfully completed activities. Feedback is provided through an absolute numerical presentation of individual performance without a direct possibility to compare to others (Seaborn and Fels 2015). This game element provides individuals with granular feedback that can be directly linked to their actions (Przybylski, Rigby, and Ryan 2010; Sailer et al. 2017).

In this study, students in the points condition received the same report as the control condition. Solely, information about the achieved points after participating in the INTUTs was added (see Figure 16). Students could achieve up to 120 points (correspond to a score of 10). Information about the achieved points may primarily evoke gameful experiences of achievement (i.e., perception of reaching own goals) and progress (i.e., perception of own development).

Thus, a gameful experience of skill development may be evoked. The same short introduction like in the control condition was provided to the students. The sole difference was that they were informed about the maximal number of points they could achieve in the INTUT.

Figure 16: Report for points condition after participating in the INTUT



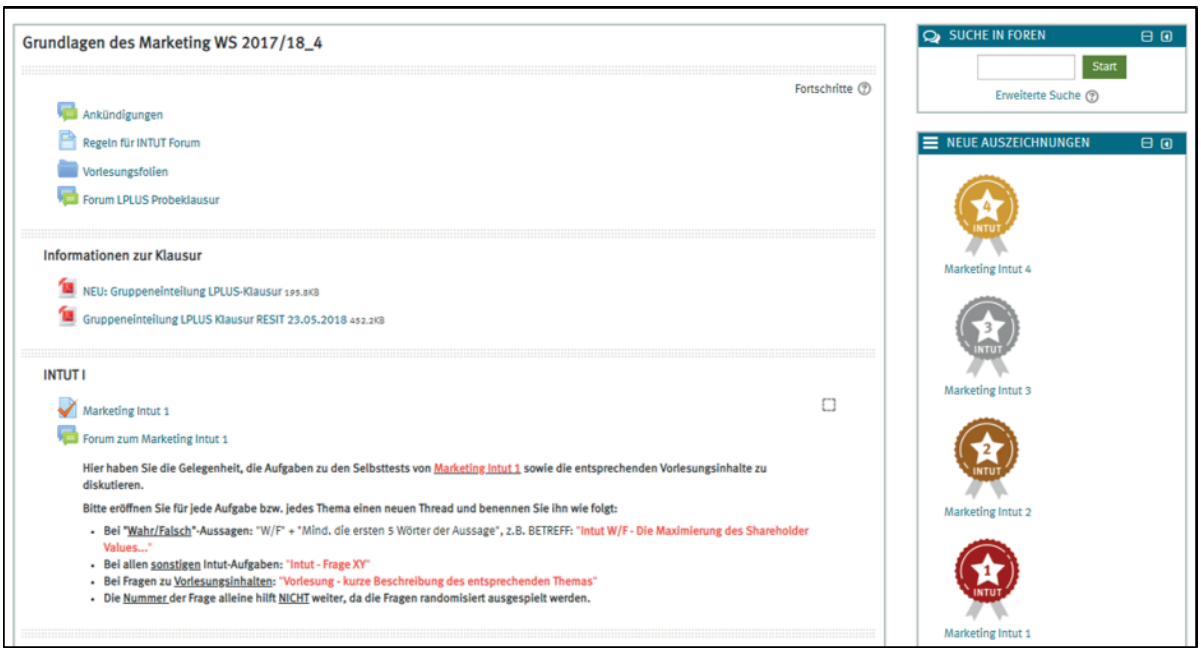
Source: Author's own illustration.

Badge condition

In contrast to numerical presentations, badges are visual icons that are awarded for a successfully conducted action such as answering a percentage of questions correctly (Mutter and Kundisch 2014; Seaborn and Fels 2015). The gameful experience of skill development (i.e., achievement) is represented in a visual way (Antin and Churchill 2011). Research shows that badges primarily consists of three elements: a completion logic, a signifier, and a reward (Hamari 2017; Hamari and Eranti 2011). The completion logic demonstrates the task requirements and the circumstances under which an individual has the possibility to unlock a badge (i.e., the number of specific actions an individual has to accomplish to earn a badge). The signifier contains the visual elements of a badge. Most frequently, badges encompass an icon, a name, and a description. The description is supposed to provide a short explanation of the completion logic. In case of rather simple completion logics (e.g., log in two times), the completion logic can correspond to the description. Rewards represent the benefits an individual attains from earning a badge. In a non-game context, the sole reward an individual receives is the unlocked badge in the user's profile (Hamari 2017; Hamari and Eranti 2011).

In this study, students in the badge condition had the possibility to earn a badge per INTUT if they answered 80% (i.e., 96 points; score 8) of the INTUT questions correctly. 80% was chosen in order to potentially observe whether students would participate multiple times in the INTUTs even if they already earned a badge. This percentage seems to represent an achievable score that is not too difficult. Students should not be discouraged by the difficulty of earning a badge. The short introduction differed from the one of the condition receiving points in the sense that information about the badge was added (i.e., completion logic). The report students received after participating in the INTUT correspond to the one in the points condition. The earned badges were illustrated at the right site of the Learnweb pages (see Figure 17). A gameful experience of skill development (i.e., perception of reaching own goals and progressing own capabilities) may be primarily evoked by the implementation of badges.

Figure 17: Example of badge condition



Source: Author's own illustration.

The design of the badges corresponded to the conceptualization of badges of Hamari and Eranti (2011). The completion logic as well as the description were represented by the sentence "You will receive a badge if you answer 80% or more of the questions correctly.". The names of the badges were kept simple in order to have a high recognition value and a simple assignment: Marketing Intut 1, Marketing Intut 2, Marketing Intut 3, and Marketing Intut 4.

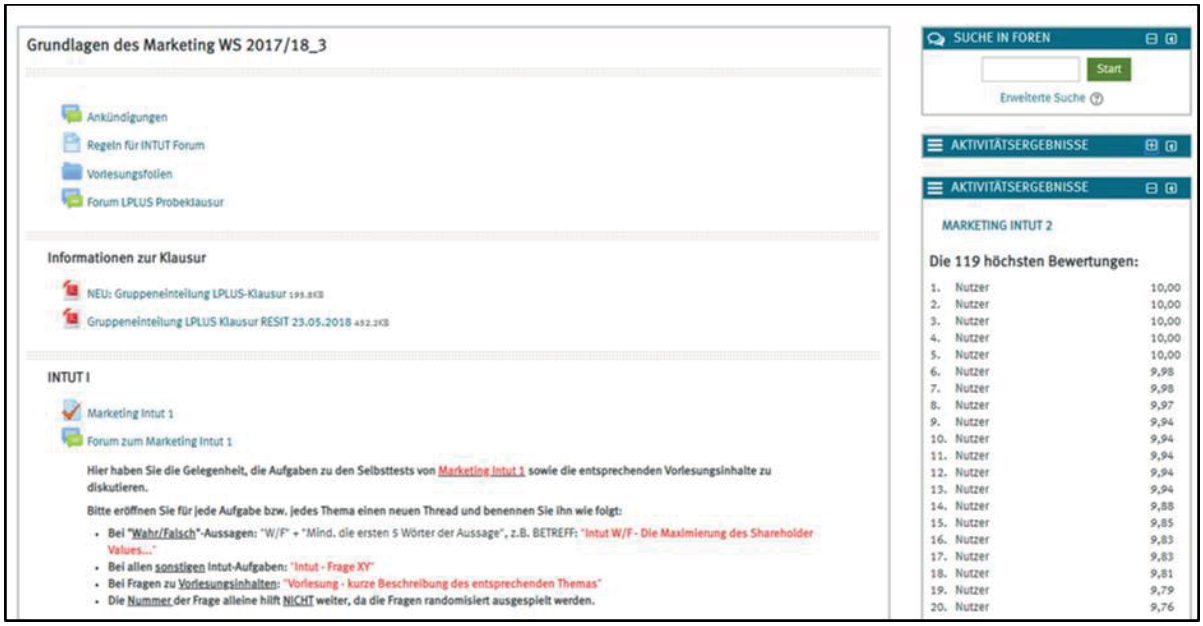
The task to design the icon was undertaken based on already established badges by a professional designer. The color of the first badge was red. This color represented a baseline. It corresponded to the color of the chair emblem that was responsible for the course. This color is very popular in Germany (Statista 2002). Red stands for confidence, power, and endurance with energy (Edwards-Wright 2011, p. 5; Thöne 2018). The second, third, and fourth badge received the colors bronze, silver, and gold respectively, resembling medals (see also Stack Overflow 2018). Different kinds of designs of the badges were pretested (n=15) by students in order to evaluate the acceptance and appropriateness of the badge for the given study.

Leaderboard condition

In general, a leaderboard is a relative instead of an absolute numerical measurement of performance. Besides the exact position on the leaderboard, the individual can also compare himself/ herself with others directly. Leaderboards help to determine who performs best in a certain activity and help to integrate an environment of competition (Seaborn and Fels 2015). The leaderboard links the individual's performance to the performance of others (Sailer et al. 2017).

In this study, students in the leaderboard condition were ranked anonymously at a dynamic leaderboard based on their achieved points. Due to the fact that students are aware of their performance compared to the other students, a gameful experience of social comparison may be evoked. The leaderboard appeared at the right site of the Learnweb pages (see Figure 18).

Figure 18: Example of leaderboard condition



Source: Author's own illustration.

If students participated in the INTUT multiple times, the best attempt was decisive for the leaderboard ranking. Students had the possibility to read the same short introduction like in the group receiving points. The sole difference was the information about the implementation of the leaderboard. The students received the same report after participating in the INTUT like in the points condition.

In the first lecture, all students were asked to subscribe on the Learnweb platform. Subsequently, students were randomly assigned to one of four conditions (i.e., control, points, badge, or leaderboard) created on Learnweb representing a between-subject design. Students were randomly assigned to avoid self-selection. An even distribution across groups and internal validity were granted (Iacobucci and Churchill 2010, p. 113). Each group received exactly the same information related to the lecture material. They solely differed with respect to the employed game elements. Students received the information that they were part of an experimental study investigating the usage behavior of the Learnweb platform. They were not informed about the real purpose of the study or the different conditions.

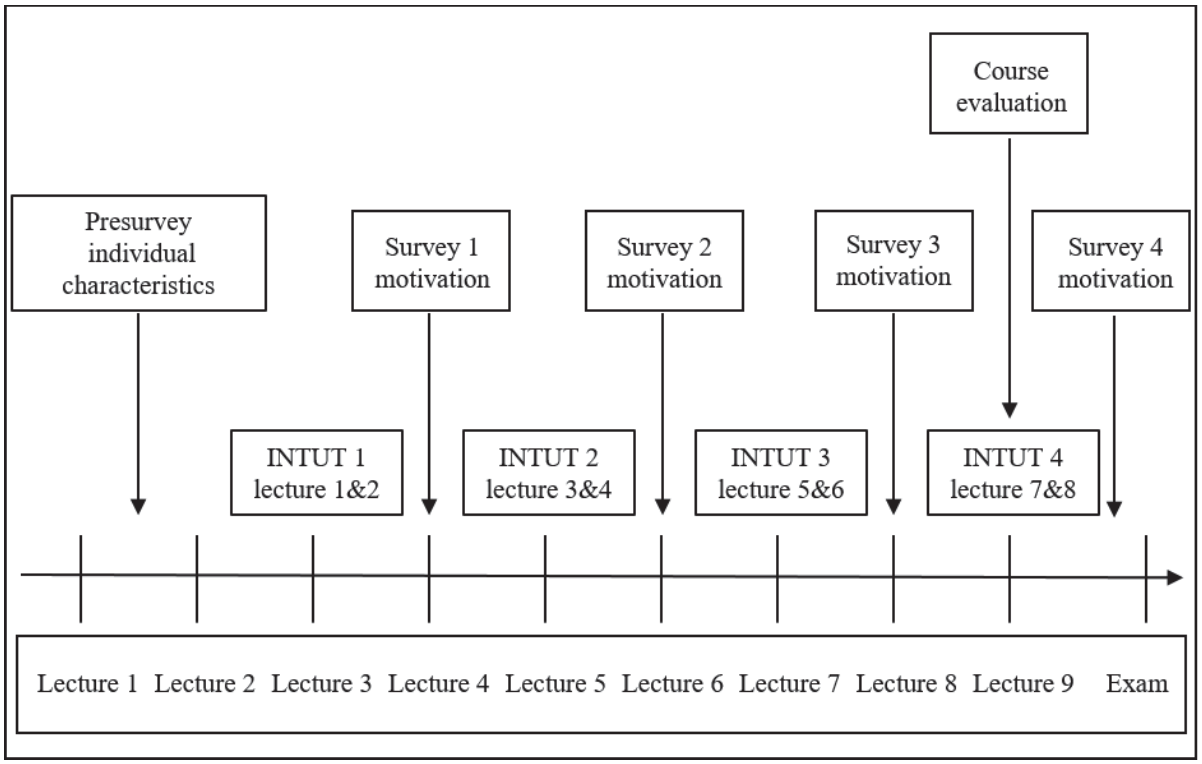
Prior to the first INTUT, students were asked to answer a presurvey about their personality characteristics (i.e., status, competition, expertise in marketing, extraversion, and conscientiousness) and demographics. After every two weeks of INTUT participation, students were sent a survey about their motivation (i.e., competence and intrinsic motivation (i.e., enjoyment)) to answer the corresponding INTUT questions. Each survey was created with the survey software Qualtrics. The survey was distributed via an individualized link in order to be able to combine all surveys into one final data sheet.

At the end of the semester, four different links were sent to the students in the corresponding Learnweb groups four course evaluation. The field experiment ended with the exam at the end of the semester. Figure 19 presents a timeline of the field experiment.

The final dataset consists of six data sources: (1) a presurvey regarding student's individual characteristics, (2) four surveys evaluating students' motivation in the course of the experiment, (3) students' evaluation of the course, (4) students' performance in the different gamified tutorials, (5) students' performance in the exam, and (6) students' GPA in their study programme.[15]

[15] GPA was available for students in the bachelor's programme economics, business administration and information systems. Due to missing data from the examination office, it was not possible to calculate a GPA of exchange students, students of the bachelor programme of business chemistry, and the students who study economics or business administration as a minor subject. In total, a GPA for 191 students can be included in further analysis.

Figure 19: Timeline of the field experiment



Source: Author's own illustration.

4.4.2 Operationalization of Variables

The variables were measured with the help of validated multi-item scales that had been used in previous studies. Instead of single-item scales, multi-item scales were applied in order to increase the validity and reliability of the chosen variables (Diamantopoulos et al. 2012). Among the wide range of scales applied in the literature, the ones that best fit the chosen definition of the corresponding variable were selected. The measurement of the constructs was made on a seven-point Likert scale anchored on 1 = "strongly disagree" and 7 = "strongly agree". In order to minimize the likelihood of biases resulting from item ambiguity, items were formulated in a simple and concise way. Unfamiliar terms and syntax were avoided (Podsakoff et al. 2003). The scales were translated from English to German. They were adjusted to suit the specific study context. The comprehensibility of the items was tested by a pretest (n=6). Minor adoptions in the wording of the questions were made. In the following, the focal variables (i.e., mediators, moderators, and dependent variable) and the corresponding measurement are described.

The mediating variables *competence* and *intrinsic motivation (i.e., enjoyment)* were measured with three items each from the IMI scale. They assess students' competence as well as fun in answering the questions in online tutorials (IMI 2018; McAuley, Duncan, and Tammen 1989). The enjoyment subscale of IMI mirrors the self-reported measure of intrinsic motivation. Enjoyment represents the sole scale within IMI that measures intrinsic motivation per se (IMI 2018). The third mediator, *participation* was assessed by the number of INTUTs a student was working on throughout the semester.

Several moderator variables (i.e., competition, status, extraversion, conscientiousness, expertise, and gender) were assessed. The moderator variable *competition* consists of three items adapted from Elliot and McGregor (2001). It captures the importance that students attribute to be in a competition with other students. *Status* was measured with four items adapted from Neel et al. (2016). It represents individuals' general desire for achieving a high status. The assessment of the personality traits *extraversion* (i.e., two items) and *conscientiousness* (i.e., two items) was taken from an adapted scale from Gosling, Rentfrow, and Swann (2003). *Extraversion* represents whether an individual is outgoing, energetic, and receives stimulation and satisfaction from outside the self compared to having a more solitary and reserved perso-nality. The measurement of *conscientiousness* reflects the degree of individuals' self-discipline and aim for achievement (Buckley and Doyle 2017).

Two types of expertise were measured. *Expertise* regarding the course subject of marketing was assessed with three items from Harackiewicz et al. (2008). In the following, the variable is named *expertise in marketing*. It captures background knowledge and experience with the marketing topic. The general expertise of studying business was operationalized by using the individual GPA of each student. The GPA was calculated based on the grades each student achieved so far during their bachelor. The variable is named *expertise in studying business*.

The dependent variable represents students' *learning performance* at the end of the semester. In the exam, students had the possibility to achieve up to 90 points representing a grade of 1.0. The *learning performance* was captured by the points students' received in the exam. Table 9 provides an overview of the items described above.

Table 9: Item overview of study 1

Dimension	Construct	Items	Item name in dataset
Competence (Mediator)	IMI (2018); McAuley, Duncan, and Tammen (1989)	After working at the INTUT tasks for awhile, I felt pretty competent.	Competence 1
		I am satisfied with my performance in answering the INTUT tasks.	Competence 2
		I think I did pretty well in answering the INTUT tasks, compared to other students.	Competence 3
Intrinsic motivation (i.e., enjoy-ment) (Mediator)	IMI (2018); McAuley, Duncan, and Tammen (1989)	Answering the INTUT tasks was fun to do.	Intrinsic motivation (i.e., enjoyment) 1
		I would describe answering the INTUT tasks as very interesting.	Intrinsic motivation (i.e., enjoyment) 2
		I enjoyed answering the INTUT tasks very much.	Intrinsic motivation (i.e., enjoyment) 3
Participation (Mediator)	-	Number of INTUTs a student was working on throughout the semester.	Participation
Expertise in marketing (Moderator)	Harackiewicz et al. (2008)	This lecture is my first exposure to the field of marketing.	Expertise in marketing 1
		I have very little experience with marketing.	Expertise in marketing 2
		I already have some background in marketing (e.g., I studied marketing in another lecture or did reading on my own).	Expertise in marketing 3
Expertise in studying business (Moderator)	GPA	GPA at the end of winter semester 17/18.	Expertise in studying business
Competition (Moderator)	Elliot and McGregor (2001)	It is important for me to do better than other students in this lecture.	Competition 1
		It is important for me to do well compared to others in this lecture.	Competition 2
		My goal in this lecture is to get a better grade than most of the other students.	Competition 3
Status (Moderator)	Neel et al. (2016)	It's important to me that other people look up to me.	Status 1
		It's important to me that others respect my rank or position.	Status 2
		I do things to ensure that I don't lose the status I have.	Status 3
		I do not worry very much about losing status.	Status 4

Dimension	Construct	Items	Item name in dataset
Extraversion (Moderator)	Gosling, Rentfrow, and Swann (2003)	I see myself as reserved, quiet.	Extraversion 1
		I see myself as extraverted, enthusiastic.	Extraversion 2
Conscien-tiousness (Moderator)	Gosling, Rentfrow, and Swann (2003)	I see myself as disorganized, careless.	Conscientiousness 1
		I see myself as dependable, self-disciplined.	Conscientiousness 2
Learning performance (Dependent variable)	-	Number of points students received in the exam.	Learning performance

Source: Author's own illustration.

4.4.3 Descriptive Statistics

In total, 648 students registered on Learnweb in order to participate in the course. The field experiment started with the first lecture (October 9, 2017) and ended with the exam (February 13, 2018). Students were equally distributed among the four Learnweb groups. Each Learnweb group contained 162 students. Table 10 provides an overview of the number of students who participated in the four INTUTs and completed the corresponding surveys. A survey is solely approved for further investigation if the individual has also answered the corresponding INTUT questions beforehand. Otherwise, the individual was not able to fill in the survey in a meaningful way because the survey queries the experience of answering the INTUT questions.

Table 10: Overview of completed surveys and INTUT participation

	Control	Points	Badges	Leaderboard	Sum
Survey completion					
Presurvey	107	107	104	104	422
Survey INTUT 1	41	56	45	48	190
Survey INTUT 2	34	34	34	31	133
Survey INTUT 3	24	27	30	25	106
Survey INTUT 4	39	40	55	43	177
INTUT participation					
INTUT 1	77	79	71	84	311
INTUT 2	59	57	61	53	230
INTUT 3	52	57	54	48	211
INTUT 4	67	56	76	71	270
Exam participation					
Exam	109	101	107	106	423[16]
Completed all surveys, participated in all INTUTs, wrote final exam					
	15	13	14	12	54

Source: Author's own illustration.

The distribution of students who wrote the exam at the end of the semester is equally distributed across groups. Out of the 423 students who wrote the exam, solely 54 students participated in all four INTUTs and completed the corresponding four surveys as well as the presurvey. Due to this small sample size, further analysis including the investigation of group differences is not meaningful. The sample size is enlarged by considering all students who completed the presurvey and completed at least one further survey. This means that each student in the final sample participated in at least one INTUT. In case students responded to more than one survey, the average of survey answers was considered. The extended sample consists of 207 students satisfying the following three criteria: (i) wrote the exam at the end of the semester, (ii) answered the presurvey, and (iii) answered at least one survey, thus participated at least in one INTUT.

[16] 13 students wrote the exam without being registered in one of the four Learnweb groups.

An initial assessment of the data leads to the exclusion of one student who clicked through the presurvey by choosing always the value *one*. Due to the inclusion of recoded items, it seems to be highly unlikely that the student filled in the survey with reasonable care. Completing the presurvey is a prerequisite for being part of the extended sample. Hence, this student is excluded from further analysis and the sample size is reduced to 206 students. There is an equal distribution of the students across conditions (see Table 11).

Table 11: Sample distribution of study 1

Condition	Sample size
Control	52
Points	55
Badges	50
Leaderboard	49
Total	206

Source: Author's own illustration.

A further student clicked through two of the four surveys by choosing consistently the same value (i.e., survey INTUT 2: 83% of value 5 and survey INTUT 3: 80% of value 4). The other two surveys were answered in an appropriate way. These two surveys but not the student as such are excluded from further analyses. An investigation of the median time (see Table 12) per group shows that solely in the second INTUT survey one student needed less than one third of the median time per group. This is below the industry. Hence, it can be assumed that this survey was not filled in with reasonable care (Peruzzi 2010). The answers from this survey are not considered in further analyses.

Table 12: Overview of survey median time

	Number of participants	Median survey duration	1/3 Median Survey duration	Minimum survey duration
Presurvey	206	9.32 min.	3.11 min.	4.95 min.
Survey INTUT 1	144	4.34 min.	1.45 min.	2.22 min.
Survey INTUT 2	108	3.68 min.	1.23 min.	**.85 min.**
Survey INTUT 3	86	3.90 min.	1.30 min.	1.58 min.
Survey INTUT 4	148	8.00 min.	2.67 min.	3.28 min.

Source: Author's own illustration.

The final dataset has an equal distribution of male (56.80%) and female (43.20%) students. The age of participants ranges from 18 to 35 years, with an average age of 20.93 years (median 20 years). Most of the students (86.41%) study business administration. It is not possible to detect whether the demographics are representative for the total sample of 648 because these information are solely available for students who participated in the presurvey that was not answered by all students. Table 13 provides an overview of the demographics.

Table 13: Overview of demographics of study 1

	Items	Percentage/ mean	Frequency
Gender	Male	56.80%	117
	Female	43.20%	89
Age	Average	20.93	-
Field of study	Exchange student	.49%	1
	Economics	.49%	1
	Minor business administration / Economics	.97%	2
	Business chemistry	5.34%	11
	Information systems	6.31%	13
	Business administration	86.41%	178

Source: Author's own illustration.

