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in Forschung und Praxis

RESEARCH

Tanja Kreitenweis

Non-Cognitive Factors and Learning within a Business Simulation

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Non-Cognitive Factors and Learning within a Business Simulation

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Geleitwort

Gemeinsames spielerisches Lernen scheint eine verlockende Idee zu sein, verglichen mit der Vorstellung des angestregten Paukens im stillen Kämmerlein. Unter dem Schlagwort der Gamification wird diese Idee in so genannten Serious Games für das Lernen im beruflichen oder akademischen Kontext verfolgt. Es existiert bisher allerdings wenig gesichertes Wissen dazu, ob in Serious Games tatsächlich gelernt wird und vor allem von welchen Faktoren der Lernerfolg abhängen könnte. Nur wenn wir dies aber wissen, können wir von einer zukunftsfähigen Idee sprechen.

Die hier veröffentlichte Arbeit von Tanja Kreitenweis ist vor dem Hintergrund derartiger Überlegungen entstanden und fokussiert auf das Lernen in Rahmen einer Unternehmenssimulation. Frau Kreitenweis stellt sich folgende Fragen: Wie kann der durch eine Unternehmenssimulation bedingte potenzielle Zuwachs an Wissen und Fähigkeiten gemessen werden? Nehmen das Wissen und die Fähigkeiten von Spielenden einer Unternehmenssimulation zu? Welche nicht-kognitiven Faktoren können das Lernen von Teilnehmenden einer Unternehmenssimulation vorhersagen? In dieser Arbeit gelingt es, diese Fragen zu beantworten, auch wenn nicht alle aufgestellten Hypothesen bestätigt werden können.

Beachtenswert an dieser Arbeit ist der große Aufwand, der betrieben werden musste, um das Lernen in einer spezifischen Unternehmenssimulation überhaupt messbar zu machen. Erst durch diese Vorarbeiten konnte es gelingen, weitere Fragestellungen, etwa nach