4.4.4 Results

A factor analysis was run to verify whether the items of one construct truly depict a single concept. The suitability for further analyses was assessed (Hair et al. 2018, p. 125). Accordingly, the underlying structure of the multi-item constructs competence, intrinsic motivation (i.e., enjoyment), expertise in marketing, status, competition, extraversion, and conscientiousness was investigated. 20 items were included in the factor analysis. For conducting a factor analysis, the sample size is supposed to be five times the number of variables included in the factor analysis (Hair et al. 2018, p. 133). The sample size is large enough to run a factor analysis because the sample size of 206 is more than five times larger than the number of inserted items.

Several criteria are supposed to be taken into account in order to verify the suitability of the data for conducting a factor analysis (here and in the following Backhaus et al. 2016, pp. 397-399).

First, the Bartlett's test of sphericity shall be significant. A significant result indicates a relationship among the variables in the population. Since the test shows a high significant result (p = .00), this assumption is fulfilled. The Kaiser-Meyer Olkin (KMO) criterion denotes the existence of underlying factors. A KMO of .73 in this study exceeds the threshold of .5. It demonstrates that the data is appropriate for conducting a factor analysis. Based on the off-diagonal elements (negative partial covariances) of the anti-image covariance matrix, data is appropriate if 25% or less are different from zero (absolute value > .09). In this study, 10.53% of the elements are different from zero, which demonstrates the data's suitability. All diagonal elements of the anti-image correlation matrix indicate measures of sampling adequacy greater than the boundary of .5. Based on these four criteria, the data is suitable for conducting a factor analysis.

The factor analysis was run using a varimax rotation and a principal component method. Based on the eigenvalues, seven factors should be extracted (Backhaus et al. 2016, p. 415). The number of extracted components corresponds to the number of theoretically derived constructs.

The rotated component matrix shows that the items for *expertise in marketing*, *competition, status*, *extraversion*, *conscientiousness*, *intrinsic motivation (i.e.,*

enjoyment), and *competence* represent distinct factors (see Table 14). Items of *status* have cross loadings on the factors *competition*, *extraversion*, and *competence*. One item of *competence* has a cross-loading on *intrinsic motivation (i.e., enjoyment*).

Table 14: Rotated component matrix with seven factors of study 1

	Competition	Intrinsic motivation (i.e., enjoyment)	Competence	Expertise in marketing	Extraversion	Status	Conscientiousness
Expertise in marketing 1				.85			
Expertise in marketing 2				.82			
Expertise in marketing 3				.76			
Competition 1	.89						
Competition 2	.85						
Competition 3	.85						
Status 1	.56					.55	
Status 2	.35					.76	
Status 3						.79	
Status 4			-.38		-.42	.40	
Extraversion 1					.86		
Extraversion 2					.84		
Conscientiousness 1							.81
Conscientiousness 2							.73
Intrinsic motivation (i.e., enjoyment) 1		.91					
Intrinsic motivation (i.e., enjoyment) 2		.85					
Intrinsic motivation (i.e., enjoyment) 3		.86					
Competence 1		.47	.68				
Competence 2			.83				
Competence 3			.83				

Source: Author's own illustration.

For evaluating the internal consistency, Cronbach's alpha was taken into account (Hair et al. 2018, p. 161). On average, the multi-item constructs surpass the threshold of .7. This demonstrates a good reliability of the constructs (Hair et al. 2018, p. 161) (see Table 15).

Solely the Cronbach's alpha of *expertise in marketing* and *status* can be improved by eliminating an item. Based on the conceptual importance of both items, the items remain in the corresponding factors. Considering the results of both analyses, it is appropriate to determine a variable score of the constructs (i.e., expertise in marketing, status, competition, extraversion, conscientiousness, intrinsic motivation (i.e., enjoyment), and competence) as summated scales.

Table 15: Reliability statistics Cronbach's alpha of study 1

Dimension	Construct	Items	Item mean	Cronbach's alpha	Mean
Expertise in marketing	Harackiewicz et al. (2008)	This lecture is my first exposure to the field of marketing.	3.34	.74	3.63
		I have very little experience with marketing.	3.48		
		I already have some background in marketing (e.g., I studied marketing in another lecture or did reading on my own).[a]	4.05		
Competition	Elliot and McGregor (2001)	It is important for me to do better than other students in this lecture.	4.14	.88	4.40
		It is important for me to do well compared to others in this lecture.	4.71		
		My goal in this lecture is to get a better grade than most of the other students.	4.33		
Status	Neel et al. (2016)	It's important to me that other people look up to me.	3.91	.61	4.20
		It's important to me that others respect my rank or position.	4.74		
		I do things to ensure that I don't lose the status I have.	4.27		
		I do not worry very much about losing status.[b]	3.88		
Extraversion	Gosling, Rentfrow, and Swann (2003)	I see myself as reserved, quiet.	4.36	.76	4.51
		I see myself as extraverted, enthusiastic.	4.67		
Conscien-tiousness	Gosling, Rentfrow, and Swann (2003)	I see myself as disorganized, careless.	4.23	.44	4.76
		I see myself as dependable, self-disciplined.	5.30		
Intrinsic motivation (i.e., enjoy-ment)	IMI (2018); McAuley, Duncan, and Tammen (1989)	Answering the INTUT tasks was fun to do.	4.25	.89	4.02
		I would describe answering the INTUT tasks as very interesting.	4.36		
		I enjoyed answering the INTUT tasks very much.	3.44		
Notes:		[a] = if item deleted, the constructs' Cronbach's alpha would be 0.77 [b] = if item deleted, the constructs' Cronbach's alpha would be 0.74			

Dimension	Construct	Items	Item mean	Cronbach's alpha	Mean
Competence	IMI (2018); McAuley, Duncan, and Tammen (1989)	After working at the INTUT tasks for awhile, I felt pretty competent.	4.07	.81	4.24
		I am satisfied with my performance in answering the INTUT tasks.	4.66		
		I think I did pretty well in answering the INTUT tasks, compared to other students.	3.99		

Source: Author's own illustration.

After confirming that the constructs are measured in a reliable and accurate way, the hypotheses of the study are tested in the following section. A set of ordinary least squares (OLS) regressions including mediation and moderation analyses were run. The regression analyses were conducted using IBM SPSS Statistics and the macro PROCESS developed by Hayes (2018, p. 551). PROCESS is increasingly used in the marketing literature including moderation and mediation analyses (e.g., Cavanaugh 2014; Roggeveen et al. 2015). The bootstrapping method was applied for estimating the indirect effects (Hayes 2018, p. 521). Compared to other methods, the bootstrapping method is considered as being more powerful and to perform best. Moreover, the bootstrapping method takes into account the irregularities of the sample distribution of the indirect effect (Hayes 2009; Hayes 2018, p. 521; Zhao, Lynch, and Chen 2010). Hayes (2009) recommends at least a generation of 5,000 bootstrap confidence intervals. In line with further studies (e.g., Cavanaugh 2014; Wolf, Weiger, and Hammerschmidt 2018), this recommendation is followed in the subsequent analyses.

Before running a regression analysis, four relevant assumptions need to be discussed: (a) correct model specification, (b) no multicollinearity, (c) homoscedasticity, and (d) normal distribution of errors (Fahrmeir et al. 2013, pp. 73-77).

(a) Correct model specification includes the premise of linearity in the parameters (Backhaus et al. 2016, p. 98). Theoretically and based on visual inspection, there is no indication of non-linear relationships. Besides linearity, all relevant variables have to be part of the model. All relevant variables for testing the hypotheses are part of the model. This assumption is fulfilled.

(b) The assumption of multicollinearity implies that an independent variable is not correlated with another independent variable or with a linear combination of other independent variables. For assessing the degree of multicollinearity, the variance inflation factor (VIF) values and the condition index (CI) can be considered (Hair et al. 2018, pp. 312-313). In order to not face a multicollinearity problem, the VIF value should be smaller than five (Hair et al. 2018, p. 316). The condition index should be smaller than 30 (Hair et al. 2018, p. 313). The test of multicollinearity for the mediation analyses shows VIF values below 3, stating no multicollinearity issue (Hair et al. 2018, p. 316) (see Tables 16-19). The CI is always below 30, indicating no multicollinearity issues (Hair et al. 2018, p. 313) (see Tables 16-19). Hence, the assumption is fulfilled.

(c) The assumption of homoscedasticity contains that the variance of the error term is constant. More specifically, the variance of the dependent variable is not affected by the independent variables (Backhaus et al. 2016, p. 103). An option in PROCESS provides the opportunity to run the analysis with a heteroscedasticity-consistent (HC) standard error estimator in order to address a potential violation. In this study, standard errors using the HC3 estimator are generated (Hayes 2018, p. 576; Hayes and Cai 2007).

(d) The error terms of the estimated model needs to be normally distributed. A potential violation of this assumption is addressed by applying the bootstrapping method when running moderation and mediation analyses with PROCESS. This method does not assume normally distributed data (Hayes 2009; Hayes 2018, p. 97).

For running OLS regression analyses, the independent variables are required to be metric or dichotomous (Hair et al. 2018, pp. 260-261). The current research model has one independent variable with four levels (i.e., control, points, badges, and leaderboards). In each regression analysis, the focus lies on the comparison of one treatment group (i.e., points, badges, or leaderboard)

to the control condition. In addition, one analysis compares all three conditions containing game elements to the control condition. Thus, in each regression analysis two levels are compared.

For testing hypotheses one to four, serial multiple mediator models were run.[17] The conceptual framework encompasses three mediators (i.e., competence, intrinsic motivation (i.e., enjoyment), and participation). PROCESS model specification six was selected as the most appropriate model (Hayes 2018, p. 174 and pp. 586-587). The goal of estimating a serial multiple mediator model is to investigate the direct and indirect influence of the independent on the dependent variable. This includes a process modeling in which the independent variable affects mediator one which in turn influence mediator two and so forth, finishing with the dependent variable as the final consequent (Hayes 2018, p. 167).

Hypothesis 1 entails the positive effect of game elements on competence. Results shows that the points condition (b = .28, p = .20) (see Table 16), badge condition (b = .34, p = .11) (see Table 17) as well as leaderboard condition (b = .05, p = .80) (see Table 18) have no significant effect on competence compared to the control condition. Thus, hypothesis 1 is not supported. The comparison of the gamification conditions (i.e., containing all three treatment groups) to the control condition show no significant effect as well (b = .23, p = .18) (see Table 19). Comparing the game elements among each other do not reveal significant differences (i.e., badge condition compared to points condition: (b = .07, p = .77); leaderboard condition compared to points condition (b = -.22, p = .32); and badge condition compared to leaderboard condition (b = .29, p = .20)).

Hypothesis 2, proposing a positive effect of competence on motivation (i.e., enjoyment), can be confirmed. Competence has a significant positive effect on intrinsic motivation (i.e., enjoyment) (b = .49, p = .00) (see Table 19).

[17] It was controlled for marketing involvement. No differences in the effect sizes of game elements (i.e., points, badges, and leaderboards) on the mediators and dependent variable could be detected.

The third hypothesis postulates that intrinsic motivation (i.e., enjoyment) has a positive influence on the participation in online tutorials. Results demonstrate that intrinsic motivation (i.e., enjoyment) has no significant effect on the parti-cipation in online tutorials (b = .25, p = .15) (see Table 19). Thus, no support of the third hypothesis can be concluded.

A positive effect of participation in online tutorials on learning performance is postulated by hypothesis 4a. This hypothesis is partially supported. When considering the points condition compared to the control condition, a significant positive effect can be stated (b = .61, p = .01) (see Table 16). A significant positive effect, when comparing gamification conditions to the control condition, can be demonstrated as well (b = .47, p = .00) (see Table 19). No significant effects can be detected when analyzing the badge condition (b = .44, p = .05) (see Table 17) as well as the leaderboard condition (b = .42, p = .07) (see Table 18) to the control condition.

Table 16: Points condition compared to control condition

	Consequent											
	M1 (Competence)			M2 (Intrinsic motivation (i.e., enjoyment))			M3 (Participation)			Y (Learning performance)		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Points)	.28	.21	.20	.06	.20	.78	.15	.55	.79	1.36	1.85	.46
M1 (Competence)	-	-	-	.51	.09	.00	.24	.31	.44	4.01	1.25	.00
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.37	.19	.06	-1.50	.97	.12
M3 (Participation)	-	-	-	-	-	-	-	-	-	.61	.24	.01
Constant	4.07	.14	.00	1.86	.36	.00	1.62	1.11	.15	63.76	5.41	.00
	$R_{adj.}^2 = .01$			$R_{adj.}^2 = .23$			$R_{adj.}^2 = .02$			$R_{adj.}^2 = .17$		
	F(1, 105) = 1.68, p = .20			F(2, 104) = 18.49, p = .00			F(3, 103) = 2.73, p = .05			F(4, 102) = 3.60, p = .01		
	Max. VIF = 1.00			Max. VIF = 1.02			Max. VIF = 1.33			Max. VIF = 1.34		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 17: Badge condition compared to control condition

	Consequent											
	M1 (Competence)			**M2 (Intrinsic motivation (i.e., enjoyment))**			**M3 (Participation)**			**Y (Learning performance)**		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Badge)	.34	.21	.11	.08	.19	.67	.66	.53	.22	2.75	1.66	.10
M1 (Competence)	-	-	-	.57	.09	.00	.16	.32	.60	2.69	1.21	.03
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.17	.30	.57	-1.16	1.01	.26
M3 (Participation)	-	-	-	-	-	-	-	-	-	.44	.22	.05
Constant	4.07	.14	.00	1.62	.37	.00	2.69	1.21	.03	68.49	5.59	.00
	$R_{adj.}^2 = .02$			$R_{adj.}^2 = .30$			$R_{adj.}^2 = .00$			$R_{adj.}^2 = .09$		
	$F(1, 100) = 2.61$, $p = .11$			$F(2, 99) = 24.49$, $p = .00$			$F(3, 98) = .91$, $p = .44$			$F(4, 97) = 2.59$, $p = .04$		
	Max. VIF = 1.00			Max. VIF = 1.03			Max. VIF = 1.48			Max. VIF = 1.48		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 18: Leaderboard condition compared to control condition

	Consequent											
	M1 (Competence)			**M2 (Intrinsic motivation (i.e., enjoyment))**			**M3 (Participation)**			**Y (Learning performance)**		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Leaderboard)	.05	.21	.80	-.15	.20	.47	.23	.56	.69	1.39	1.82	.45
M1 (Competence)	-	-	-	.61	.12	.00	.18	.30	.55	3.24	1.19	.01
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.28	.26	.28	-1.92	.94	.04
M3 (Participation)	-	-	-	-	-	-	-	-	-	.42	.23	.07
Constant	4.07	.14	.00	1.44	.49	.00	2.19	1.14	.06	69.30	5.41	.00
	$R_{adj.}^2$= -.01			$R_{adj.}^2$= .28			$R_{adj.}^2$= .00			$R_{adj.}^2$= .08		
	F(1, 99) = .07, p = .80			F(2, 98) = 13.36, p = .00			F(3, 97) = 1.13, p = .34			F(4, 96) = 2.87, p = .03		
	Max. VIF = 1.00			Max. VIF = 1.00			Max. VIF = 1.42			Max. VIF = 1.42		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 19: Game elements compared to control condition

	Consequent											
	M1 (Competence)			M2 (Intrinsic motivation (i.e., enjoyment))			M3 (Participation)			Y (Learning performance)		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Game elements)	.23	.17	.18	.01	.16	.93	.30	.43	.48	2.03	1.57	.20
M1 (Competence)	-	-	-	.49	.07	.00	.37	.20	.07	2.49	.72	.00
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.25	.17	.15	-1.26	.60	.04
M3 (Participation)	-	-	-	-	-	-	-	-	-	.47	.14	.00
Constant	4.07	.14	.00	1.95	.30	.00	1.56	.87	.07	69.56	3.60	.00
	$R_{adj.}^2 = .00$			$R_{adj.}^2 = .22$			$R_{adj.}^2 = .03$			$R_{adj.}^2 = .11$		
	$F(1, 204) = 1.83$, $p = .18$			$F(2, 203) = 27.80$, $p = .00$			$F(3, 202) = 3.30$, $p = .02$			$F(4, 201) = 5.21$, $p = .00$		
	Max. VIF = 1.00			Max. VIF = 1.0			Max. VIF = 1.30			Max. VIF = 1.32		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Besides an investigation of the direct effects, the serial multiple mediator models demonstrate the indirect effects of game elements (i.e., points, badges, and leaderboard) on learning performance for testing hypothesis 4b. Game elements (i.e., points, badges, and leaderboard) are supposed to influence the outcome variable learning performance through three intervening variables (i.e., competence, intrinsic motivation (i.e., enjoyment), and participation).

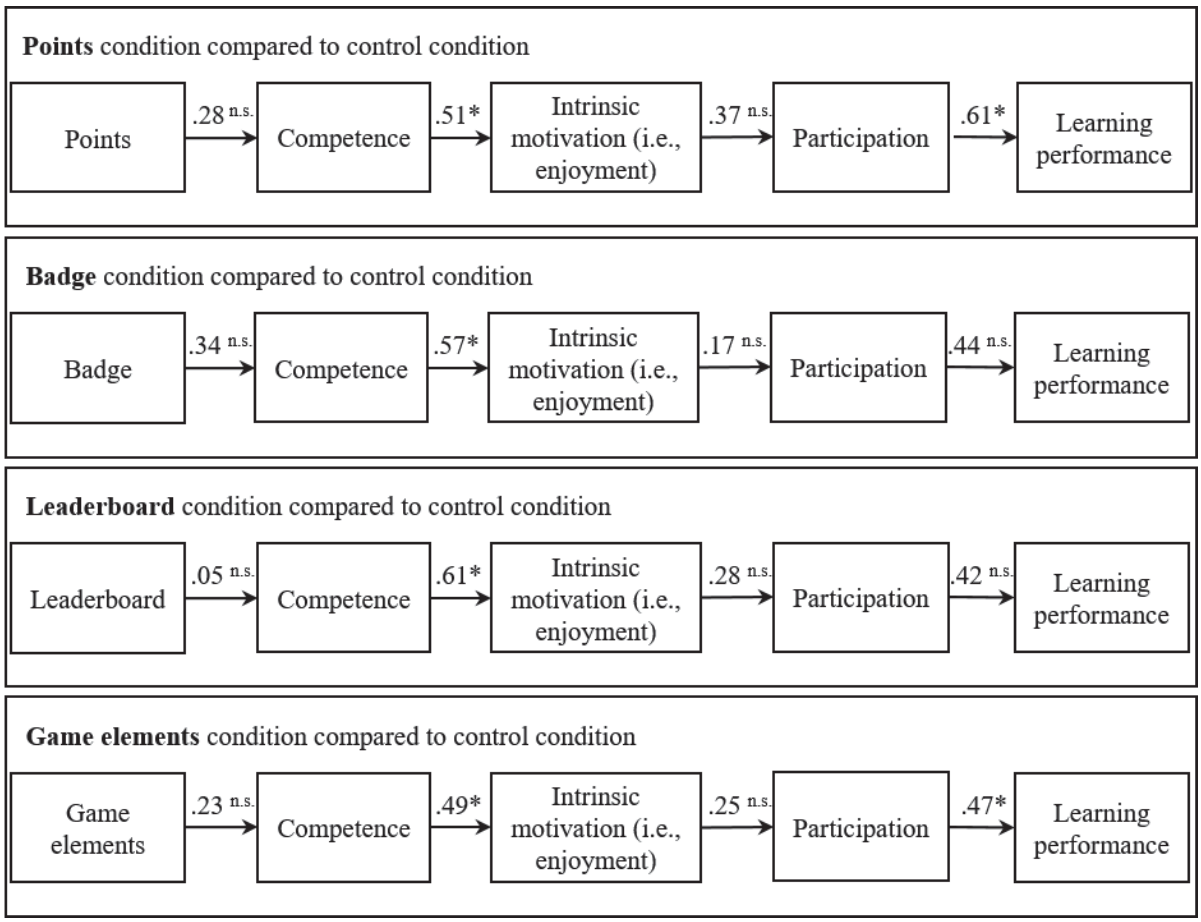
The total effect comprises the direct effect of game elements (i.e., points, badges, and leaderboard) on learning performance and the indirect effect through the mediators (Hayes 2009).

The indirect effect results from the multiplication of the beta values (Hayes 2018, p. 171). The bootstrap confidence intervals that are based on 5,000 samples have to be entirely above or below zero for demonstrating a significant indirect effect (Hayes 2018, p. 172). In cases where zero is not situated between the lower and upper bound, an indirect effect can be stated with 95% confidence (Hayes 2009). Effects are displayed in unstandardized form because the specific indirect effects of the independent on the dependent variable are not dependent on the scale of measurement of the intervening variables (Hayes 2009). Researchers explicitly advise to report the effect in unstandardized form to allow substantive interpretation. This especially counts for effects containing dichotomous variables (Hayes 2009; Hayes 2018, p. 519; Zhao, Lynch, and Chen 2010).

It is possible to reveal an indirect but no direct effect of the independent on the dependent variable (Hayes 2009). An indirect only mediation can still be demonstrated even if the direct effect is reported not to be significant (Zhao, Lynch, and Chen 2010). An unexplained negative direct path do not hinder publication of findings that reveal a positive indirect path (Zhao, Lynch, and Chen 2010). The indirect effect should be further examined in order to avoid missing something potentially interesting even in the case of having a significant indirect but absent total effect (Hayes 2009; Preacher and Hayes 2004). A significant total indirect effect is not a requirement for investigating the specific indirect effects (Preacher and Hayes 2008). Taken together, this study concentrates on the interpretation of the specific indirect effects.

Mediation results show that there is no significant indirect effect of game elements (i.e., points, badges, and leaderboard) on learning performance (i.e., points condition: $b = .03$, lower level confidence interval (LLCI) = -.01, upper level confidence interval (ULCI) = .15; badge condition: $b = .01$, LLCI = -.04, ULCI = .13; leaderboard condition: $b = .00$, LLCI = -.03, ULCI = .08). Among others, this results from the insignificant effect of game elements (i.e., points, badges, and leaderboard) on competence. Thus, hypothesis 4b can not be supported. An overview of the mediation effects is provided in Figure 20.

Figure 20: Overview of indirect effects



Source: Author's own illustration.

In order to test hypotheses five to ten, moderation analyses with PROCESS were conducted. The configurations in PROCESS made for the mediation analysis remained unchanged. Solely the model was adjusted. For running a simple moderation analysis with one moderator, model one is most suitable (Hayes 2018, p. 238 and p. 584). Summarizing the results, none of the moderating effect is significant. Thus, none of the hypotheses five to ten can be supported. In the following an overview of the insignificant results is provided in Tables 20-26.

Table 20: Overview moderation effect of gender

Points condition compared to control condition				**Badge** condition compared to control condition			
	Y (Competence)				**Y (Competence)**		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Points)	.13	.30	.66	**X_1** (Badge)	.44	.30	.14
X_2 (Gender)	-.32	.29	.26	**X_2** (Gender)	-.32	.29	.26
M (Gender * Points)	.28	.43	.52	**M** (Gender * Badge)	-.24	.42	.56
Constant	4.23	.20	.00	**Constant**	4.23	.20	.00
$R_{adj.}^2 = .00$ $F(3, 103) = .97, p = .41$ Max. VIF = 2.67 // CI = 5.54				$R_{adj.}^2 = .04$ $F(3, 98) = 2.29, p = .08$ Max. VIF = 2.81 // CI = 5.59			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Leaderboard condition compared to control condition			
	Y (Competence)		
	Coeff	*SE*	*p*
X_1 (Leaderboard)	.03	.28	.92
X_2 (Gender)	-.32	.29	.26
M (Gender * Leaderboard)	-.04	.43	.92
Constant	4.23	.20	.00
$R_{adj.}^2 = .00$ $F(3, 97) = .88, p = .45$ Max. VIF = 2.44 // CI = 5.19			
X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 21: Overview moderation effect of extraversion

Points condition compared to control condition				**Badge** condition compared to control condition			
	Y (Competence)				**Y (Competence)**		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Points)	1.32	.68	.06	**X_1** (Badge)	.36	.73	.62
X_2 (Extraversion)	.06	.11	.61	**X_2** (Extraversion)	.06	.11	.61
M (Extraversion * Points)	-.23	.16	.15	**M** (Extraversion * Badge)	.00	.16	1.00
Constant	3.81	.48	.00	**Constant**	3.81	.48	.00
$R_{adj.}^2 = .02$ $F(3, 103) = 2.15, p = .10$ Max. VIF = 12.67 // CI = 17.07				$R_{adj.}^2 = .00$ $F(3, 98) = 1.20, p = .31$ Max. VIF = 12.89 // CI = 16.47			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Leaderboard condition compared to control condition			
	Y (Competence)		
	Coeff	*SE*	*p*
X_1 (Leaderboard)	.43	1.03	.68
X_2 (Extraversion)	.06	.11	.61
M (Extraversion * Leaderboard)	-.08	.22	.71
Constant	3.81	.48	.00
$R_{adj.}^2 = -.03$ $F(3, 97) = .13, p = .94$ Max. VIF = 14.44 // CI = 16.78			
X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 22: Overview moderation effect of conscientiousness

Points condition compared to control condition				**Badge** condition compared to control condition			
	Y (Competence)				**Y (Competence)**		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Points)	.04	.83	.96	**X_1** (Badge)	.33	1.10	.76
X_2 (Conscientousness)	.10	.11	.35	**X_2** (Conscientousness)	.10	.11	.35
M (Conscientiousness * Points)	.05	.17	.77	**M** (Conscientiousness * Badge)	.00	.22	.98
Constant	3.59	.52	.00	**Constant**	3.59	.52	.00
$R_{adj.}^2 = .01$ $F(3, 103) = 1.35, p = .26$ Max. VIF = 19.21 // CI = 20.25				$R_{adj.}^2 = .01$ $F(3, 98) = 1.38, p = .25$ Max. VIF = 17.20 // CI = 19.10			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Leaderboard condition compared to control condition			
	Y (Competence)		
	Coeff	*SE*	*p*
X_1 (Leaderboard)	.21	1.01	.83
X_2 (Conscientousness)	.10	.11	.35
M (Conscientiousness * Leaderbaord)	-.03	.20	.89
Constant	3.59	.52	.00
$R_{adj.}^2 = -.02$ $F(3, 97) = .40, p = .75$ Max. VIF = 18.48 // CI = 19.12			
X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 23: Overview moderation effect of competition

Leaderboard condition compared to control condition			
	Y (Competence)		
	Coeff	*SE*	*p*
X_1 (Leaderboard)	.55	.57	.34
X_2 (Competition)	.09	.09	.31
M (Competition * Leaderboard)	-.12	.13	.38
Constant	3.67	.40	.00
$R_{adj.}^2 = .01$ $F(3, 97) = .40, p = .75$ Max. VIF = 1.11 // CI = 7.25			
X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 24: Overview moderation effect of status

Leaderboard condition compared to control condition			
	Y (Competence)		
	Coeff	*SE*	*p*
X_1 (Leaderboard)	-.04	.86	.96
X_2 (Status)	-.04	.12	.75
M (Status * Leaderboard)	.02	.22	.92
Constant	4.23	.52	.00
$R_{adj.}^2 = -.03$ $F(3, 97) = .07, p = .98$ Max. VIF = 14.65 // CI = 16.92			
X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 25: Overview moderation effect of expertise of studying

Points condition compared to control condition				**Badge** condition compared to control condition			
	Y (Competence)				**Y (Competence)**		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Points)	-.07	1.18	.96	**X_1** (Badge)	-2.03	1.20	.09
X_2 (Expertise of studying business)	-.67	.34	.05	**X_2** (Expertise of studying business)	-.67	.34	.05
M (Expertise of studying business * Points)	.10	.44	.83	**M** (Expertise of studying business * Badge)	.89	.45	.05
Constant	5.90	.93	.00	**Constant**	5.90	.93	.05
$R_{adj.}^2 = .07$ $F(3, 96) = 3.55, p = .02$ Max. VIF = 26.00 // CI = 26.37				$R_{adj.}^2 = .05$ $F(3, 90) = 2.35, p = .08$ Max. VIF = 21.90 // CI = 24.44			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

Table 26: Overview of moderation effect of expertise in marketing

Points condition compared to control condition				**Badge** condition compared to control condition			
	Y (Competence)				**Y (Competence)**		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Points)	.55	.58	.35	**X_1** (Badge)	.20	.46	.66
X_2 (Expertise in marketing)	.05	.08	.54	**X_2** (Expertise in marketing)	.05	.08	.54
M (Expertise in marketing * Points)	-.07	.14	.59	**M** (Expertise in marketing * Badge)	.04	.12	.72
Constant	3.88	.31	.00	**Constant**	3.88	.31	.00
$R_{adj.}^2 = -.01$ $F(3, 103) = .75, p = .53$ Max. VIF = 7.95 // CI = 12.08				$R_{adj.}^2 = .01$ $F(3, 98) = 1.60, p = .19$ Max. VIF = 6.49 // CI = 10.99			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

An overview of the tested hypotheses is provided in Table 27.

Table 27: Overview of hypotheses of study 1

H#	Description	Supported
H1	Game elements evoking gameful experiences of skill development or social comparison have a positive influence on competence compared to the control condition.	No
H2	Competence has a positive influence on intrinsic motivation (i.e., enjoyment).	Yes
H3	Intrinsic motivation (i.e., enjoyment) has a positive influence on participation.	No
H4a	Participation has a positive influence on learning performance.	Partially
H4b	The positive effect of game elements evoking gameful experiences of skill development or social comparison on learning performance is fully, serially mediated by (a) an increase in competence, (b) an increase in intrinsic motivation (i.e., enjoyment), and (c) and an increase in participation.	No
H5a	The positive effect of game elements evoking a gameful experience of skill development on competence is stronger for men than for women.	No
H5b	The positive effect of game elements evoking a gameful experience of social comparison on competence is stronger for men than for women.	No
H6a	The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's level of extraversion.	No
H6b	The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's level of extraversion.	No
H7a	The positive effect of game elements evoking a gameful experience of skill development on competence is weakened by individual's level of conscientiousness.	No
H7b	The positive effect of game elements evoking a gameful experience of social comparison on competence is weakened by individual's level of conscientiousness.	No
H8	The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's perceived importance of being in a competition.	No
H9	The positive effect of game elements evoking a gameful experience of social comparison on competence is strengthened by individual's desire for status.	No
H10a	The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise in studying (i.e., GPA).	No
H10b	The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise in the subject of the course (i.e., marketing).	No

Source: Author's own illustration.

4.4.5 Discussion of Results

The purpose of the study was to examine the effectiveness of gamification in higher education. More specifically, the study investigated the effects of different game elements on (i) students' motivation to learn moderated by individual characteristics, (ii) their participation in the course (i.e., in online tutorials), and (iii) the exam results as the primary measure of learning performance. For achieving this aim, the study empirically compared the effects of three game elements (i.e., points, badge, and leaderboard) to a control condition without receiving such a game element. The effects on both psychological mediators and behavioral outcomes were investigated.

Results demonstrate that neither points, badge, nor leaderboard have a significant effect on competence. In order to experience a feeling of competence, services have to be able to provide individuals with balanced challenges to master (Deci and Ryan 1985a, p. 58; Deterding 2015; Ryan and Deci 2000a; b). A potential explanation for the insignificant effect may be that students did not consider the INTUTs as being challenging. However, results of an analysis of variance (ANOVA) reveal that the INTUTs are perceived as quite challenging across the four Learnweb groups (see Table 28). The perceived amount of challenge is above average and does not differ between the four conditions.

Table 28: Group comparisons of perceived challenge, autonomy, and pressure

Variable	Condition	Mean	Significance
Challenges	Control	4.68	.09
	Points	4.55	
	Badge	4.82	
	Leaderboard	4.34	
Autonomy	Control	4.90	.99
	Points	4.94	
	Badge	4.86	
	Leaderboard	4.90	
Pressure	Control	2.28	.54
	Points	2.25	
	Badge	2.17	
	Leaderboard	2.47	

Variables were measured on a seven-point Likert scale anchored on 1 = "strongly disagree" and 7 = "strongly agree".

Source: Author's own illustration.

When autonomy is collaterally satisfied, a full satisfaction of competence can be achieved (Ryan and Deci 2017, p. 97 and p. 250). Hence, students should not perceive the participation in the INTUTs as pressure or control. Based on group comparisons (i.e., ANOVA), there is no difference in perceived pressure or control (i.e., measured as perceived autonomy) among all four groups. Students in all four Learnweb groups experience a low level of pressure and a high level of autonomy (see Table 28). Taken together, neither, points, badges, or a leaderboard seem to be experienced as controlling. They do not harm students' motivation or influence learning performance in a negative way. This leads to the conclusion that these game elements to not have an influence on competence need satisfaction even if they were provided in a non-controlling setting. A reason may be that these elements did not provide enough meaning, informational feedback in order to support participants' judgment of their performance (Deci, Koestner, and Ryan 1999).

Another design of points, badge, and leaderboard may have led to different results. A different design may amplify the game elements' potential to evoke gameful experiences of skill development and social comparison and subsequently increase students' competence and intrinsic motivation. For instance,

the implementation of an anonymous leaderboard may not evoke sufficient gameful experience of social comparison. Due to the fact that the design of the leaderboard and the presentation of points was predefined by Learnweb, the implementation of a non-anonymous leaderboard and a different presentation of points was not feasible.

A professional designer created the four badges implemented in the study and the badges were pretested. However, study participants could have preferred another design in order to perceive a gameful experience of skill development (i.e., progress and achievement) and consequently an increase in competence.

The actual performance in the INTUTs can affect the influence of the condition on competence as well as learning performance. Results show that the performance does not significantly differ between groups (see Table 29). Independently of the implementation of certain game elements, the students achieved on average the same number of points. Based on these results, gamification does not seem to be necessary in order to achieve a high INTUT performance.

Table 29: Overview of INTUT performance among conditions

	Control	Points	Badge	Leaderboard	Sign.
Performance in INTUT 1	7.36	7.92	7.79	7.14	.33
Performance in INTUT 2	6.06	7.45	7.25	7.19	.09
Performance in INTUT 3	6.68	7.90	7.42	7.38	.33
Performance in INTUT 4	7.86	7.98	8.56	8.41	.27

Source: Author's own illustration.

In the points condition, the maximum number of points a student achieved in a certain INTUT has a significant positive effect on his/her competence feeling (besides for INTUT 2) and on the learning performance. Hence, the higher the number of points students received in the INTUTs, the higher their competence level as well as learning performance have been (see Table 30).

Table 30: Impact of performance in points condition

	Competence INTUT #	Learning performance
Maximum of points in INTUT 1	$b = .26$, $p = .00$	$b = 1.73$, $p = .01$
Maximum of points in INTUT 2	$b = .27$, $p = .02$	$b = .57$, $p = .25$
Maximum of points in INTUT 3	$b = .33$, $p = .01$	$b = 1.19$, $p = .02$
Maximum of points in INTUT 4	$b = .21$, $p = .01$	$b = 1.23$, $p = .01$

Source: Author's own illustration.

There may be a difference in the badge condition between students that actually receive a badge in the corresponding INTUT on competence and learning performance to students who do not earn a badge. Besides in INTUT 2, participants that actually earned a badge show a significant higher level of competence compared to students that did not earn a badge (see Table 31). The learning performance do not depend on whether students received the badge in a certain INTUT. The number of badges a student received did not influence the learning performance as well ($b = 1.7$, $p = .06$).

Table 31: Impact of performance in badge condition

	Competence INTUT #	Learning performance
Earned a badge in INTUT 1	$b = 1.37$, $p = .00$	$b = 2.63$, $p = .17$
Earned a badge in INTUT 2	$b = .78$, $p = .09$	$b = 3.53$, $p = .08$
Earned a badge in INTUT 3	$b = 2.30$, $p = .00$	$b = 3.84$, $p = .08$
Earned a badge in INTUT 4	$b = 1.03$, $p = .04$	$b = 2.67$, $p = .30$

Source: Author's own illustration.

Hence, in both conditions the performance in the INTUTs has an impact on student's competence perception.

The actual position at the leaderboard could have influenced student's competence as well. Potentially, students that ranked high on a leaderboard perceived a higher feeling of competence. Based on the investigation of the leaderboard position students reached after participating in the INTUTs, results reveal no significant effect on competence or learning performance (see Table 32). Even students that ranked high on a leaderboard do not feel a higher level of competence.

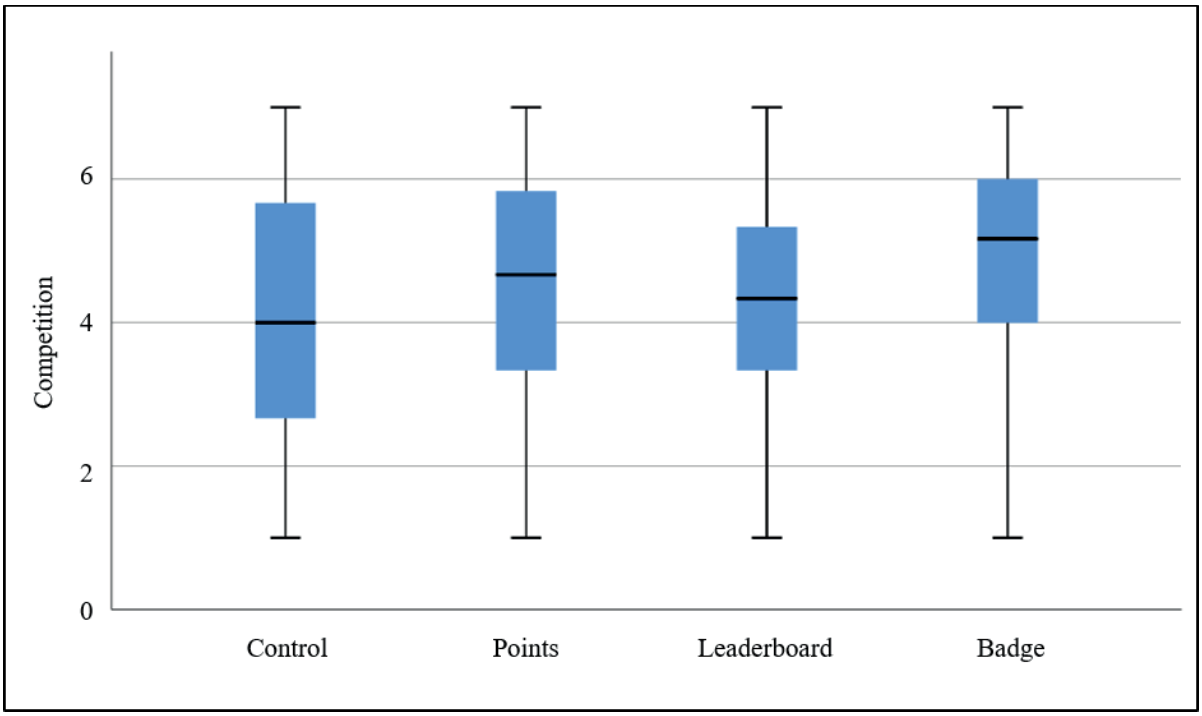
Table 32: Impact of performance in leaderboard condition

	Competence INTUT #	Learning performance
Ranking INTUT 1	b = -.02, p = .08	b = -.01, p = .94
Ranking INTUT 2	b = -.01, p = .76	b = -.10, p = .44
Ranking INTUT 3	b = -.04, p = .34	b = -.14, p = .47
Ranking INTUT 4	b = -.02, p = .21	b = -.14, p = .11

Source: Author's own illustration.

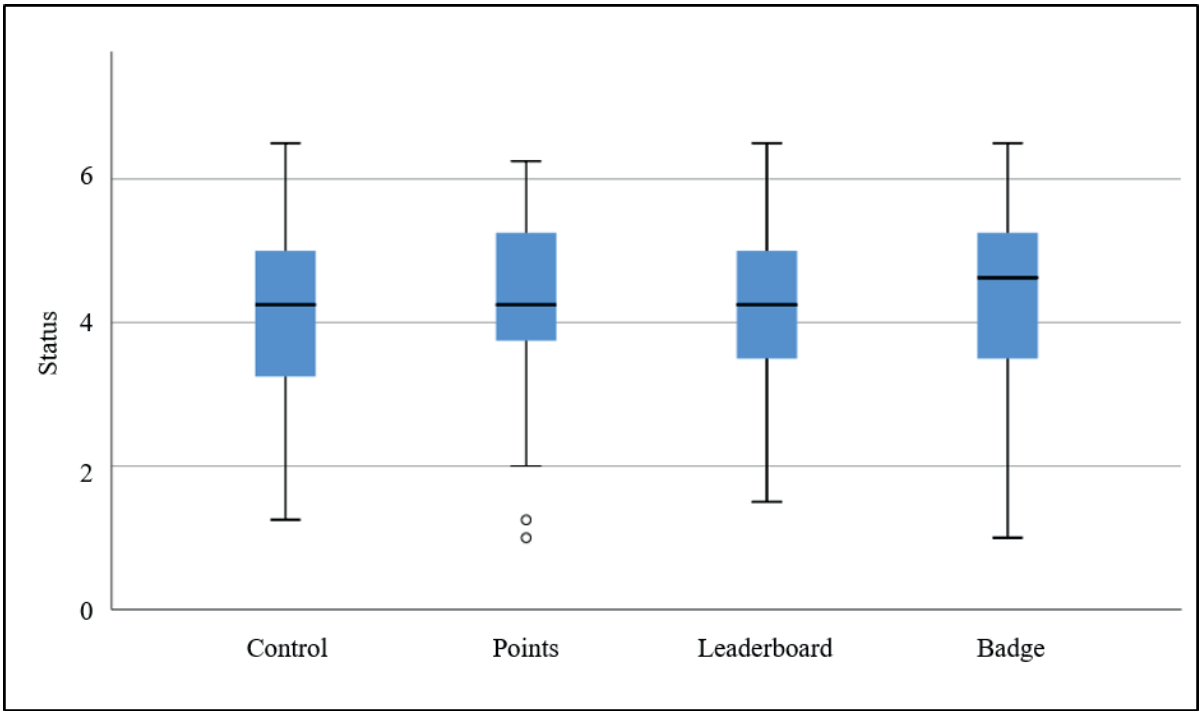
None of the personality characteristics as well as gender have a significant moderating effect on the relationship of game elements on competence. The individual characteristics do not differ significantly between conditions (i.e., points, badges, leaderboard, and control). Thus, a systematic bias does not exist. The non-significant effect of personality characteristics (i.e., status, competition, expertise, extraversion, and conscientiousness) may arise due to a small standard deviation in each condition (see boxplots in Figures 21 to 26). The personality characteristics extraversion, conscientiousness, competition, and status show comparable distributions. A high number of students have an average to high desire for status and an average to high level of competitiveness. Students with a low competitive and status level are rare (see Figure 21 and Figure 22). Potentially, individuals studying business and economics generally have a higher intention to strive for competition and status compared to other courses of study.

Figure 21: Deviation of competition among conditions



Source: Author's own illustration.

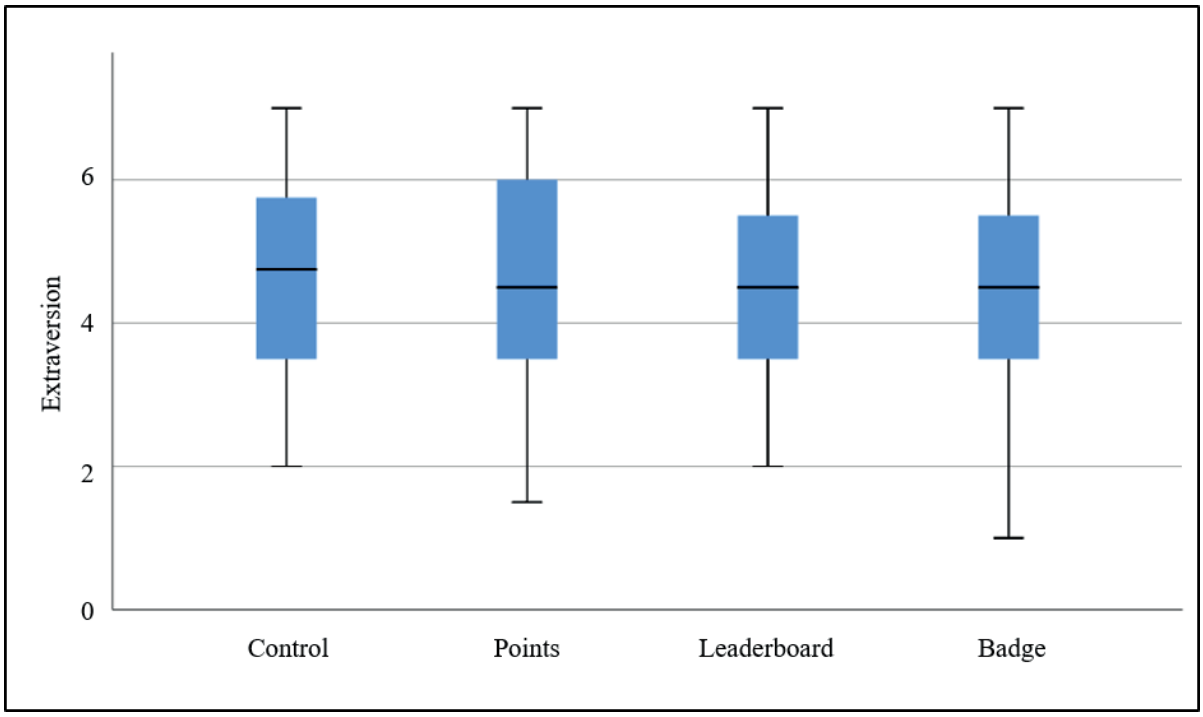
Figure 22: Deviation of status among conditions



Source: Author's own illustration.

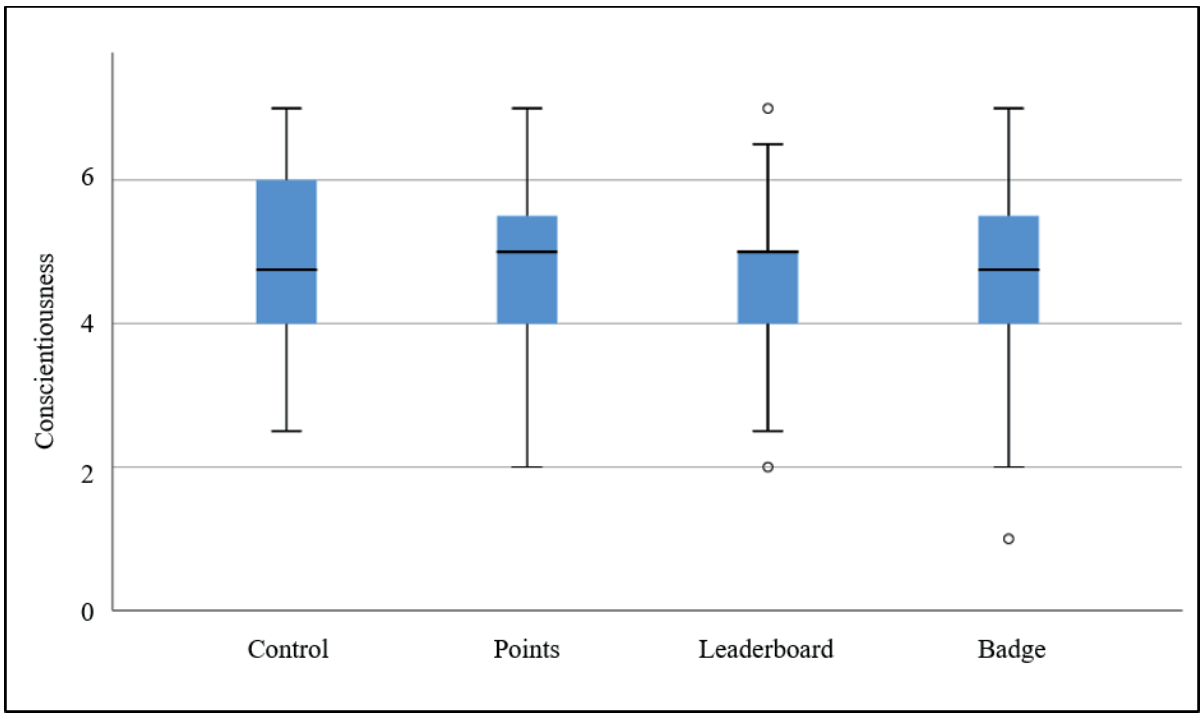
A high number of students have a high level of extraversion (see Figure 23) and a high level of conscientiousness (see Figure 24). One reason might by that students do not want to indicate that they are reserved and lazy. Thus, a social desirability bias occurs (Fisher 1993; King and Bruner 2000).

Figure 23: Deviation of extraversion among conditions



Source: Author's own illustration.

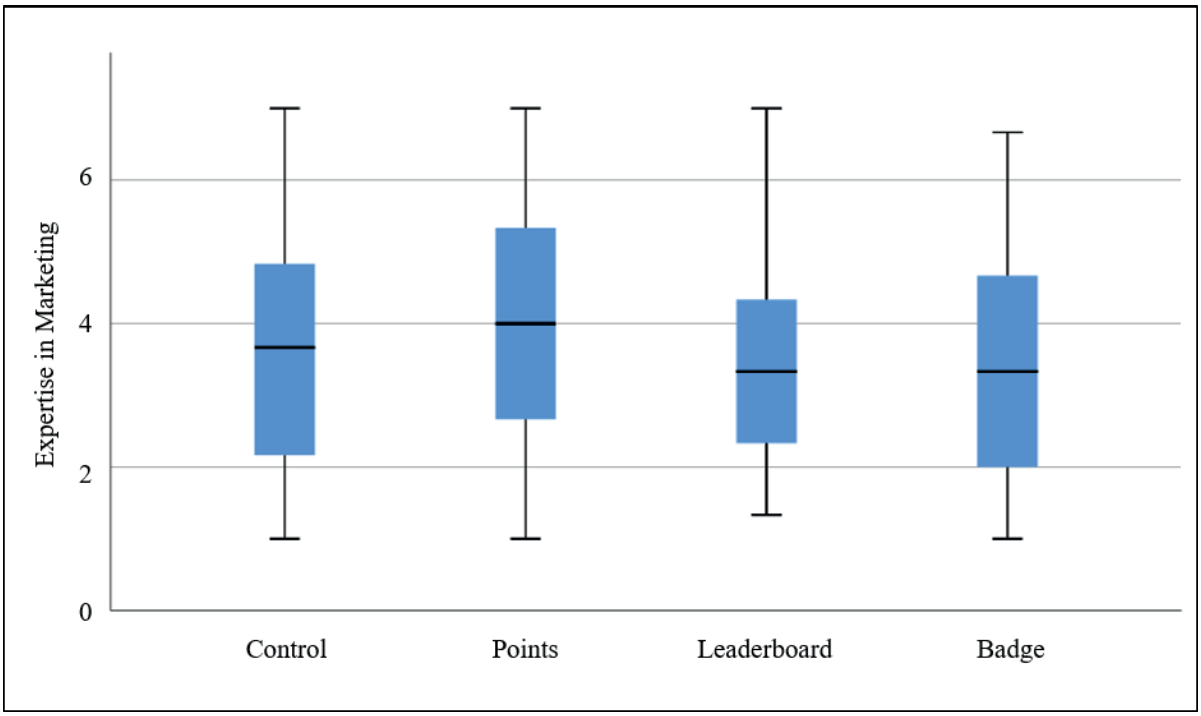
Figure 24: Deviation of conscientiousness among conditions



Source: Author's own illustration.

Most of the students report an expertise in marketing below or around average (see Table 25). This may result from the fact that the course *Foundations of Marketing* is the first marketing course within their bachelor studies. Most of the students may have a relatively low marketing expertise before taking the course.

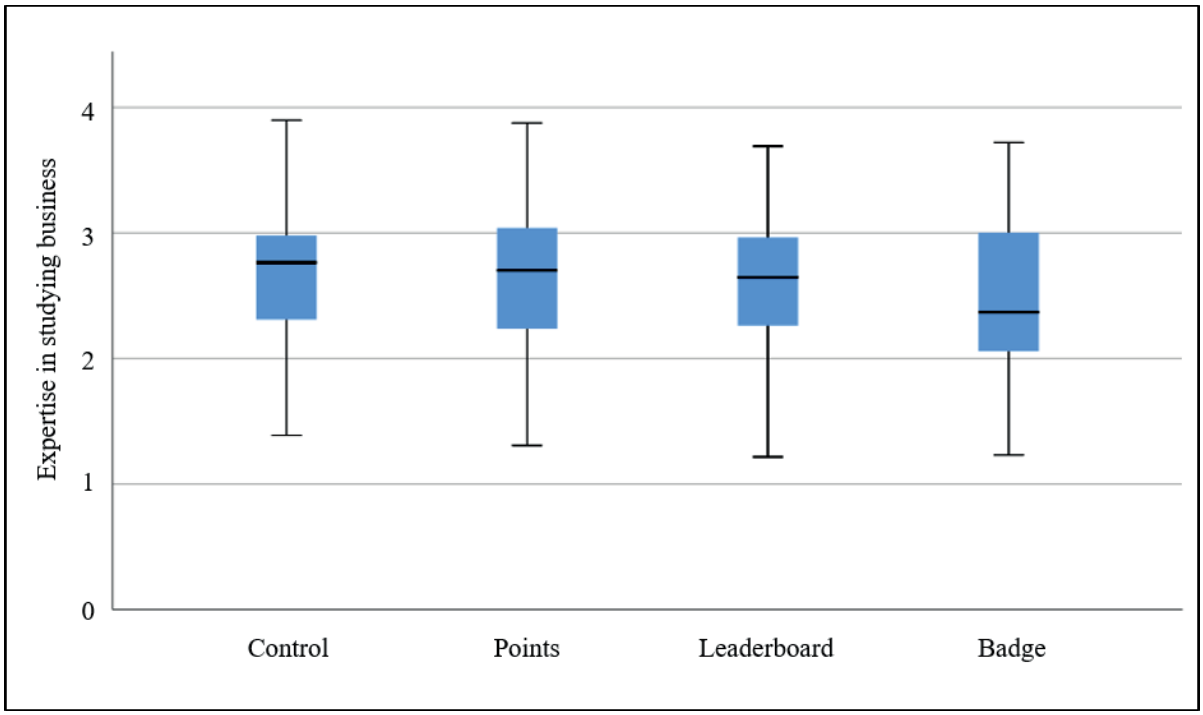
Figure 25: Deviation of expertise in marketing among conditions



Source: Author's own illustration.

Regarding students' expertise in studying business the variation within conditions is low (see Figure 26). Most of the students have a GPA between 2.0 and 3.0. Thus, very good students are missing and very bad students are missing as well. One reason why there are no very good students may be that it is their third semester and the exams of the basic courses in the first two semesters are quite difficult.

Figure 26: Deviation of expertise in studying business among conditions



Source: Author's own illustration.

Although the thesis could not state evidence for a positive effect of game elements on competence compared to a control condition, fundamental coherences of previous studies could be verified. Competence positively drive intrinsic motivation (i.e., enjoyment) (IMI 2018; Ryan and Deci 2000a; b).

Regarding the second sub-goal (i.e., investigating the effect of game elements on students' participation in the course (i.e., in online tutorials)), no significant indirect effects can be stated. Among others, these result from the fact that game elements (i.e., points, badge, and leaderboard) do not significantly influence competence. Intrinsic motivation (i.e., enjoyment) does not have a significant positive effect on participation as well.

Considering the third sub-goal – enhancing the learning performance, no significant indirect effect of game elements (i.e., points, badge, and leaderboard) on learning performance via competence, intrinsic motivation (i.e., enjoyment), and participation can be detected. However, it is worth noting that students in the badge condition wrote a significant better exam than students in the control condition (b = 3.69, p = 0.04). However, this effect needs to be interpreted with caution. Due to the fact that the underlying motivational mechanism is not significant, there might be other mechanisms mediating this effect. The direct effect of points (b = 2.35, p = .24) and leaderboard (b = 1.87, p = .33) compared to the control condition is not significant.

Taken together, the reported results are based on a sample of 206 students that meet three criteria: (i) wrote the exam at the end of the semester, (ii) answered the presurvey, and (iii) answered at least one survey, thus participated at least in one INTUT. In contrast, there are 216 students who do not fulfill these criteria. Thus, they were not part of the sample. However, they were assigned to one of the four Learnweb groups at the beginning of the semester. A comparison of the exam results of the sample group (n=206) to the students that are not part of the sample (n=216) leads to a significant difference (p = .00) in exam results. Students in the sample group received on average 78.63 points in the exam. The average grade of the exam was 1.63. Students in the nonsample group achieved on average 72.42 points. They had an average grade of 2.07. This significant difference in learning performance emphasizes that students in the sample group performed better than in the non-sample group (see Table 33). This may lead to the insignificant results between groups. Students in this group may already be motivated for continuous learning. Consequently, it may not be possible to disentangle the effects of game elements on competence for students that already have a high level of motivation. Even in the control condition without game elements students receive good exam results.

Table 33: Comparison of student performance

Condition	Part of sample (n=206)			Not part of sample (n=216)		
	N	Points (p = .199)	Grade (p = .208)	N	Points (p = .139)	Grade (p = .109)
Control	52	76.66	1.78	57	70.44	2.24
Points	55	79.01	1.61	46	76.43	1.78
Badge	50	80.35	1.50	56	72.04	2.11
Leaderboard	49	78.54	1.63	57	71.62	2.11

Source: Author's own illustration.

Finally, the implementation of gamification was not supposed to have an influence on the students' perception of content and organization of the course. Each student should be able to receive the same course content as well as the content that was conveyed in the online tutorials. Ethical principles should not be violated. Based on the course evaluation, it is possible to verify that students in the control condition were not discriminated against students in the treatment groups. The implementation of game elements did not result in significant differences across groups with regard to the perceptions of the course (see Table 34).

Table 34: Overview of course evaluation

Item	1	2	3	4	Sign.
The course provided me with a good overview of the topics covered.	5.98	5.64	5.75	5.63	.27
The teacher often used examples that helped me understand the course content.	6.15	5.60	5.95	5.80	.04[1]
In my opinion, the teacher responded adequately to students' questions and comments.	5.94	5.58	5.44	5.80	.14
The course content was presented in a way that aroused my interest.	5.26	5.10	5.07	4.98	.75
During the course, I was able to follow the structure at all times.	5.43	5.14	5.44	5.31	.64
In my opinion, the teacher's time management in the course was good.	5.90	5.54	5.72	5.71	.57
The course made me look forward to deeper involvement in certain course content in the future.	5.00	4.84	4.56	4.59	.35
The course content was presented in such a way that I was able to understand it well.	5.51	5.36	5.24	5.29	.67
The course content was presented in such a way that interconnections between the topics became clear to me.	5.45	5.22	5.16	5.32	.64
I received concrete information regarding post-preparation of the course content.	5.21	5.34	4.78	4.84	.17
I had the impression that the teacher was always well prepared.	6.06	5.86	5.95	5.98	.89
I was satisfied with the organization of the tutorial.	5.15	5.36	5.09	5.09	.72
I had the impression that tutorial and lecture were well coordinated.	5.77	5.58	5.55	5.41	.52
The tutorial makes me feel well prepared for the final exam.	4.55	4.40	4.15	4.29	.50
For me, the presentation and communication of the course content was… [1 = too difficult; 5 = too easy]	2.87	2.88	2.84	2.88	.98
How many hours did you spend every week on preparation and post-preparation for the lecture?	2.48	2.27	2.62	2.10	.38
On a scale ranging from 1.0 (very good) to 5.0 (unacceptable), I would grade the course:	1.87	2.03	2.04	2.06	.34

Learnweb groups:
1 = Control (n=53)
2 = Points (n=50)
3 = Badges (n=55)
4 = Leaderboard (n=59)

[1] Post hoc test does not reveal significant results among groups.

Unless otherwise stated:
Seven-point Likert scale: [1 = "disagree completely"; 7 = "agree completely"]

Source: Author's own illustration.

5 Study 2: Effectiveness of Gamification in Market Research

The second study investigates the effectiveness of gamification in market research. The relevance of the topic is motivated and subsequently, the aim of the second study is set up. The conceptual framework is constituted and the hypotheses are derived. The design of the empirical study investigating the conceptual framework is outlined as well as the operationalization of variables. The descriptive statistics and results are presented. The chapter ends with a discussion of the results.

5.1 Improving Participants' Motivation through Gamification in Market Research

In order to maintain a competitive advantage and keep up with market trends, companies attach great importance to market research. Companies base their key strategic and operational decisions on results of market research (Hedewig-Mohr 2018, Shah 2017; Singh 2017; Statista 2017a). Market research data provides companies with feedback from their target customers and insights into what they want and need regarding the offered products and services (Hedewig-Mohr 2018; Patel 2018). Therefore, valid market research data is critical for companies.

Due to online surveys, companies have found an easy way to reach different consumer groups (Homburg and Krohmer 2008, p. 29). Online market research is especially suitable to conduct employee and customer surveys as well as conjoint analyses[18] (Statista 2011). Conjoint analyses are one of the most widely adopted quantitative methods when conducting online market research (Sawtooth 2018; Statista 2011). They have become the preferred technique to investigate consumer preferences for product or service attributes with over 18,000 applications per year (Eggers, Hauser, and Selove 2017; Orme 2009, p. 127; Orme 2016). Over the last 40 years, the conjoint analysis

[18] The objective of a conjoint analysis is to estimate the structure of an individual's preferences by decomposing overall evaluations for a specific set of products or services into utilities for attribute levels (Green and Rao 1971; Green and Srinivasan 1978; Luce and Tukey 1964).

has been used across various industries to quantify individual preferences for products and services (e.g., Chaparro-Peláez, Agudo-Peregrina, and Pascual-Miguel 2016; Green and Rao 1971; Green and Srinivasan 1990; Wessling, Huber, and Netzer 2017). Thus, conjoint analyses are an important market research method that provide useful insights for companies.

Individuals perceive different benefits and burdens of participating in market research. Benefits encompass financial incentives, satisfaction, and curiosity regarding the market research topic, the perception of contributing to research, and a feeling of reward from helping others (e.g., Fox and Crask 1988; Groves, Cialdini, and Couper 1992; Heberlein, Thomas, and Baumgartner 1978; Porter 2004). In parallel, there are also several perceived burdens: survey length, the amount of effort necessary responding to questions, and the amount of emotional stress related to the responses (Bradburn 1978; Sharp and Frankel 1983).

Hence, companies face the problem of negative respondent behavior such as speeding, random responding, high break-off rates, and lack of attention in market research studies (Guin et al. 2012; Harms et al. 2015). The implementation of game elements may be an opportunity to provide individuals with a more challenging, relevant, involving, rewarding, and consequently, a more positive survey experience (Harms et al. 2015; Schacht et al. 2017). The positive survey experience may result in the psychological outcomes that participating in online market research becomes more engaging, involving, and fun. The implementation of gamification may reduce the perceived burdens of emotional and cognitive load. Hence, gamification seems to be useful to make online market research more enjoyable in order to increase continuous participation.

However, companies face the challenge of evaluating the effectiveness of gamification. First, they need to assess whether gamification represents an effective tool when conducting market research. They have to evaluate whether the implementation of gamification provides value to the participants by reducing their emotional and cognitive stress. Besides value to the participant, gamification has to generate value to the company such as more reliable and valid responses. Second, it is necessary for companies to know why gamification is effective and for what type of respondent it works best. The why encompasses knowledge about the underlying psychological mechanisms.

The resulting knowledge helps companies to implement game elements that are suitable to enhance participants' motivation and behavioral (re)actions. If companies comprehend the underlying motivational mechanisms, they can more easily use further game elements and predict their effects.

In sum, companies miss a profound understanding of if, how, and under which conditions gamification is an appropriate tool to reduce customers' emotional and cognitive load in market research studies. This may help them to decrease the negative respondent behaviors and thus motivate customers to participate continuously in market research studies.

Based on the literature review in chapter 3, three important research gaps are identified. First, an examination of the effects of specific game elements is needed instead of considering gamification as a uniform concept. Second, current research lacks investigations of specific game elements on psychological mediators and behavioral outcomes. Most of the studies focusing on specific game elements solely investigate behavioral outcomes. These studies do not aim to investigate the underlying motivational mechanisms, e.g., by applying the self-determination theory. Third, gamification research that investigates the moderating effect of individual characteristics is scarce. However, the same trigger (i.e., game element) may be perceived differently by different individuals (Bui, Veit, and Webster 2015; Kankanhalli et al. 2012; Ryan and Deci 2017, p. 220 and p. 238).

In order to address these three research gaps the aim of the second study is to *investigate the effectiveness of gamification in market research (i.e., online survey).*

More specifically, this study investigates the effect of a specific form of gamified market research (i.e., a memory-type game) on (i) individuals' motivation to perform a task moderated by individual characteristics (ii) their evaluation of market research, and (iii) their intention to re-participate in future market research. Gamified market research may influence individual's motivation by affecting competence and subsequently their intrinsic motivation (i.e., enjoyment) of performing a certain task. An enhanced intrinsic motivation (i.e., enjoyment) may result in the achievement of positive short-term (i.e., evaluation of market research) and long-term re(actions) (i.e., intention to re-participate in future market research).

This study contributes to current research by focusing on the implementation of a game element (i.e., memory-type game) instead of investigating a gamified survey (i.e., use multiple game elements) as a whole. The study provides insights from the application of the self-determination theory as a theoretical foundation in order to explain the underlying motivational mechanisms. The effect of a specific game element on the mediating psychological and subsequently behavioral outcomes is investigated. Moreover, an investigation of short- and long-term effects of gamification is provided. Finally, the study enriches current research with the examination of the moderating effect of individual characteristics.

Besides a theoretical contribution, the study additionally provides practical contributions. By understanding the underlying psychological mechanisms, companies can design their market research studies more effectively through the implementation of game elements. The integration of gamification may make research studies more enjoyable and reduce the perceived burden for participation. The amelioration of their market research design may positively influence consumers' emotional and cognitive load. The ameliorated design may lead to higher quality as well as quantity of participation rates and thus attenuates the negative respondent behavior. The examination of individual characteristics provides companies insights into opportunities to better target their market research designs.

5.2 Literature Review on Gamification in Market Research

Previous research has already investigated factors that affect response rates in survey development. These factors can be grouped in two major categories: content of surveys (i.e., sponsor, topic, and length) and presentation of surveys (i.e., question writing, question ordering, and visual display of online surveys) (Fan and Yan 2010). Recent studies extend the investigation concerning the presentation of online surveys. They attempt to make surveys not only more visually appealing but also more engaging by implementing dynamic and interactive online survey question formats (Dolnicar, Grün, and Yanamandram 2013).

So far, there are a few studies investigating the effect of gamification in market research (e.g., Guin et al. 2012; Harms et al. 2015). The majority of studies is descriptive in nature. These studies do not allow evaluations of the causal effect of gamification on survey data quality (Keusch and Zhang 2017). Based on the literature review provided in chapter 3, two studies (i.e., Guin et al. 2012; Harms et al. 2015) were identified. Thus, an overview table of studies investigating gamification in market research as well as a framework that illustrates the results of the studies is not meaningful. Hence, the results of the two studies are discussed in the text. Guin et al. (2012) gamify a survey by using a style of presentation that is supposed to make the survey engaging. This design encompasses game elements such as avatars, rules, narrative, and rewards (Guin et al. 2012). Besides a visual design and micro-games, Harms et al. (2015) additionally implement game elements such as avatars and feedback mechanisms by providing coins and medals in their gamified survey.

Both studies investigate the effects of gamification on psychological as well as behavioral outcomes. However, they solely consider the direct effects of gamification on both outcomes and a theoretical foundation is lacking. The studies demonstrate a significant positive effect of a gamified survey on enjoyment compared to a non-gamified survey (Guin et al. 2012; Harms et al. 2015). In addition, a gamified survey has a significant positive influence on the attitude towards gamification (Guin et al. 2012). The effects of a gamified survey on the quantity of action (i.e., actual behavior) are mixed (Guin et al. 2012; Harms et al. 2015). Guin et al. (2012) find a significant negative effect on completion rates. However, individuals answering a gamified survey are more inclined to frequently use as well as recommend the gamified survey (i.e., behavioral intention) (Harms et al. 2015). Due to the consideration of a gamified survey as a whole, it is not possible to disentangle the effects of different game elements on psychological and behavioral outcomes. Both studies neglect the investigation of the moderating effects of individual characteristics as well as an examination of the quality of action.

Besides papers that explicitly use the term gamification, there are studies that investigate the influence of the game element *progress bar* without naming it gamification[19] (e.g., Crawford, Couper, and Lamias 2001; Yan et al. 2010).

[19] Consequently, the following studies were not identified as relevant in section 3.1.

Crawford, Couper, and Lamias (2001) demonstrate that participants facing a progress bar show significant higher break-off rates. However, other studies do not find a significant difference between groups regarding survey completion rates (Couper, Traugott, and Lamias 2001; Yan et al. 2010). Thus, a progress bar does not seem to be an appropriate way to reduce customers' perceived burden to participate in online surveys and overcome the negative respondent behavior.

A further study that implements gamification without focusing on and naming it is the one by Schlereth and Schulz (2014). They introduce a new type of conjoint analysis (i.e., Restricted-Click-Stream (RCS) analysis), resembling the Choice-Based Conjoint analysis[20] (CBC). The difference lies in the fact that an individual is confronted with a kind of memory game. In contrast to the traditional CBC where all attribute levels are visible, in the RCS all attribute levels are covered at the beginning. The individual is asked to uncover a restricted number of attribute levels and base their choice on these uncoverings (Schlereth and Schulz 2014). The authors try to overcome the problem that respondents face a high emotional and cognitive load answering a traditional CBC. By implementing a memory-type game, the authors show similar validity in the results compared to Rating-Based-Conjoint (RBC)[21] and CBC but lower cognitive and emotional load for the respondents (Schlereth and Schulz 2014).

The approach of Schlereth and Schulz (2014) seems to be promising to make market research studies more enjoyable by reducing emotional and cognitive load even if they do not intend to study the influence of gamification. They focus on the implementation of a new conjoint method. This method may decrease negative respondent behavior such as speeding, random responding, high break-off rates, and lack of attention in market research studies. More profound research is needed in order to understand the underlying theoretical framework.

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[20] The CBC offers respondents a selection of product or service alternatives in a choice set. Then, respondents are asked to state their most preferred option (Louviere and Woodworth 1983).

[21] The RBC contains the evaluation of each stimulus on a rating scale (Green, Krieger, and Wind 2001; Green and Rao 1971).

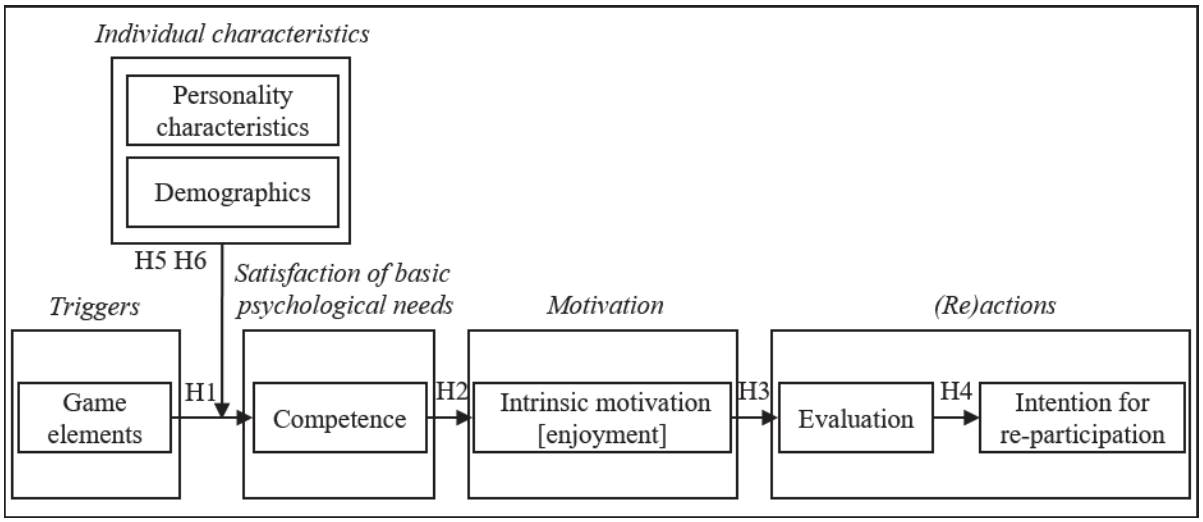
Taken together, current research that investigates gamification in market research is still scarce. The two studies that intentionally examine gamification in market research considers gamification as a uniform concept (Guin et al. 2012; Harms et al. 2015). Studies using gamification unintentionally and focusing on specific game elements show mixed results. Whereas the implementation of a memory-type game seems to be a promising approach, the results of implementing progress bars are less positive. Due to the complexity of a market research method, it seems to be a more exiting task to gamify a method than to investigate whether the sole implementation of a progress bar has an effect on individuals' psychological and behavioral outcomes. Hence, gamifying a market research method is of primary interest of this study. The resulting effects on individuals' motivation and subsequently behavior are supposed to generate higher value for both participants and companies.

Besides the consideration of specific game elements, current research can be enriched by applying the self-determination theory in order to explain the underlying motivational mechanisms. In addition, the mediating psychological as well as behavioral outcomes are investigated. Due to the fact that current research neglects an investigation of individual characteristics, an examination of the moderating effect of individual characteristics provides a further contribution.

5.3 Conceptual Framework and Hypotheses

In the following, the conceptual framework and the hypotheses are derived (see Figure 27).

Figure 27: Conceptual framework of study 2



Source: Author's own illustration.

The aim of implementing a specific game element in a market research method is to enhance participants' competence and intrinsic motivation (i.e., enjoyment). An increase in motivation may lead to positive short-term (i.e., evaluation of market research) and long-term (re)actions (i.e., intention to re-participate in future market research). Based on the self-determination theory, triggers (i.e., game elements) have a positive effect on competence when they are perceived as providing an informational functional significance (Deci and Ryan 1980, pp. 62-65). Competence reflects "a need for challenge and feelings of effectance" while consciously interacting with the environment (Ryan and Deci 2000b; Ryan, Rigby, and Przybylski 2006, p. 349; White 1959). It can be assumed that every individual attempts to feel competent when consciously influencing the environment they interact with (Deci and Ryan 2012, p. 85; Ryan and Deci 2017, p. 95; White 1959). The need for competence stems from individuals' desire to use their skills and capacities to master optimal challenges (Jung, Schneider, and Valacich 2010). Deci (1975) and later Deci and Ryan (1980) introduce the concepts of optimal challenges and positive feedback. They use these concepts to show the match of individuals' abilities with task demands in which they receive the experience of mastery and feelings of

competence satisfaction (Ryan and Deci 2017, p. 118). Based on the self-determination theory, optimal challenges represent challenges that are readily but not easily mastered. These challenges are not overly stressful or demanding (Ryan and Deci 2017, p. 153). Hence, when individuals are free to choose a task, they chose the one that provides an optimal challenge (Deci and Ryan 2012, pp. 102-103; Ryan and Deci 2017, p. 153; Shapira 1976). Optimally challenging tasks result in greater pleasure (Harter 1974).

Consequently, triggers (i.e., game elements) that reinforce a feeling of competence (i.e., facing optimal challenges) increase the perception of competence which subsequently raise intrinsic motivation (Deci and Ryan 1980, p. 42 and pp. 61-64; Deci and Ryan, 2000; Gagné and Deci 2005; IMI 2018). For instance, competence supportive game features lead to enhanced perceptions of competence (Ryan, Rigby, and Przybylski 2006). The need for competence further enhance game enjoyment independently from other basic psychological needs (Ryan, Rigby, and Przybylski 2006; Sheldon and Filak 2008). Consequently, the effect of game elements on intrinsic motivation (i.e., enjoyment) is mediated by the satisfaction of the basic psychological need for competence (Peng et al. 2012).

This is in line with Wolf, Weiger, and Hammerschmidt (2018) who assume that triggers (i.e., game elements) that satisfy the need for competence evoke a gameful experience of skill development. This gameful experience encompasses that individuals feel like they behave effectively when they attain personal goals, make progress, or meet challenging tasks. Hence, feelings of achievement, challenge, and progress relate to this factor (Wolf, Weiger, and Hammerschmidt 2018).

Hence, this study proposes that triggers (i.e., game elements) that evoke a gameful experience of skill development have a positive effect on competence and subsequently intrinsic motivation (i.e., enjoyment).

H1: Game elements evoking a gameful experience of skill development have a positive influence on competence compared to a control condition.

H2: Competence has a positive influence on intrinsic motivation (i.e., enjoyment).

In line with the self-determination theory, individuals who are autonomously motivated (i.e., intrinsic motivation and autonomous forms of extrinsic motivation) are more likely to demonstrate a high level of engagement, positive

effective experiences and persistence (Deci and Ryan 2000; Hanus and Fox 2015; Huang and Hew 2018; Ryan and Deci 2000a; Vallerand and Bissonnette 1992). Individuals participate more in an activity when they experience hedonic values while performing it (Deci and Ryan 1985b; Deci and Ryan 2000). Individuals' intrinsic motivation (i.e., enjoyment) is a moderate to strong antecedent of the quantity and quality of behavior (Cerasoli, Nicklin, and Ford 2014; Vallerand and Bissonette 1992). Moreover, intrinsic motivation (i.e., enjoyment) may not solely influence behavioral intention directly but also indirectly through attitude (Lee, Cheung, and Chen 2005).

Attitudes are primarily formed by individuals based on the evaluation of information about past behavior and both affective and cognitive information (Zanna and Rempel 1988, p. 319). An attitude represents an individual's "feeling of favorableness or unfavorableness toward some stimulus object" (Fishbein and Ajzen 1975, p. 216). In this study, attitude towards the market research study refers to the overall evaluation of the market research study, be it favorable or unfavorable (Ajzen 1991). Based on the theory of planned behavior, the attitude towards a certain behavior is a reliable predictor of behavioral intentions (Ajzen 1991; Fishbein and Ajzen 1975, p. 15). A strong association between attitude and behavioral intention has already been shown in several studies (e.g., Bock et al. 2005; Lin and Bhattacherjee 2010; Mäntymäki et al. 2014).

Taken together, a higher intrinsic motivation (i.e., enjoyment) leads to a more positive attitude regarding the market research study itself. Individuals that perceive the market research study as more enjoyable will evaluate the market research study in a more positive way. Subsequently, a positive evaluation of the market research study has a positive effect on the intention to participate in comparable future market research studies.

H3: Intrinsic motivation (i.e., enjoyment) has a positive influence on the evaluation of the market research study.

H4a: The positive evaluation of the market research study has a positive effect on the intention to re-participate in future market research studies.

Besides considering the single direct effects of the conceptual framework, a mediation effect is postulated.

H4b: The positive effect of game elements evoking a gameful experience of skill development on the intention to re-participate in future market research studies is fully, serially mediated by (a) an increase in competence, (b) an increase in intrinsic motivation (i.e., enjoyment), and (c) a positive evaluation of the market research study.

According to the causality orientations theory, individual characteristics may act as moderators of the effect of game elements on competence. Individuals differ in their extent to which they perceive triggers (i.e., game elements) as informational or controlling (Deci and Ryan 1985a, p. 153; Ryan and Deci 2017, pp. 216-220). In the following, individual characteristics that may influence the strength of the relationship between game elements evoking skill development and competence are discussed. In the context of market research, it seems not to be meaningful to investigate gameful experiences of social comparison (i.e., competition). When filling in an online market research study there are no correct or incorrect answers. Companies are mostly interested in individual's real opinion independent of whether it is a positive or a negative one. Thus, it is not possible for an individual to answer in a better way than a competitor. Consequently, the personality characteristics of status and competition are not investigated. The personality traits extraversion and conscientiousness are not considered as well because the second study does not focus on the implementation of external stimuli such as progress bars (i.e., achievement) or rewards in a survey. The focus of this study lies in the fact to gamify a market research method. Hence, the personality characteristics extraversion (i.e., receive stimulation and satisfaction from outside the self) and conscientiousness (i.e., self-discipline and the aim for achievement) are not supposed to have a moderating effect. In comparison to the first study, solely the individual characteristics gender and expertise (i.e., domain specific knowledge) seem to be important to investigate in a context of market research.

Various studies have already demonstrated that men indicate more game-related knowledge, play more often, and for longer durations than women do (e.g., Brown et al. 1997; Hartmann and Klimmt 2006; Ivory 2006; Lucas and Sherry 2004; Wright et al. 2001). The study of Hartmann and Klimmt (2006) demonstrates gender-specific game preferences. Hence, women and men react differently to game elements and it seems to be important to consider gender

in an investigation of the effects of gamification (Attali and Arieli-Attali 2015). Transferred to the gamification context, men may be generally more attracted by game elements that enable a gameful experience of skill development (i.e., challenge, achievement, and progress). Since men may derive more value from these gameful experiences and are more used to it, the influence of skill development on competence will be stronger for men.

H5: The positive effect of game elements evoking a gameful experience of skill development on competence is stronger for men than for women.

Expertise encompasses individuals' ability to accomplish product-related tasks in a successful way (Alba and Hutchinson 1987). For instance, expertise supports individuals by interpreting stimulus information in order to facilitate the meaning of a message in a simple and accurate way. Expertise provides individuals with knowledge they need to reject inappropriate pragmatic implications (Alba and Hutchinson 1987). It helps individuals to effortlessly understand the link of one assertion to another. Hence, individuals increase their accuracy in generating product beliefs by enhancing the probability of analytic thought and by decreasing overgeneralization from known facts (Alba and Hutchinson 1987). Individuals that have a high expertise (i.e., domain specific knowledge) in a specific field may perceive a higher confidence in their ability to solve problems and be more persistent (e.g., Gupta, Bostrom, and Huber 2010, Johnson and Marakas 2000, Santhanam, Liu, and Shen 2016; Yi and Davis 2003). Individuals' perceptions of being able to deal with given tasks in a successful way may influence them to invest more energy to resolve them. In contrast, individuals that feel not capable to handle a certain situation because of a lack of expertise in the subject may consider themselves as less competent even if the gameful experience of skill development is high. They may not perceive game elements as supportive by providing informational feedback. Consequently, individuals' expertise in the market research topic may strengthen the effect of skill development on competence.

H6: The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise about the market research topic.

5.4 Empirical Study

In this section, the design of the empirical study is outlined. The main variables for examining the hypotheses are operationalized. The result section entails descriptive statistics as well as the analysis of hypotheses. The section concludes with a discussion of the results.

5.4.1 Design of Empirical Study

In light of the defined research objective – the examination of gamification effectiveness in market research – a field experiment was conducted to test the proposed conceptual framework. Gamifying a market research method instead of implementing game elements in a survey is of primary interest of this study.

The conjoint analysis seems to be a suitable market research method to test the conceptual framework. It is one of the most widely adopted quantitative methods when conducting online market research (Sawtooth 2018; Statista 2011). The objective of a conjoint analysis is to estimate the structure of an individual's preferences by decomposing overall evaluations for a specific set of products or services into utilities for attribute levels. In a conjoint analysis, there are no correct or incorrect answers. The purpose is to measure individuals' subjective opinions about which is the best option and subsequently discover utilities that attributes contribute to the overall utility of a product or a service. As a result, companies receive a utility function that translates the specific attribute levels of a product or service into individuals' preferences (Green and Rao 1971; Green and Srinivasan 1978; Luce and Tukey 1964). A conjoint analysis provides useful insights for companies. Accordingly, individuals need to be motivated to overcome the perceived burdens and to avoid negative respondent behaviors such as speeding, random responding, high break-off rates, and lack of attention.

Since Luce and Tukey developed the conjoint analysis in 1964, several types of conjoint analyses and measurements were developed (e.g., Johnson 1974; Louviere and Woodworth 1983). The traditional conjoint analysis contains the evaluation of each stimulus on a rating scale (e.g., on a seven-point scale) (Green, Krieger, and Wind 2001; Green and Rao 1971; Green and Srinivasan 1978; Johnson 1974). This evaluation task does not seem to be realistic (Elrod, Louviere, and Davey 1992; Johnson and Orme 2007, p. 1; Moore 2004).

In contrast, the CBC (developed by Louviere and Woodworth in 1983) may overcome this potential limitation and enhances the realism of the task (Elrod, Louviere, and Davey 1992; Johnson and Orme 2007, p. 1; Moore 2004; Sawtooth 2017; Schlereth and Schulz 2014). This approach offers respondents a selection of product or service alternatives in a choice set. Respondents are asked to indicate their most preferred option. Each respondent has to repeat this choice of the most preferred option across multiple sequential choice sets (Louviere and Woodworth 1983). The decision within a choice set often requests a trade-off between attributes (Green, Krieger, and Wind 2001; Louviere and Woodworth 1983). As a result, this decision enhances the realism of the task (Elrod, Louviere, and Davey 1992; Johnson and Orme 2007, p. 1; Moore 2004; Sawtooth 2017; Schlereth and Schulz 2014). For instance, respondents have to make trade-off decisions like in a buying context: a lower price is offered with a lower quality. The increase in realism of CBC experiments enhances the expectations that CBCs perform with a higher validity compared to traditional conjoint analyses. However, studies do not discover significantly better results for CBC compared to traditional conjoint analyses although the direction of the effects corresponds to the expectations (Moore 2004; Vriens, Oppewal, and Wedel 1998).

However, the CBC is the most commonly used approach, accounting for over 80% of the research projects (Orme 2016). This reflects the high relevance of the CBC for managerial decision making. CBC questionnaires may be easier for participants to respond to compared to traditional conjoint analyses (Eggers, Hauser, and Selove 2017; Green, Krieger, and Wind 2001; Johnson and Orme 2007, p. 1). Nevertheless, respondents still face an extensive evaluation task because they have to evaluate ten or more scenarios (Green, Krieger, and Wind 2001). This results in high time, cognitive, and emotional expenditures (Schlereth and Schulz 2014). Thus, an improvement of the design of the evaluation tasks is still needed.

Gamification is supposed to help individuals to reduce the overtaxing as well as to make the evaluation task more fun by enabling a gameful experience of a challenge (i.e., being claimed by a task) to the respondents.

Based on the literature, being claimed by a task (i.e., challenge) relates to the gameful experience of skill development (Wolf, Weiger, and Hammerschmidt 2018). A facilitation of such a gameful experience may help individuals to increase their skills in evaluating choice tasks.

In order to empirically investigate the research aim, the CBC is gamified due to its high relevance for managerial decision making. In the current study, a gamified CBC is compared to a traditional CBC as well as a traditional conjoint analysis (i.e., RBC). The aim is to reduce the cognitive load respondents are confronted with. The gamified CBC helps respondents to focus on attributes that are really important for them. This gamified CBC is based on the RCS developed by Schlereth and Schulz (2014).[22] Respondents face two tasks. First, they have to think about what attribute levels to uncover. Second, they have to decide on one alternative based on the attribute levels uncovered. Based on the number of uncovered levels per attribute importance weights are calculated (Schlereth and Schulz 2014).

In the current study, activity trackers represent the chosen product (see Figure 28 for examples). Activity trackers are very popular in Germany throughout the population (Statista 2017b; c). They can be classified as high involvement products. High involvement products (i.e., durable products like consumer electronics and automobiles) are assumed to be more suitable for conducting a conjoint analysis than low involvement products (Backhaus et al. 2016, p. 523; Gu, Park, and Konana 2012; Laurent and Kapferer 1985). The reason behind this is that low involvement products are perceived as habitual, are of low personal interest, and the decision process does not contain a high cognitive load (Laurent and Kapferer 1985; Zaichkowsky 1985).

[22] A detailed description of the method is provided on pp. 147-148.

Figure 28: Examples of activity trackers

Source: Fitbit (2018a; b).

Attributes of products and services investigated in a conjoint analysis are supposed to fulfill seven criteria (here and in the following, Backhaus et al. 2016, pp. 523-524). First, product attributes need to be *preference relevant*. This means that the attributes are relevant for the buying decision. Second, companies must *be able to influence* the attributes. Third, attributes are supposed to be *independent*. The perceived use of one attribute level shall not be influenced by levels of other attributes. Fourth, attribute levels need to be *realizable* and fifth, in a *compensatory* relationship to each other. Sixth, they are not allowed to constitute *exclusion criteria* and seventh, the *number* of attributes and attribute levels has to be *limited*.

All attributes of activity trackers chosen in this study fulfill all seven requirements (see Table 35). Taken together, an activity tracker represents a suitable product for conducting a conjoint analysis.

In sum, the conjoint experiment includes six attributes: brand, display, heart rate monitor, battery life, average customer review, and price. The attributes have two or three levels (see Table 35). The study follows the rule of thumb to not exceed six attributes (Green and Srinivasan 1990; Hair et al. 2014, p. 359). Besides the brand attribute, all attributes have an equal number of levels, constituting a symmetrical design (Backhaus et al. 2016, p. 526).

Table 35: Overview of attributes and attribute levels

Attribute/Level	Level 1	Level 2	Level 3
Brand	Fitbit	SportPlus	
Display	small display incl. smartphone notifications	LED indicators	no display
Heart rate monitor	integrated heart rate monitor (wrist)	separate chest strap available	no heart rate monitoring possible
Battery life	approx. 3 days	approx. 7 days	more than 14 days
Average customer review	3.3 out of 5 stars	3.5 out of 5 stars	3.7 out of 5 stars
Price	79 Euro	99 Euro	119 Euro

Source: Author's own illustration.

As mentioned above, the study investigates three different types of conjoint analyses (i.e., RBC, CBC, and gamified CBC). The study was set-up in line with the study of Schlereth and Schulz (2014). Due to the fact that the time of answering the conjoint task is not supposed to be a reason for breaking-off the survey, the different conjoint analyses should approximately take the same amount of time to answer (Schlereth and Schulz 2014). This results in a variation of the number of choice sets between conjoint analyses. No *no choice* option is included in the study to ensure comparability. A *no choice* option is not applicable for a RBC (Schlereth and Schulz 2014).

All types of conjoint analyses contain the same attributes and attribute levels. The alternative a respondent is asked to evaluate always contains one level of each of the six defined attributes (see Table 36 for an example).

Table 36: Example of alternative

Attributes	Attribute levels
Brand:	Fitbit
Display:	no display
Heart rate monitor:	separate chest strap available
Battery life:	approx. 7 days
Average customer review:	3.3 out of 5 stars
Price:	79 Euro

Source: Author's own illustration.

The study comprises three different groups with a between-subject design. Each respondent was randomly assigned to one of the three conditions to ensure an even distribution and to enhance internal validity (Iacobucci and Churchill 2010, p. 113).

RBC condition

In the RBC condition, a D-efficient design was specified. Respondents had to rate 16 different product alternatives on a seven-point Likert scale (1 = very unattractive, 7 = very attractive) based on their preferences. Figure 29 illustrates an example.

Figure 29: Example of RBC condition

Source: Author's own illustration.

CBC condition

In the CBC condition, respondents were confronted with 12 choice sets of four product alternatives (see Figure 30). A D-efficient factorial design was specified. This design satisfies the criteria of orthogonality, minimal overlap and balance of attribute levels (Huber and Zwerina 1996). Respondents had to choose one alternative in every choice set based on their preferences.

Figure 30: Example of CBC condition

Source: Author's own illustration.

Gamified CBC condition

The gamified CBC differs from the CBC in the fact that a memory-type game as a game element was implemented[23]. Hence, the alternatives within the choice sets were covered (see Figure 31). In the following, the term gamified CBC will be used as a synonym for *CBC containing the game element memory-type game* due to convenient reasons.

Figure 31: Example of gamified CBC condition – covered

Source: Author's own illustration.

[23] This game element is in line with the definition of Deterding et al. (2011). They state that game elements are characteristic for games, i.e., elements that are part of most but not necessarily of all games, that can be associated with games, and have a significant role in gameplay (Deterding et al. 2011).

Each respondent had the opportunity to uncover a restricted number of attribute levels. The respondent was free to uncover every attribute level (s)he was interested in for making the final choice. There was a counter below the gamified CBCs. It showed the number of remaining clicks (see Figure 32). In total, each respondent was confronted with four choice sets.

The first choice set was a test run and does not count for the preference measurement. Within each choice set the respondent had the possibility to uncover 12 fields (i.e., attribute level). In order to ensure comparability and simplicity, the design of the first four choice sets of the CBC condition were used.

The gameful experience of a challenge resulted from considering which fields to uncover and how to derive a decision based on 12 uncovered attribute levels. This might guide respondents to think about which attributes might be the most important ones for making a decision compared to solely comparing a defined number of choice sets. This gamified CBC was assumed to help individuals reducing their feeling of being overwhelmed by the task by focusing on important attributes or attribute levels. The aim was to introduce an optimal challenge without being bored or overwhelmed by the task.

Figure 32: Example of gamified CBC condition – uncovered

Source: Author's own illustration.

Besides answering the conjoint task, respondents in all conditions were asked to answer a related survey. The survey contains the same questions for all respondents regardless of the type of conjoint task they were assigned to. Each respondent was exposed to the same procedure. After some initial questions about respondents' fitness involvement, respondents received a brief introduction to the conjoint scenario. After answering one of the three conjoint tasks, respondents filled out questions about the focal variables. They finished with responding to demographical questions and providing a survey evaluation.

The whole study (i.e., conjoint task and survey) was distributed via an anonymous link. A convenience sample was used by distributing the anonymous link online in context specific groups.

A promising way to increase the response rate is to offer a participation incentive (e.g., Yammarino, Skinner, and Childers 1991). Incentive-aligned studies provide a higher out-of-sample predictive performance of actual purchase behaviors. This results in improved estimates of individuals' preference structures compared to hypothetical studies without incentives (Ding, Grewal, and Liechty 2005). Data that is collected in hypothetical settings shows weaker external validity than data collection from incentive-aligned individuals (Ding 2007). An increase in external validity is achievable by using lottery incentives reducing the financial costs regarding the implementation of the mechanism (Ding 2007).

In this study, each participant who filled out the survey completely had the possibility to win one of two activity trackers. The specific activity tracker the participants were able to win was related to the real decisions participants made during the conjoint analyses. They had the possibility to win an activity tracker based on their specified preferences. Potential differences to the maximum value of 119 Euro were paid out as a voucher from amazon.de. The possibility to win an activity tracker based on their specified preferences should encourage the participants to carefully and honestly fill in the survey.

5.4.2 Operationalization of Variables

The variables were measured by adapting validated multi-item scales used in established former research. In order to enhance the validity and reliability of the measured variables, multi-item instead of single-item scales are applied (Diamantopoulos et al. 2012). Among the different scales applied in the literature, the ones that best match the chosen definition of the respective variable were selected. The constructs were measured on a seven-point Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree". For minimizing the probability of biases caused by item ambiguity, item formulations were kept simple and concise. Complicated syntax and unfamiliar terms were avoided (Podsakoff et al. 2003). All scales were translated from English to German. They were adapted to fit to the specific study context. A pretest verified their comprehensibility (n=5).

Afterwards, minor adjustments in the wording of the questions were made. The focal variables (i.e., mediator, moderator, and dependent variables) and their measurement are explained in the following (see Table 37 for an overview).

The mediating variables *competence* (i.e., two items) and *intrinsic motivation (i.e., enjoyment)* (i.e., three items) were assessed using items from the IMI scale to capture respondents' competence as well as fun with regard to choosing an activity tracker (IMI 2018; McAuley, Duncan, and Tammen 1989). The enjoyment subscale of IMI represents the self-reported measure of intrinsic motivation. Thus, enjoyment is the sole scale within IMI that assesses intrinsic motivation (IMI 2018).

The *evaluation* variable consists of two parts (i.e., survey evaluation and evaluation of choice task). The *evaluation of the survey* was measured with a one item question at the end of the survey. The respondents were asked to evaluate the survey based on a grading system from 1 = "very good" to 6 = "unsatisfactory". The second part of the evaluation variable consists of the variable *choice satisfaction*. It was assessed with a four-item scale adapted from Fitzsimons (2000) to capture respondents' evaluation of the decision process. The moderator variable *expertise* consists of three items adapted from Fuchs, Prandelli, and Schreier (2010). The variable capture respondents' ability to evaluate activity trackers and choose the best one.

The dependent variable *intention for re-participation* was measured in percent. Respondents were asked to assess their probability to re-participate in comparable future market research studies and type it in a blank box.

Table 37: Item overview of study 2

Dimension	Construct	Items	Item name in dataset
Competence (Mediator)	IMI (2018); McAuley, Duncan, and Tammen (1989)	After engaging in the task of choosing activity trackers for awhile, I felt increasingly competent to make a choice.	Competence 1
		I am satisfied with my performance in the task of choosing activity trackers.	Competence 2
Intrinsic motivation (i.e., enjoyment) (Mediator)	IMI (2018); McAuley, Duncan, and Tammen (1989)	The task of choosing activity trackers was fun to do.	Intrinsic motivation (i.e., enjoyment) 1
		I would describe the task of choosing activity trackers as very interesting.	Intrinsic motivation (i.e., enjoyment) 2
		I enjoyed the task of choosing activity trackers very much.	Intrinsic motivation (i.e., enjoyment) 3
Choice satisfaction (Mediatior)	Fitzsimons (2000)	I am satisfied with the choice of activity tracker.	Choice satisfaction 1
		I found the decision making process for choosing an activity tracker interesting.	Choice satisfaction 2
		I have been sufficiently informed about all aspects that were important for the selection of the activity trackers.	Choice satisfaction 3
		I think I'm going to purchase one of the activity trackers I've chosen.	Choice satisfaction 4
Survey evaluation (Mediator)	-	Please evaluate the survey you just completed with grades from 1 to 6.	Survey evaluation
Expertise (Moderator)	Fuchs, Prandelli, and Schreier (2010)	I felt competent enough to select the best activity tracker.	Expertise 1
		I feel that I have the relevant knowledge and expertise to make sound evaluations of activity trackers.	Expertise 2
		I had difficulties evaluating the activity trackers properly.	Expertise 3
Intention for re-participation (Dependent variable)	-	How likely is that you will follow an invitation for participating in a market research study, if this study is similar to this survey about activity tracker? Please enter the probability in %.	

Source: Author's own illustration.

5.4.3 Descriptive Statistics

The second study was available online for approximately four weeks from January 24 to February 23, 2018. In total, 516 out of 1373 respondents completed the survey. The completion rate is 37.58% and equally distributed across groups (i.e., RBC 37.55%; CBC: 35.62%, and gamified CBC: 39.48%). An initial assessment of the data leads to the exclusion of one respondent who inserted invalid data (i.e., more than 100%) with respect to his/her intention to re-participate in future market research. Six respondents were excluded from further analysis because they clicked through the questionnaire by choosing the same value for all questions after participating in the conjoint task[24].

Two participants took less than one third of the median response time per group (i.e., RBC: 3.82 minutes; CBC: 4.15 minutes; gamified CBC: 4.14 minutes) to complete the questionnaire which is the industry standard for exclusion (Peruzzi 2010). It seems to be highly unlikely that they filled out the questionnaire with reasonable care. These two respondents were deleted as well.

After cleaning the data, a final sample of 507 participants remains for subsequent analyses. Table 38 displays the distribution of the final sample across the three groups and the median duration of conjoint analyses.

Table 38: Sample distribution of study 2

Condition	Number of Participants	Median duration conjoint analysis	Significance
(1) RBC	176	2.99 minutes	Sig. different to 2, 3
(2) CBC	154	3.89 minutes	Sig. different to 1, 3
(3) Gamified CBC	177	3.50 minutes	Sig. different to 1, 2

Source: Author's own illustration.

The table shows that participants are equally distributed across groups. The median of the duration for conducting each conjoint analysis differs significantly across groups (p = .00).

[24] Three respondents clicked through the survey by always choosing the same value (100%); one respondent constantly chose the same value in 96% of the questions, and two 74% of the questions.

In the final dataset, 40.04% of men and 59.76% of women answered the study. One respondent chose the option *other*. The age of participants ranges from 19 to 71 years. The average age is 29.79 years (median: 26 years). In accordance with the age structure, students account for almost half of the sample (i.e., 48.52%). Participants in a full-time job (i.e., 43.20%) represent the majority of the other half of the sample. In terms of education, 53.65% of the participants have a university degree (i.e., bachelor: 29.19% and master: 24.46%). 30.18% of the respondents already have an activity tracker. An overview of the demographics and descriptive statistics are provided in Table 39.

Table 39: Overview of demographics and descriptive statistics of study 2

	Items	**Percentage/ mean**	**Frequency**
Gender	Male	40.04%	203
	Female	59.76%	303
	Other	.20%	1
Age	Average	29.79	-
Education	No educational qualifications	.20%	1
	Comprehensive school	5.52%	28
	Abitur	34.71%	176
	Bachelor of science / arts	29.19%	148
	Master of science / arts / diploma	24.46%	124
	State examination	1.97%	10
	PhD	1.97%	10
	Other	1.97%	10
Profession	Full time job	43.20%	219
	Part time job	3.94%	20
	School, study	48.52%	246
	In training	.39%	2
	Unemployed	.59%	3
	Housewife / man	.59%	3
	Pensioner	.79%	4
	Other	1.97%	10
Ownership of activity tracker	No	69.82%	354
	Yes	30.18%	153

Source: Author's own illustration.

5.4.4 Results

A factor analysis was conducted to verify whether the items of one construct truly represent a single concept and to assess their suitability for further analysis (Hair et al. 2018, p. 125). The underlying structure of the multi-item constructs intrinsic motivation (i.e., enjoyment), competence, expertise, and choice satisfaction were analyzed. 12 items were included in the factor analysis.

For running a factor analysis, the sample size is supposed to be five times the number of variables considered in the factor analysis (Hair et al. 2018, p. 133). As the sample size of 507 exceeds 60 (5 x 12), the sample size is large enough to conduct a factor analysis. Several further criteria shall be considered in order to confirm the suitability of the data for running a factor analysis (here and in the following Backhaus et al. 2016, pp. 397-399). First, the Bartlett's test of sphericity has to be significant. This means that variables in the population are related. Since the test is highly significant (p = .00), this assumption is fulfilled. The KMO criterion indicates whether underlying factors exist. A resulting KMO of .89 can be classified as meritorious. Based on the off-diagonal elements (negative partial covariances) of the anti-image covariance matrix, data is suitable if 25% or less of off-diagonal elements are different from zero (absolute value > .09). In this study, 12.12% of the elements are different from zero which indicates that the data is suitable. All diagonal elements of the anti-image correlation matrix show measures of sampling adequacy greater than the boundary of .5. Consequently, the four criteria reveal that the data is suitable for running a factor analysis.

The factor analysis was conducted with a varimax rotation and a principal component method. Based on the eigenvalues, two factors should be extracted (Backhaus et al. 2016, p. 415). Thus, the number of extracted components (i.e., two) is lower than the number of theoretically derived constructs (i.e., four). The rotated component matrix reveals that the items for *intrinsic motivation (i.e., enjoyment)* and *expertise* constitute separate factors. The items of *competence* and *choice satisfaction* have high factor loadings on the intrinsic motivation (i.e., enjoyment) factor as well as on the expertise factor. As the actual number of factors is already known, a factor analysis with four forced factors was conducted. *Intrinsic motivation (i.e., enjoyment)* and *expertise* still represent distinct factors. *Competence* represents the third factor.

Solely two out of four items of *choice satisfaction* load on intrinsic motivation (i.e., enjoyment) and competence, whereas the other two items represent the fourth factor *choice satisfaction* (see Table 40).

Table 40: Rotated component matrix with four factors of study 2

	Intrinsic motivation (i.e., enjoyment)	Expertise	Competence	Choice satisfaction
Intrinsic motivation (i.e., enjoyment) 1	.89			
Intrinsic motivation (i.e., enjoyment) 2	.90			
Intrinsic motivation (i.e., enjoyment) 3	.89			
Competence 1			.81	
Competence 2		.47	.67	
Expertise 1		.84		
Expertise 2		.88		
Expertise 3		.82		
Choice satisfaction 1		.44	.50	.32
Choice satisfaction 2	.71		.34	
Choice satisfaction 3		.32		.77
Choice satisfaction 4	.37			.70

Source: Author's own illustration.

Cronbach's alpha was considered to evaluate the internal consistency (Hair et al. 2018, p. 161). On average, the multi-item constructs exceed the threshold of .7 indicating a satisfactory reliability of the constructs (Hair et al. 2018, p. 161) (see Table 41). No construct can be improved by eliminating an item. High Cronbach's alphas for *intrinsic motivation (i.e., enjoyment)*, *choice satisfaction*, and *competence* support the decision to keep them as distinct constructs. Summarizing the above, combining the 12 items to four factors represent a good solution for further analysis. Based on the results of both analyses, it is appropriate to calculate a variable score for each of the constructs (i.e., intrinsic motivation (i.e., enjoyment), competence, expertise, and choice satisfaction) as summated scales.

Table 41: Reliability statistics Cronbach's alpha of study 2

Dimension	Construct	Items	Item mean	Cronbach's alpha	Construct mean
Intrinsic motivation (i.e., enjoyment)	IMI (2018); McAuley, Duncan, and Tammen (1989)	The task of choosing activity trackers was fun to do.	4.43	.94	4.28
		I would describe the task of choosing activity trackers as very interesting.	4.40		
		I enjoyed the task of choosing activity trackers very much.	4.01		
Competence	IMI (2018); McAuley, Duncan, and Tammen (1989)	After engaging in the task of choosing activity trackers for awhile, I felt increasingly competent to make a choice.	4.78	.62	5.02
		I am satisfied with my performance in the task of choosing activity trackers.	5.25		
Expertise	Fuchs, Prandelli, and Schreier (2010)	I felt competent enough to select the best activity tracker.	5.03	.87	4.80
		I feel that I have the relevant knowledge and expertise to make sound evaluations of activity trackers.	4.66		
		I had difficulties evaluating the activity trackers properly.	4.71		
Choice satisfaction	Fitzsimons (2000)	I am satisfied with the choice of activity tracker.	5.26	.73	4.59
		I found the decision making process for choosing an activity tracker interesting.	4.75		
		I have been sufficiently informed about all aspects that were important for the selection of the activity trackers.	4.72		
		I think I'm going to purchase one of the activity trackers I've chosen.	3.64		

Source: Author's own illustration.

In the following, the hypotheses of the study are tested. A set of OLS regression analyses, including mediation and moderation analyses, were conducted. In line with the analyses in study 1, the regression analyses were conducted with IBM SPSS Statistics and the macro PROCESS developed by Hayes (2018, p. 551). A statistical estimate for the indirect effects can be provided by using PROCESS via the bootstrapping method (Hayes 2009; Hayes 2018,

p. 521). The bootstrapping method is supposed to be more powerful and performs best compared to other methods. It takes the irregularities of the sample distribution of the indirect effect into account (Hayes 2009; Hayes 2018, p. 521; Zhao, Lynch, and Chen 2010). Hayes (2009) suggests at least a generation of 5,000 bootstrap confidence intervals. This recommendation is followed in line with further studies (e.g., Cavanaugh 2014; Wolf, Weiger, and Hammerschmidt 2018).

Before running a regression analysis, four relevant assumptions need to be considered: (a) correct model specification, (b) no multicollinearity (c) homoscedasticity, and (d) normal distribution of errors (Fahrmeir et al. 2013, pp. 73-77).

(a) The model is correctly specified if the included parameters fulfill the premise of linearity (Backhaus et al. 2016, p. 98). Theoretically and based on visual inspection, there is no indication of non-linear relationships. Moreover, all relevant variables have to be included in the model. All relevant variables to test the hypotheses are part of the model. Hence, the assumption is fulfilled.

(b) The assumption of multicollinearity encompasses that an independent variable is not supposed to be correlated with another independent variable or with a linear combination of other independent variables. For assessing the degree of multicollinearity, the VIF values and the CI need to be considered (Hair et al. 2018, pp. 312-313). The test of multicollinearity for the mediation analyses shows VIF values below 3, indicating no multicollinearity issue (Hair et al. 2018, p. 316) (see Tables 42-47). The CI is always below 20, showing no multicollinearity issues (Hair et al. 2018, p. 313) (see Tables 42-47). Hence, the assumption is fulfilled.

(c) The assumption of homoscedasticity entails that the variance of the error term is constant. More specifically, the variance of the dependent variable is not affected by the independent variables (Backhaus et al. 2016, p. 103). An option in PROCESS provides the opportunity to run the analysis with a heteroscedasticity-consistent standard error estimator in order to address a potential violation. In this study, standard errors using the HC3 estimator are generated (Hayes 2018, p. 576; Hayes and Cai 2007).

(d) A normal distribution of the error terms of the estimated model is assumed. A potential violation of this assumption is addressed by applying the bootstrapping method when running moderation and mediation analyses with PROCESS. This approach does not assume normally distributed data (Hayes 2009; Hayes 2018, p. 97).

The OLS regression analyses base on the condition that the independent variables are dichotomous or metric (Hair et al 2018, pp. 260-261). The current research model contains a multicategorical independent variable that varies by three levels (i.e., RBC, CBC, and gamified CBC). The focus lies on the comparison of the gamified CBC condition with either the RBC condition or the CBC condition. This leads to the conduction of several serial multiple mediator models and moderator analyses. Each of them compares two levels (based on Hayes 2018, p. 143 a legitimate way). In addition, there is one comparison of gamified market research (i.e., gamified CBC) to non-gamified market research (i.e., RBC and CBC).

For testing hypotheses one to four, serial multiple mediator models were conducted[25]. Due to the fact that at least two mediators are included in the model, PROCESS model specification six was chosen as the most appropriate model (Hayes 2018, p. 174 and pp. 586-587). When estimating a serial multiple mediator model, the goal is to examine the direct and indirect effects of the independent on the dependent variable. This includes a process modeling in which the independent variable influences mediator one which in turn leads to mediator two and so forth, terminating with the dependent variable as the final consequent (Hayes 2018, p. 167).

Hypothesis 1 states a positive influence of a gamified CBC condition on competence. Results reveal that the gamified CBC condition has a significant positive influence on competence compared to both CBC condition ($b = .38$, $p = .00$) (see Table 42 and Table 43) and RBC condition ($b = .25$, $p = .03$) (see Table 44 and Table 45). Thus, hypothesis 1 is supported.

[25] It was controlled for fitness involvement and survey involvement. No differences in the effect sizes of the gamified CBC on the mediators and dependent variable could be detected.

Hypothesis 2, proposing a positive influence of competence on intrinsic motivation (i.e., enjoyment), is supported. Competence has a significant positive effect on intrinsic motivation (i.e., enjoyment) (b = .64, p = .00) (see Table 46 and Table 47).

Hypothesis 3 assumes that intrinsic motivation (i.e., enjoyment) has a positive effect on the evaluation of the market research study (i.e., survey evaluation and choice satisfaction). Results reveal that intrinsic motivation (i.e., enjoyment) has a significant positive effect on survey evaluation (b = .19, p = .00) (see Table 47) as well as on choice satisfaction (b = .40, p = .00) (see Table 46). Support of the third hypothesis can be concluded.

Hypothesis 4a postulates that a positive evaluation of the market research study has a positive influence on the intention to re-participate in future market research studies. Results reveal that survey evaluation (b = 4.43, p = .00) (see Table 47) as well as choice satisfaction (b = 6.49, p = .00) (see Table 46) have a significant positive effect on the intention to re-participate in future market research studies. Thus, hypothesis 4a is supported.

Table 42: Gamified CBC condition compared to CBC condition (1/2)

	Consequent											
	M1 (Competence)			M2 (Intrinsic motivation (i.e., enjoyment))			M3 (Choice satisfaction)			Y (Intention for re-participation)		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.38	.12	.00	.42	.14	.00	-.35	.08	.00	-1.33	2.70	.62
M1 (Competence)	-	-	-	.60	.06	.00	.28	.04	.00	2.17	1.64	.19
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.42	.03	.00	6.27	1.27	.00
M3 (Choice satisfaction)	-	-	-	-	-	-	-	-	-	4.38	1.68	.01
Constant	4.84	.09	.00	1.08	.31	.00	1.55	.21	.00	.99	7.86	.90
	$R_{adj.}^2 = .02$			$R_{adj.}^2 = .26$			$R_{adj.}^2 = .54$			$R_{adj.}^2 = .27$		
	F(1, 329) = 9.13, p = .00			F(2, 329) = 61.30, p = .00			F(3, 327) = 113.30, p = .00			F(4, 326) = 25.45, p = .00		
	Max. VIF = 1.00			Max. VIF = 1.03			Max. VIF = 1.36			Max. VIF = 2.21		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 43: Gamified CBC condition compared to CBC condition (2/2)

	Consequent											
	M1 (Competence)			**M2 (Intrinsic motivation (i.e., enjoyment))**			**M3 (Survey evaluation)**			**Y (Intention for re-participation)**		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.38	.12	.00	.42	.14	.00	-.11	.11	.35	-2.49	2.61	.34
M1 (Competence)	-	-	-	.60	.06	.00	.15	.06	.01	2.93	1.54	.06
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.18	.05	.00	7.50	1.12	.00
M3 (Survey evaluation)	-	-	-	-	-	-	-	-	-	3.33	1.49	.03
Constant	4.84	.09	.00	1.08	.31	.00	3.21	.28	.00	-2.94	8.54	.73
	$R_{adj.}^2 = .02$			$R_{adj.}^2 = .26$			$R_{adj.}^2 = .11$			$R_{adj.}^2 = .27$		
	$F(1, 329) = 9.13$, $p = .00$			$F(2, 329) = 61.30$, $p = .00$			$F(3, 327) = 12.07$, $p = .00$			$F(4, 326) = 25.46$, $p = .00$		
	Max. VIF = 1.00			Max. VIF = 1.03			Max. VIF = 1.36			Max. VIF = 1.43		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 44: Gamified CBC condition compared to RBC condition (1/2)

	Consequent											
	M1 (Competence)			M2 (Intrinsic motivation (i.e., enjoyment))			M3 (Choice satisfaction)			Y (Intention for re-participation)		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.25	.12	.03	.23	.13	.07	-.24	.08	.00	-3.76	2.63	.15
M1 (Competence)	-	-	-	.69	.06	.00	.29	.05	.00	2.17	1.59	.17
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.40	.04	.00	4.03	1.35	.00
M3 (Choice satisfaction)	-	-	-	-	-	-	-	-	-	7.29	1.70	.00
Constant	4.97	.08	.00	.79	.31	.01	1.45	.21	.00	.34	7.71	.96
	$R_{adj.}^2 = .01$			$R_{adj.}^2 = .30$			$R_{adj.}^2 = .50$			$R_{adj.}^2 = .25$		
	$F(1, 351) = 4.79$, $p = .03$			$F(2, 350) = 76.55$, $p = .00$			$F(3, 350) = 119.75$, $p = .00$			$F(4, 349) = 24.45$, $p = .00$		
	Max. VIF = 1.00			Max. VIF = 1.01			Max. VIF = 1.44			Max. VIF = 2.03		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 45: Gamified CBC condition compared to RBC condition (2/2)

	Consequent											
	M1 (Competence)			**M2 (Intrinsic motivation (i.e., enjoyment))**			**M3 (Survey evaluation)**			**Y (Intention for re-participation)**		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.25	.12	.03	.23	.13	.07	.01	.11	.92	-5.55	2.61	.03
M1 (Competence)	-	-	-	.69	.06	.00	.15	.07	.02	3.61	1.54	.02
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.22	.05	.00	5.93	1.18	.00
M3 (Survey evaluation)	-	-	-	-	-	-	-	-	-	4.68	1.46	.00
Constant	4.97	.08	.00	.79	.31	.01	2.86	.31	.00	-2.51	7.92	.75
	$R_{adj.}^2 = .01$			$R_{adj.}^2 = .30$			$R_{adj.}^2 = .14$			$R_{adj.}^2 = .24$		
	$F(1, 351) = 4.79$, $p = .03$			$F(2, 350) = 76.55$, $p = .00$			$F(3, 350) = 14.99$, $p = .00$			$F(4, 349) = 23.63$, $p = .00$		
	Max. VIF = 1.00			Max. VIF = 1.01			Max. VIF = 1.44			Max. VIF = 1.53		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 46: Gamified CBC compared to non-gamified market research (1/2)

	Consequent											
	M1 (Competence)			M2 (Intrinsic motivation (i.e., enjoyment))			M3 (Choice satisfaction)			Y (Intention for re-participation)		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.31	.10	.00	.32	.12	.01	-.29	.07	.00	-2.54	2.29	.27
M1 (Competence)	-	-	-	.64	.05	.00	.31	.04	.00	2.00	1.35	.14
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.40	.03	.00	5.23	1.10	.00
M3 (Choice satisfaction)	-	-	-	-	-	-	-	-	-	6.49	1.44	.00
Constant	4.91	.06	.00	.97	.25	.00	1.43	.16	.00	-1.84	6.11	.76
	$R_{adj.}^2 = .02$			$R_{adj.}^2 = .28$			$R_{adj.}^2 = .53$			$R_{adj.}^2 = .27$		
	F(1, 505) = 9.01, p = .00			F(2, 504) = 97.29, p = .00			F(3, 503) = 186.36, p = .00			F(4, 502) = 42.22, p = .00		
	Max. VIF = 1.00			Max. VIF = 1.02			Max. VIF = 1.39			Max. VIF = 2.16		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Table 47: Gamified CBC compared to non-gamified market research (2/2)

	Consequent											
	M1 (Competence)			**M2 (Intrinsic motivation (i.e., enjoyment))**			**M3 (Survey evaluation)**			**Y (Intention for re-participation)**		
Antecedent	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*	Coeff	*SE*	*p*
X (Gamified CBC)	.31	.10	.00	.32	.12	.01	-.04	.10	.72	-.4.28	2.24	.06
M1 (Competence)	-	-	-	.64	.05	.00	.13	.05	.01	3.42	1.25	.01
M2 (Intrinsic motivation (i.e., enjoyment))	-	-	-	-	-	-	.19	.04	.00	6.99	.96	.00
M3 (Survey evaluation)	-	-	-	-	-	-	-	-	-	4.43	1.19	.00
Constant	4.91	.06	.00	.97	.25	.00	3.16	.25	.00	-.6.58	6.52	.31
	$R_{adj.}^2 = .02$			$R_{adj.}^2 = .28$			$R_{adj.}^2 = .11$			$R_{adj.}^2 = .27$		
	F(1, 505) = 9.01, p = .00			F(2, 504) = 97.29, p = .00			F(3, 503) = 16.33, p = .00			F(4, 502) = 41.21, p = .00		
	Max. VIF = 1.00			Max. VIF = 1.02			Max. VIF = 1.39			Max. VIF = 1.46		

X = Independent variable
M1 = Mediator 1
M2 = Mediator 2
M3 = Mediator 3
Y = Dependent variable

Source: Author's own illustration.

Besides investigating the direct effects, the serial multiple mediator models provide insights into the indirect effects of the gamified CBC condition on the intention to re-participate in future market research studies compared to the RBC condition and the CBC condition for testing hypothesis 4b. A gamified CBC condition is postulated to exert an effect on the outcome variable intention to re-participate in future market research studies through several intervening variables (e.g., competence, intrinsic motivation (i.e., enjoyment), and

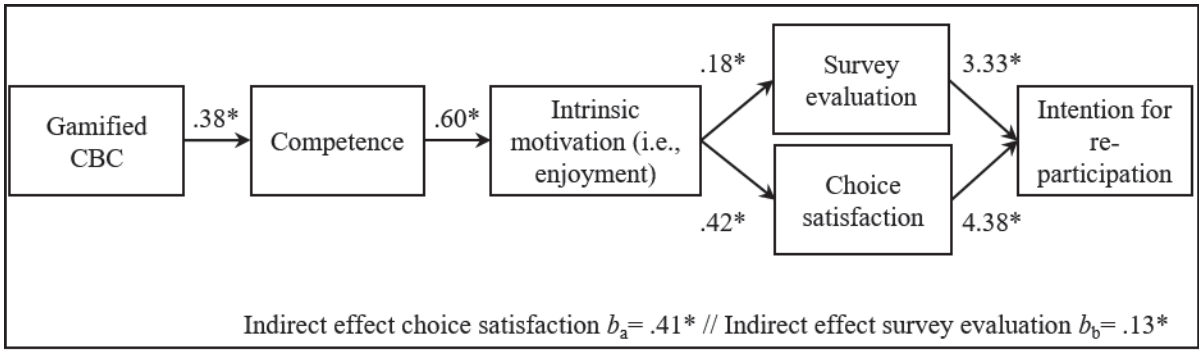
survey evaluation) compared to the CBC condition and the RBC condition. The total effect results from the direct effect of the gamified CBC condition on the intention to re-participate in future market research plus the indirect effects through the mediators (e.g., competence, intrinsic motivation (i.e., enjoyment), and survey evaluation) (Hayes 2009). The indirect effect is generated by the multiplication of the beta values (Hayes 2018, p. 171). In order to estimate the indirect effects that are of primary interest in the study, the bootstrapping method is applied (Hayes 2018, p. 521). The bootstrap confidence intervals which are based on 5,000 bootstrapping samples are supposed to be entirely above or below zero in order to show a significant indirect effect (Hayes 2018, p. 172). If zero does not lie between the lower and upper bound, it is possible to state that the indirect effect is not zero with 95% confidence (Hayes 2009). Effects are reported in unstandardized form because the specific indirect effects of the independent on the dependent variable are independent of the scale of measurement of the intervening variables (Hayes 2009). Hayes (2009; 2018, p. 519) and Zhao, Lynch, and Chen (2010) explicitly recommend to report the effects in an unstandardized form to allow substantive interpretation, especially for effects encompassing dichotomous variables.

In general, there is the possibility to detect an indirect but no direct effect of the independent on the dependent variable (Hayes 2009). If the direct effect is revealed not to be significant, an indirect only mediation can still be stated (Zhao, Lynch, and Chen 2010). An unexplained negative direct path is not supposed to hinder publication of findings revealing a positive indirect path (Zhao, Lynch, and Chen 2010). Even in the case of a significant indirect but absent total effect, the indirect effect should be further investigated in order to avoid missing something potentially interesting (Hayes 2009; Preacher and Hayes 2004). A significant total indirect effect is not a prerequisite for examining the specific indirect effects (Preacher and Hayes 2008). Consequently, this study concentrates on the interpretation of the specific indirect effects.

The indirect effect of the gamified CBC condition as the predictor variable, competence, intrinsic motivation (i.e., enjoyment), and survey evaluation (respectively choice satisfaction) as the mediators, and the intention to re-participate in future market research studies as the outcome variable is tested. Results reveal a significant positive indirect effect of the gamified CBC condition on the intention to re-participate when including choice satisfaction

(*b* = .41, LLCI = .06, ULCI = .93) as well as survey evaluation (*b* = .13, LLCI =.01, ULCI = .34) among others (see Figure 33). The total and direct effect are not significant. Hence, the effects are fully mediated. When considering the short-term effects, a significant positive indirect effect of the gamified CBC condition on survey evaluation can be stated (*b* = .04, LLCI = .01, ULCI = .08). The total and direct effects are not significant. The indirect effect of the gamified CBC condition on choice satisfaction is significant positive (*b* = .09, LLCI = .03, ULCI = .17) but the direct effect is significantly negative (*b* = -.35, *p* = .00). The total effect does not show a significant result.

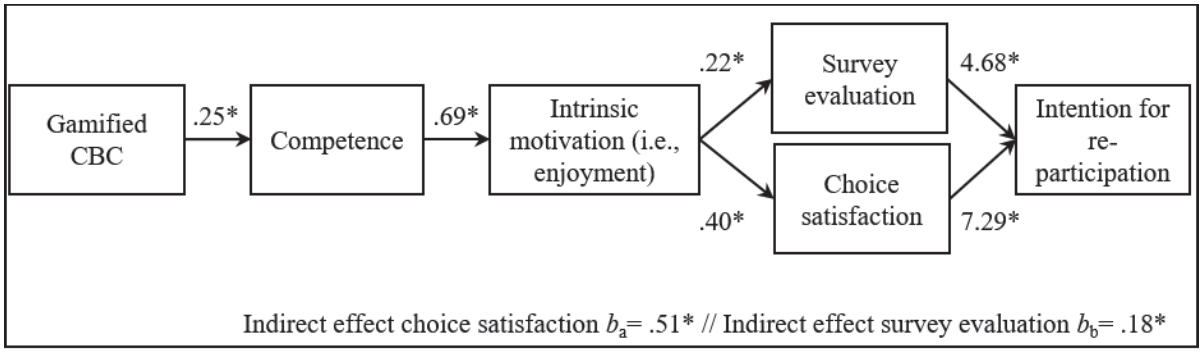
Figure 33: Overview of indirect effect – gamified CBC compared to CBC



Source: Author's own illustration.

Changing the predictor to the gamified CBC condition compared to the RBC condition also demonstrates a significant positive indirect effect when including choice satisfaction (*b* = .51, LLCI = .05, ULCI = 1.17) as well as survey evaluation (*b* = .18, LLCI = .01, ULCI = .47) on the intention to re-participate in future market research (see Figure 34). The direct and total effect are not significant when choice satisfaction is included. The direct effect is significant negative (*b* = -5.55, *p* = .03) when integrating survey evaluation. Hence, the effect is not fully mediated. Considering the indirect effect until survey evaluation, a positive indirect effect (*b* = .04, LLCI = .00, ULCI = .08) and an insignificant direct and total effect can be demonstrated. Regarding the indirect effect of the gamified CBC condition on choice satisfaction, a significant positive indirect effect (b = .07, LLCI = .01, ULCI = .14) and a significant negative direct effect (*b* = -.24, *p* = .00) can be stated. The total effect is not significant. Hence, hypothesis 4b is partially supported.

Figure 34: Overview of indirect effect – gamified CBC compared to RBC



Source: Auhtor's own illustration.

For testing hypotheses 5 and 6, moderation analyses with PROCESS were conducted. The same configurations as for the mediation analyses were applied. The sole difference is the model. For running a simple moderation analysis with one moderator, model one is most appropriate in PROCESS (Hayes 2018, p. 238 and p. 584).

Hypothesis 5 postulates a moderating effect of gender. A moderating effect of gender can solely be supported when comparing the gamified CBC condition and the RBC condition (see Table 48).

Table 48: Overview moderation effect of gender

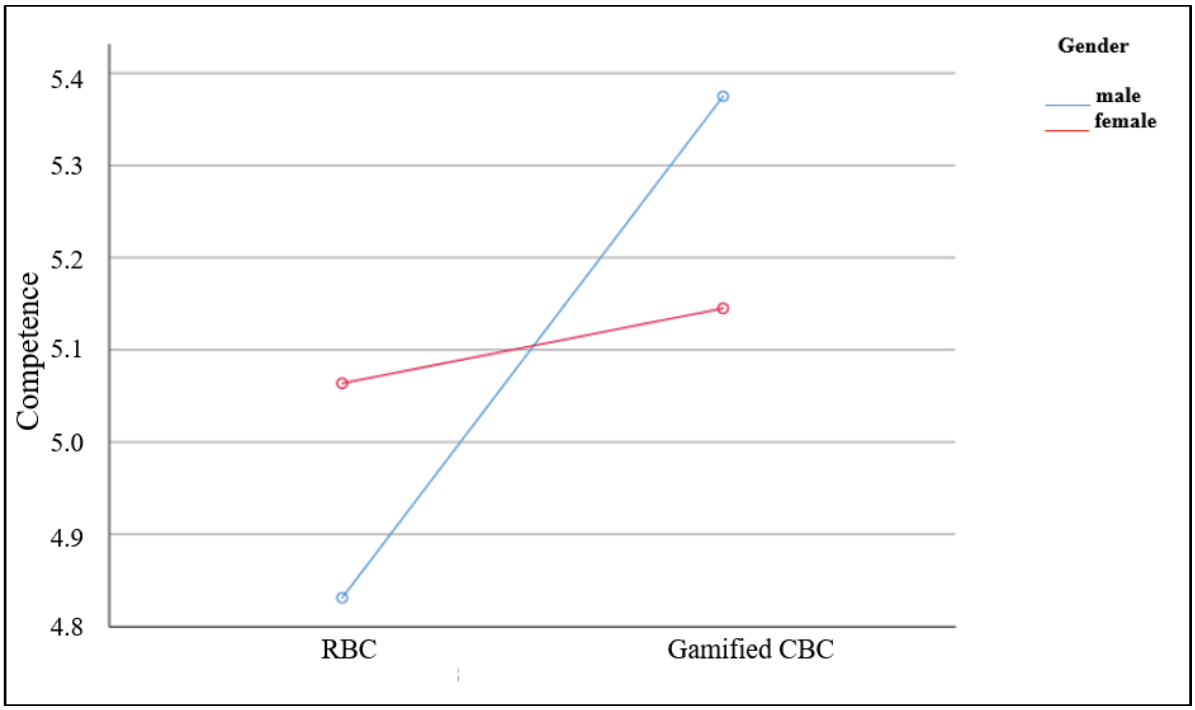
Gamified CBC compared to CBC				Gamified CBC compared to RBC			
	Y (Competence)				Y (Competence)		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Gamified CBC)	.54	.20	.01	**X_1** (Gamified CBC)	.54	.15	.00
X_2 (Gender)	.02	.20	.92	**X_2** (Gender)	.23	.16	.14
M (Gender * Gamified CBC)	-.25	.26	.33	**M** (Gender * Gamified CBC)	-.46	.22	.04
Constant	4.83	.17	.00	**Constant**	4.83	.11	.00
$R_{adj.}^2 = .03$ $F(3, 326) = 4.88, p = .00$ Max. VIF = 3.62 // CI = 7.40				$R_{adj.}^2 = .02$ $F(3, 348) = 4.22, p = .01$ Max. VIF = 3.33 // CI = 6.51			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

The gamified CBC condition has a significant positive effect on competence (b = .54, p = .00). The direct effect of gender[26] on competence is not significant (b = .23, p = .14). The interaction effect of gender and the gamified CBC condition has a significant negative effect (b = -.46, p = .04). The results are visualized in Figure 35. The hypothesis 5 can be partially supported.

[26] Male = 0 and female = 1.

Figure 35: Visualization of moderation effect of gender



Source: Author's own illustration.

Finally, hypothesis 6 postulates that the effect of a gamified CBC on competence is positively moderated by the participants' level of expertise about the market research topic. None of the moderation analyses show a significant moderating effect. Hence, hypothesis 6 is not supported. An overview of the insignificant results is presented in Table 49.

Table 49: Overview moderation effect of expertise

Gamified CBC compared to CBC				Gamified CBC compared to RBC			
	Y (Competence)				Y (Competence)		
	Coeff	*SE*	*p*		Coeff	*SE*	*p*
X_1 (Gamified CBC)	-.02	.54	.97	**X_1** (Gamified CBC)	.19	.47	.69
X_2 (Expertise)	.31	.08	.00	**X_2** (Expertise)	.39	.06	.00
M (Expertise * Gamified CBC)	.09	.11	.39	**M** (Expertise * Gamified CBC)	.02	.09	.83
Constant	3.32	.40	.00	**Constant**	3.11	.30	.00
$R_{adj.}^2 = .21$ $F(3, 327) = 22.74, p = .00$ Max. VIF = 15.46 // CI = 19.52				$R_{adj.}^2 = .25$ $F(3, 349) = 28.79, p = .00$ Max. VIF = 14.03 // CI = 17.32			
X = Independent variable M = Moderator Y = Dependent variable				X = Independent variable M = Moderator Y = Dependent variable			

Source: Author's own illustration.

An overview of the tested hypotheses is provided in Table 50.

Table 50: Overview of hypotheses of study 2

H#	Description	Supported
H1	Game elements evoking a gameful experience of skill development have a positive influence on competence compared to a control condition.	Yes
H2	Competence has a positive influence on intrinsic motivation (i.e., enjoyment).	Yes
H3	Intrinsic motivation (i.e., enjoyment) has a positive influence on the evaluation of the market research study.	Yes
H4a	The positive evaluation of the market research study has a positive effect on the intention to re-participate in future market research studies.	Yes
H4b	The positive effect of game elements evoking a gameful experience of skill development on the intention to re-participate in future market research studies is fully, serially mediated by (a) an increase in competence, (b) an increase in intrinsic motivation (i.e., enjoyment), and (c) a positive evaluation of the market research study.	Partially
H5	The positive effect of game elements evoking a gameful experience of skill development on competence is stronger for men than for women.	Partially
H6	The positive effect of game elements evoking a gameful experience of skill development on competence is strengthened by individual's expertise about the market research topic.	No

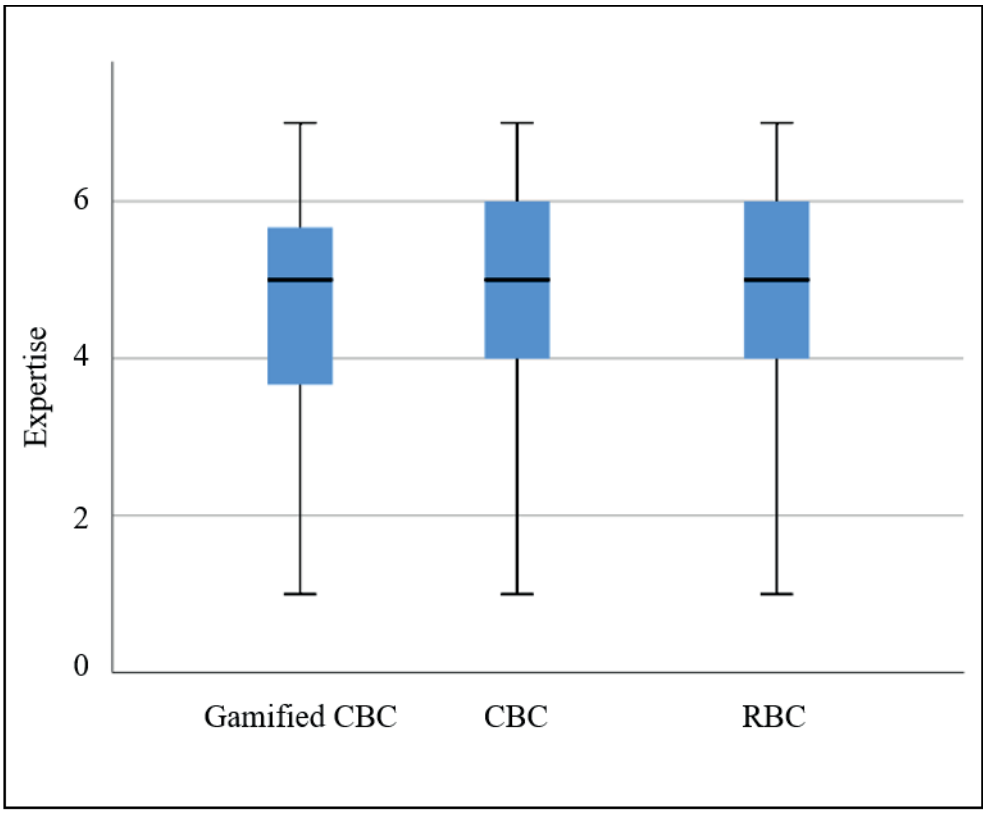
Source: Author's own illustration.

5.4.5 Discussion of Results

The aim of the study was to investigate the effectiveness of gamification in market research. More precisely, the study examined the effects of a gamified CBC on (i) individuals' motivation to perform a task moderated by individual characteristics, (ii) on their evaluation of market research, and (iii) their intention to re-participate in future market research. In order to achieve this aim, this study empirically compared the effects of three different versions of a conjoint analysis (i.e., RBC, CBC, and gamified CBC) on the psychological and behavioral outcomes. Results reveal that the gamified CBC condition has a positive influence on participants' competence and subsequently intrinsic motivation (i.e., enjoyment) compared to the CBC condition and the RBC condition. Hence, the gamified CBC condition seems to be appropriate to achieve the aim of increasing participants' motivation to perform a task regardless of the personality characteristic expertise.

The non-significant moderating effect of expertise may result from the small standard deviation in each group. Besides a mean of approximately 4.8, the standard deviation in each group is approximately 1.35 (see Figure 36).

Figure 36: Deviation of expertise among conditions



Source: Author's own illustration.

There is a high number of respondents with a high expertise but respondents with a low expertise are rare. Two reasons for that might be possible. On the one hand, respondents do not want to admit that they have a low expertise and show a social desirability bias (Fisher 1993; King and Bruner 2000). On the other hand, an activity tracker seems to be a high involvement product with attributes and attribute level that are easy to comprehend. Products such as cars might have more complex attributes such as engine, horsepower, and torque. Thus, cars may afford more expertise to put oneself in an evaluation situation.

A moderating effect of gender can solely be demonstrated when comparing the effect of the gamified CBC condition to the RBC condition. Men in the gamified CBC condition show a higher level of competence than women in the gamified CBC condition. Considering solely women, the gamified CBC

condition does not show a significant higher level of competence compared to the RBC condition. Consequently, the CBC gamified condition compared to the RBC condition is more effective for men than for women. Nevertheless, the use of a gamified CBC is also suitable for women but the effect is weaker.

Considering the second sub-goal (i.e., examination of the gamified CBC on the evaluation of market research study), results of the mediation analyses reveal that there is a significant positive indirect effect of the gamified CBC condition compared to the CBC condition and the RBC condition on competence, competence on intrinsic motivation (i.e., enjoyment), and intrinsic motivation (i.e., enjoyment) on the survey evaluation. The gamified CBC represents an appropriate method to foster a positive evaluation of the survey. In contrast, the gamified CBC does not lead to an improved choice satisfaction of the respondents. There is a significant positive indirect effect through competence and intrinsic motivation (i.e., enjoyment). The direct effect is significantly negative and the effect size is larger. Besides a higher level of competence and intrinsic motivation (i.e., enjoyment), the respondents are not more satisfied with the decision process. This may result from the novelty and subsequently uncertainty of the conjoint method. Due to the fact that the respondents were not able to see all alternatives of potential activity trackers, they fear they might miss something.

Considering the third sub-goal – increasing the intention to re-participate in future market research studies – the implementation of a gamified CBC compared to a traditional CBC show promising results. The effect of the gamified CBC condition on the intention to re-participate in future market research studies is fully, positively mediated. In comparison to the RBC condition, the respondents in the gamified CBC condition do not state a higher intention to re-participate in future market research studies. A reason might be that respondents needed significantly more time to respond to the gamified CBC condition (i.e., median = 3.50 minutes) compared to the RBC condition (i.e., median = 2.99 minutes). Potentially, the time aspect outweigh the positive psychological outcomes.

Regarding the preference estimations, the gamified CBC performs best and the RBC worst. Hence, the gamified CBC method is most suitable to estimate the selection decisions in the hold-out sample. This leads to the conclusion that the data quality in the gamified CBC condition is better than in the RBC condition. Hence, companies should focus on the gamified CBC condition due to better predictions. Through the evocation of a feeling of an optimal challenge, respondents perceive themselves as more competent and the perceived cognitive load may be reduced.[27]

[27] This study was conducted in cooperation with the chair of Digital Marketing (WHU Otto Beisheim School of Management). They focus on the calculation of preference estimations. Thus, the results of the conjoint analyses (i.e., preference estimations) are based on their calculations.

6 Discussion

In the following, a summary of the thesis is provided. Based on the findings of both studies, theoretical as well as managerial implications are derived for subsequent academic and practical use. A critical reflection of both studies' limitations is outlined. The thesis ends with an outlook on potential future research.

6.1 Summary

The overall aim of the thesis was to empirically evaluate the effect of gamification on psychological (i.e., competence, intrinsic motivation (i.e., enjoyment), and attitude) and subsequently behavioral (i.e., behavioral intention and actual behavior) outcomes as well as the moderating effect of individual characteristics. Short- as well as long-term effects of game elements were investigated. A literature review comprising 53 papers served as the basis for investigating the effectiveness of gamification. Based on the literature review, three main gaps in gamification research were identified.

First, most of the gamification literature investigates gamification as a uniform concept instead of focusing on specific game elements. Thus, it is not possible to evaluate the effectiveness of specific game elements. Second, the majority of studies concentrates on the direct effects of game elements on behavioral outcomes without considering the mediating effect of psychological outcomes. Therefore, they do not aim to shed light on the question why certain effects occur. Third, the majority of studies fails to consider the moderating effects of individual characteristics. However, this seems to be important because individual characteristics might present boundary conditions.

This thesis addressed the three research gaps by (i) examining the effects of specific game elements (i.e., comparison of points, badges, leaderboard, and memory-type game) in real life settings, (ii) applying the self-determination theory as a theoretical foundation in order to explain the underlying motivational mechanisms, and (iii) investigating the moderating effect of individual characteristics.

The thesis is the first to investigate the effect of specific game elements on motivation and subsequently behavior, while considering the moderating effects of individual characteristics. Two studies were conducted in order to investigate the effectiveness of gamification in higher education and market research.

In the context of higher education, a field experiment lasting one semester was conducted. Students were randomly assigned to one of four conditions: points, badge, leaderboard, or control. The final dataset consists of 206 students and data from six different sources: (1) a presurvey regarding student's individual characteristics, (2) four surveys evaluating students' motivation in the course of the experiment, (3) students' evaluation of the course, (4) students' performance in the different gamified tutorials, (5) students' performance in the exam, and (6) students' GPA in their study programme.

Contrary to expectations, in the context of education, no significant effect of gamification on motivation could be stated. None of the investigated game elements (i.e., points, badges, and leaderboard) significantly influence competence. Thus, the effect of game elements on learning performance is not significantly mediated by competence, intrinsic motivation (i.e., enjoyment), and participation. None of the individual characteristics (i.e., extraversion, conscientiousness, expertise, status, competition, and gender) has a significant moderating effect on the relationship between game elements and competence. Besides these insignificant effects, it is worth noting that the influence of competence on intrinsic motivation (i.e., enjoyment) is positive and significant. This provides further support for the self-determination theory (IMI 2018; Ryan and Deci 2000a; b). Moreover, students in the badge condition wrote a significantly better exam than students in the control condition, indicating at least a direct effect of badges on learning performance. However, this direct effect should be interpreted with caution. Due to the fact that the underlying motivational mechanism is not significant, there might be other mechanisms that mediate this effect. The direct effects of leaderboards and points on students' learning performance are not significant.

In the context of market research, a gamified Choice-Based Conjoint (CBC) (i.e., implementation of a memory-type game) was compared to traditional conjoint analyses (i.e., Rating-Based Conjoint (RBC) and CBC) in an online survey. The final dataset in this study consists of 507 individuals who were randomly assigned to one of three conditions. The final dataset comprises the following

information: (1) respondents' individual characteristics, (2) respondents' motivation in the course of the experiment, (4) respondents' evaluation of the survey, (5) respondents' behavioral intention for re-participation, and (6) respondents' preference estimations from the corresponding conjoint analyses and the hold-out sample.

Compared to CBC and RBC, the gamified CBC enhances individuals' motivation to perform a task regardless of the personality characteristic expertise. This direct effect is moderated by gender (i.e., the gamified CBC condition compared to the RBC condition is more effective for men than for women). The effect of a gamified CBC compared to a traditional CBC on the intention to re-participate in future market research studies was fully mediated by competence, intrinsic motivation (i.e., enjoyment), and evaluation (i.e., survey evaluation and choice satisfaction). The effect of a gamified CBC compared to a RBC on the intention to re-participate in future market research studies is fully mediated by competence, intrinsic motivation (i.e., enjoyment), and choice satisfaction.

Considering the quality of the data, the gamified CBC method is most suitable to estimate the selection decisions in the hold-out sample. This leads to the conclusion that the data quality in the gamified CBC condition is better than in the CBC and RBC condition.

Taken together, the thesis provides valuable first insights into the investigation of different game elements on psychological and behavioral outcomes and the moderating effects of individual characteristics.

6.2 Theoretical Implications

Current gamification research focuses on the investigation of gamification as a uniform concept (e.g., Kappen, Mirza-Babaei, and Nacke 2018; Zainuddin 2018). The first study of this thesis is so far the only study that provides further insights by comparing the effectiveness of established game elements (i.e., points, badges, and leaderboard). The second study extends the scope of gamification research. It provides insights by examining the effects of a new game element (i.e., memory-type game). Thus, this thesis provides the possibility to disentangle the effects of specific game elements on psychological and behavioral outcomes.

The thesis provides further insights through the application of the self-determination theory in order to explain the underlying motivational mechanism. Contrary to expectations, points, badges, and leaderboards did not significantly affect the satisfaction of the basic psychological need for competence. A reason may be that these elements did not provide enough informational feedback to support participants' (i.e., actual users) judgment of their performance (Deci, Koestner, and Ryan 1999). This is in line with the results of Mekler et al. (2017) who demonstrate that leaderboards, levels, and points do not significantly influence the competence perception of non-actual users. Thus, each game element alone might not be effective enough to increase individuals' competence perception. However, these game elements did not harm student's intrinsic motivation. This contradicts the study of Hanus and Fox (2015) who demonstrated that a gamified course has a negative effect on intrinsic motivation.

The results reveal that the implementation of badges has a positive effect on students' final learning performance. This positive effect opposes the negative effect of studies considering gamification as a uniform concept (e.g., DeMarcos et al. 2014; Domínguez et al. 2013) as well as the insignificant effect of studies investigating badges individually on final learning performance (Hakulinen, Auvinen, and Korhonen 2013). The demonstration of a positive effect of badges on the quality of action enriches current research.

The insignificant effect of leaderboards on performance is not in line with previous studies in education (e.g., Christy and Fox 2014). Thus, the effectiveness of leaderboards is ambiguous. However, the non-significant effect of points on the quality of action is in line with previous studies regardless of their contexts (e.g., Attali and Arieli-Attali 2015; Mekler et al. 2017).

Whereas points, badges, and leaderboards do not significantly enhance the perception of competence, using a memory-type game has a significant positive effect on competence. Thus, current research is enriched by an effective game element. In addition, the effect of a further trigger that evoke a gameful experience of an optimal challenge and in turn increases competence can be explained by the self-determination theory. Besides these general theoretical implications, the second study of the thesis enriches gamification research in the context of market research. Solely two studies were identified in the literature review in chapter 3 that investigate gamification in market research.

However, these studies investigate gamification as a uniform concept and do not use a theoretical foundation to understand the underlying motivational mechanism (Guin et al. 2012; Harms et al. 2015).

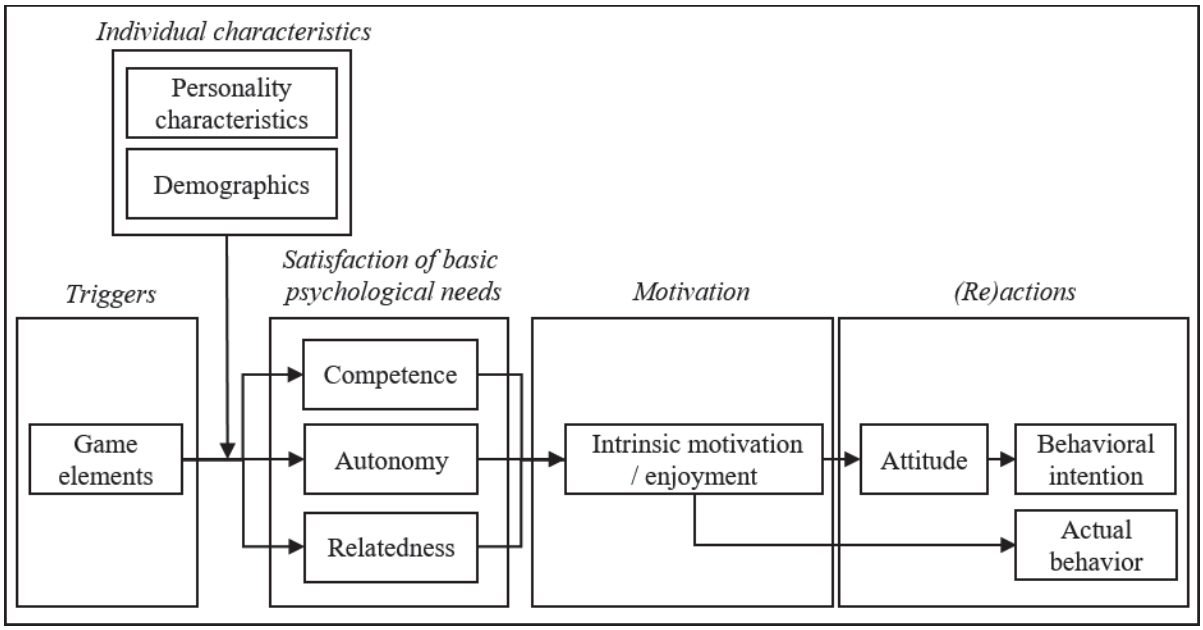
Moreover, additional general theoretical implications can be derived from both studies. In this thesis, intrinsic motivation (i.e., enjoyment) as well as its driver (i.e., satisfaction of the basic psychological need for competence) are considered. This differentiation provides further insights to gamification studies that investigate intrinsic motivation with the Intrinsic Motivation Inventory (IMI) scale as a whole (e.g., Hanus and Fox 2015). By explicitly differentiating between the basic psychological needs and intrinsic motivation (i.e., enjoyment), current research gains further insights.

The self-determination theory proposes a positive effect of competence on intrinsic motivation (IMI 2018). Both studies provide empirical evidence in support of this relationship. Thus, the scope of application can be extended to specific contexts of higher education and market research.

Whereas the majority of current research investigates the influence of game elements on psychological outcomes independently of behavioral outcomes, the thesis examines the effect of specific game elements on both mediating psychological outcomes and behavioral outcomes in two studies. Insights into short- as well as long-term effects of game elements on psychological and behavioral outcomes are provided. Moreover, the thesis contributes to existing research by providing insights into the moderating effects of several individual characteristics (i.e., gender, extraversion, conscientiousness, expertise, competition, and status) in both studies.

Taken together, this thesis is the first to investigate all components of the framework (see Figure 37). Thus, the findings of both studies extent the body of empirical gamification research. These findings nuance academia's understanding of gamification's effectiveness. A detailed report of the design and implementation of specific game elements may further enable researchers to get a deeper understanding of the causal chain that relates goals, design, implementations, and findings in gamification research.

Figure 37: Investigated components of the framework in both studies



Source: Author's own illustration.

6.3 Managerial Implications

This thesis provides insights regarding the effectiveness of specific game elements in two studies. Hence, several managerial implications can be derived based on the above-mentioned research findings. These findings help organizations to evaluate whether the implementation of specific game elements is effective in influencing individuals' motivation as well as behavioral outcomes.

In the context of higher education, the results provide limited insights into the psychological mechanisms of points, badges, and leaderboards. They reveal that points, badges, and leaderboards do not harm students' feelings of competence and their intrinsic motivation for learning but they also do not enhance their motivation. Students in all three conditions experienced a low level of pressure and a high level of autonomy. Thus, none of the three game elements is perceived as controlling. This indicates their suitability in providing a non-controlling environment. Consequently, points, badges, and leaderboards can be implemented but should be considered with caution. The significant effect of badges on learning performance may be an indicator that the implementation of badges may help educators to provide guidance and feedback to students. Badges may serve as a substitute for personal feedback in environments where face-to-face interaction is not feasible. Hence, the implementation of badges may help educators to make learning goals visible to students. Students

may subsequently be more satisfied with the course. In general, more satisfied students may have a stronger relationship to their alma mater in the long-run. A strong relationship does not solely result from the implementation of game elements. However, it can be one influencing factor among others. Compared to costly implementations of full-fledged games, integrating badges may be an efficient alternative to reach comparable results.

The implementation of game elements (i.e., memory-type games) in market research provides valuable implications for companies. When investigating a research topic with a conjoint analysis, the gamified CBC should be preferred to the traditional CBC and RBC. Even if the intention of re-participation is slightly higher in the RBC condition, companies should focus on the gamified CBC condition due to better predictions of preferences. Besides the better data quality, the implementation of the gamified CBC enhances individuals' competence perception and consequently their intrinsic motivation (i.e., enjoyment) by providing the respondents with the feeling of an optimal challenge. By implementing the gamified CBC, companies can enhance participants' survey evaluation (i.e., short-term effect) as well as intention to re-participate in market research studies (i.e., long-term effect) in comparison to a traditional CBC. Thus, companies can generate value for the respondents and in turn increase their retention. Moreover, the gamified CBC may decrease the perceived burden of survey participation and enhance the perceived benefits of participating in market research. The benefits of participating in market research can be strengthened because individuals perceive a higher level of competence and intrinsic motivation (i.e. enjoyment). Hence, individuals may recognize the value of participating in market research and do so out of interest. This may lead to a reduction of negative respondent behavior such as speeding, random responding, high break-off rates, and lack of attention (Guin et al. 2012; Harms et al. 2015). Through a reduction of break-off rates and speeders, less respondents need to be initially addressed.

The exclusion of individuals who randomly clicked through the survey without paying real attention is difficult. Thus, a reduction of these individuals decreases companies' efforts to detect them and increases data validity. Building up a group of respondents that continuously participate in market research reduces acquisition costs of new participants. This group of respondents is already familiar with the procedure and the gamified CBC in particular.

Taken together, the gamified CBC can be considered as an effective tool for companies to implement. The implementation of gamification may help companies to provide participants with a more engaging, relevant, involving, rewarding, and consequently, a more positive survey experience (Harms et al. 2015; Schacht et al. 2017). The results of the study further help managers to understand the underlying psychological mechanisms. This knowledge enables them to implement further game elements and predict their results.

Considering the question whether to gamify or not to gamify higher education and market research, a positive answer can be provided. Although the thesis was not able to demonstrate that specific game elements (i.e., points, badges, and leaderboard) foster motivation, these game elements certainly do not hinder these relationships.

Table 51 provides an overview of research gaps, main results, and implications.

Table 51: Summary of research gaps, main results, and implications

Aim	Identified research gaps	Main results	Theoretical implications	Managerial implications
Study 1 Investigation of the effect of gamification (i.e., points, badges, and leaderboard) in **higher education** on (i) students' motivation (i.e., competence and intrinsic motivation (i.e., enjoyment)) to learn moderated by individual characteristics, (ii) their participation in the course (i.e., in online tutorials), and (iii) the exam results as the primary learning performance.	- Current research does not focus on the comparison of specific game elements (especially in the context of education). - Current research considering specific game elements does not focus on the investigation of mediating psychological and behavioral outcomes by applying the self-determination theory. - Current research focusing on specific game elements lacks an investigation of the moderating effect of personality characteristics.	- Points, badges, and leaderboard do not have a significant effect on competence. - The effect of gamification on learning performance is not significantly mediated by competence, intrinsic motivation (i.e., enjoyment), and participation. - None of the individual characteristics has a significant moderating effect (i.e., extraversion, conscientiousness, status, competition, expertise, and gender). - Competence has a significant effect on motivation (i.e., enjoyment). - Badges have a significant positive effect on learning performance, whereas the direct effects of points and leaderboards are not significant. However, this direct effect should be interpreted with caution. Due to the fact that the underlying motivational mechanism is not significant, there may be other mechanisms mediating this effect.	- Insights from the comparison of points, badges, and leaderboard in a real life setting with actual users. - Points, badges, and leaderboard may not provide enough informational feedback in order to support participants' (i.e., actual users) judgment of their performance. - The positive effect of badges on final learning performance opposes current research. - Current research is enriched by investigating badges on the quality of action. - Verification of self-determination theory (i.e., significant positive effect of competence on intrinsic motivation (i.e., enjoyment)). - Insights from investigating all components of the framework. - Insights into moderating effects of individual characteristics (i.e., extraversion, conscientiousness, status, competition, expertise, and gender).	- Insights into the psychological mechanisms are limited due to insignificant effects of game elements on competence. - The implementation of points and leaderboards neither harm nor support students' motivation and behavior. - Badges may be implemented in order to increase student performance. - Badges may serve as a substitute for personal feedback in environments where face-to-face interactions are not feasible. Hence, the implementation of badges helps educators to connect a particular behavior and make learning goals visible to students. Students may subsequently be more satisfied with the course. In general, more satisfied students have a stronger relationship to their alma mater in the long-run. A strong relationship does not solely results from the implementation of game elements. However, it can be one influence factor among others. - Compared to costly implementations of games, implementing badges may be an efficient alternative to reach comparable results.

Aim	Identified research gaps	Main results	Theoretical implications	Managerial implications
Study 2 Investigation of the effect of gamification (i.e., memory-type game) in **market research** on (i) ndividuals' motivation (i.e., competence and intrinsic motivation (i.e., enjoyment) to perform a task moderated by individual characteristics (ii) their evaluation of market research, and (iii) their intention to re-participate in future market research.	- Current research focusing on specific game elements is scarce (especially in market research context). - Current research considering specific game elements does not focus on the investigation of mediating psychological and beha-vioral outcomes by applying the self-determination theory (in the context of market research, studies neglect to use a theoretical foundation to explain their results). - Current research focusing on specific game elements lacks an investigation of the moderating effect of individual characteristics.	- Gamified CBC has a significant positive effect on competence and intrinsic motivation (i.e., enjoyment). - Expertise has no moderating effect. - Gamified CBC compared to RBC is more effective for men than for women. - Effect of gamified CBC compared to CBC on the intention to re-participate is fully serially mediated by an increase in competence, an increase in intrinsic motivation (i.e., enjoyment), and an increase in evaluation (i.e., survey evaluation and choice satisfaction). - Effect of gamified CBC compared to RBC on the intention to re-participate is fully serially mediated by an increase in competence, an increase in intrinsic motivation (i.e., enjoyment), and an increase in choice satisfaction. - Gamified CBC is most suitable to estimate the selection decision in the hold-out sample. RBC performs worst.	- Insights from implementing gamification in market research. - Insights from extending the scope of previously investigated game elements by investigating the effect of a memory-type game. - Current research is enriched by providing a theoretical foundation by applying the self-determination theory (especially in the context of market research). - Self-determination theory is extended by a further trigger (i.e., memory-type game) that provides an optimal challenge for the individuals and in turn increase competence. - Verification of self-determination theory (i.e., significant positive effect of competence on intrinsic motivation (i.e., enjoyment)). - Insights from investigating all components of the framework. - Insights from moderating effects of individual characteristics (i.e., gender and expertise).	- When investigating a research topic with a conjoint analysis, gamified CBC should be preferred to CBC and RBC due to higher data quality. - The comprehension of the underlying psychological mechanisms provides managers the opportunity to easily implement new game elements in market research and anticipate their effects. - By implementing a gamified CBC, companies can enhance participants' survey evaluation (i.e., short-term effect) as well as intention to re-participate in market research studies (i.e., long-term effect) in comparison to CBC. - Companies can generate value to the respondents and in turn increase their retention by decreasing the perceived burden and enhance the perceived benefits of participating in market research. - This may decrease negative respondent behavior such as speeding, higher break-off rates, and lack of attention. Hence, companies can reduce their effort by addressing a smaller initial sample size and by reducing their time doing data cleaning.

Source: Author's own illustration.

6.4 Limitations and Future Research

Despite the insights delivered by both studies, the underlying research is also subject to limitations that provide opportunities for future research. In general, the data collection for both studies was limited to the German market. Hence, the implementation of specific game elements in a different cultural background might lead to different findings. Thus, future research could verify potential cultural differences.

Moreover, the findings of the studies may be limited to the specific contexts of both studies (i.e., higher education and market research). Participants of the first study were second-year bachelor students studying business administration, information systems, or economics. They were enrolled in the core marketing course. It may be possible that the observed effects are limited to this sample group. Future research should extent the comparison of points, badges, and leaderboards on the motivation to learn to master students, different domains, different courses, other universities, and more generally to online learning platforms. However, an investigation of these game elements should not be restricted to the context of education. For instance, fostering continuous motivation to learn is also important for companies. They need to motivate their employees to learn continuously. Future research could also be extended to crowdsourcing and physical exercise. In the second study, the memory-type game seems to be an appropriate game element to improve the results of traditional conjoint analyses (i.e., CBC and RBC). However, future research might take further conjoint ana-lyses into account for comparison. It is also possible that a memory-type game is a suitable game element in further contexts besides conjoint analyses.

The focus of both studies lies on game elements that may enable gameful experiences of skill development and social comparison. The scope of specific game elements that enable these gameful experiences can be extended. Specific game elements that evoke gameful experiences of social connectedness (e.g., teams, chats, and social feedback functions) and expressive freedom (e.g., avatars and user profiles) should also be taken into account.

While this study provides valuable insights, the question of which game element works best in which contexts and for which individual would benefit from further research. Moreover, the effects of additional game elements evoking a gameful experience of skill development and social comparison can be investigated in future studies.

In both studies, surveys were conducted in order to measure psychological variables, individual characteristics, and behavioral intentions. When collecting data through surveys, it can be expected that individuals fill in the surveys in a careless manner. In order to address this problem, the datasets in both studies were scanned for outliers and unreliable answering behavior (i.e., choosing the same value for most of the survey). A small number of responses was detected. However, other unfit responses might remain undetected in the dataset. Moreover, potential extraneous variables might have influenced the results because both studies represent field experiments.

The insignificant effects of individual characteristics hint to further contingency factors that drive the effects in both studies. Thus, future research should consider further individual characteristics that moderate the effects of specific game elements on psychological outcomes.

Besides these general limitations, there are also specific limitations for both studies. The first study took place in a real-life learning environment. Hence, it was necessary to consider the imperatives of the academic program that provided the empirical context. The learning platform Learnweb limited the number of specific game elements that could be investigated to points, badge, and leaderboard. In addition, the design of the specific game elements points and leaderboard was predefined by Learnweb. Potentially, a different presentation of both game elements would have led to different results. For instance, the leaderboard could be non-anonymous. A different design may amplify the game elements' potential to evoke gameful experiences of skill development and social comparison and subsequently increase students' competence and intrinsic motivation. The same might be possible regarding the design of badges. Even if the design of the badges was pretested with students, study participants could have preferred another design in order to perceive a gameful experience of skill development (i.e., progress and achievement) and subsequently an increase in competence. However, for any given problem, there is

an infinite number of potential designs that can be created. Each of these designs may lead to an infinite number of different implementations. Thus, there might be the possibility that different implementations would have led to better or worse outcomes. Consequently, it seems to be difficult to find the optimal design of game elements. Future research can at least attempt to analyze diverse game design features and there consequences.

A further specific limitation of the first study represents the small number of students that did all INTUTs, answered all five surveys and wrote the exam at the end of the winter semester 2017/18. Due to the small sample size, an average of the four INTUT surveys was calculated. This leads to the fact that no time effects could be considered. Future research could re-run the study by trying to enlarge the sample size. This may enable researchers to investigate whether the answers of the surveys change over time. A reason behind the small sample size might be that students have had other priorities throughout the semester (i.e., preparation for exam in December). Future research should take this student behavior into account. One possibility might be to choose courses that last solely one term instead of the whole semester including the first and the second term and having the exam phase in between.

A specific limitation for the second study represents the measurement of re-participation. Potentially, the intention of participants differ from their real behavior. Future research should investigate whether gamification influence actual re-participation in future market research studies.

Overall, both studies are a valuable first step for providing a more comprehensive view of the effectiveness of gamification on motivation and behavioral outcomes in two different contexts. Despite potential limitations, the thesis demonstrates the usefulness of the gamification approach. It provides valuable insights for both academics and practioners. The thesis lay a fruitful ground for future research that aim to examine the effectiveness of gamification.

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Impact of Gamification on Individual's Motivation and Behavior

Charlotte Hufnagel

Das übergeordnete Ziel der Dissertation ist die empirische Bewertung der Auswirkungen von spezifischen Spielelementen auf die Motivation und das anschließende Verhalten der Individuen unter Berücksichtigung von individuellen Charakteristika. Dabei dient die Selbstbestimmungstheorie als theoretische Fundierung. In der ersten Studie im Kontext von Bildung wird der Einfluss spezifischer Spielelemente (Abzeichen, Punkte und Rangordnung) auf die Lernmotivation und die Lernleistung von Studierenden untersucht. Die gewählten Spielelemente haben weder einen direkten Effekt auf die Motivation noch einen indirekten Effekt auf die Lernleistung. In der zweiten Studie im Kontext von Marktforschung konnte jedoch ein Einfluss auf die Motivation und das anschließende Verhalten konstatiert werden. Hierbei wurde eine Marktforschungsmethode (Conjoint Analyse) gamifiziert. Basierend auf den Ergebnissen sollte diese den traditionellen Conjoint Methoden ohne Gamification vorgezogen werden.

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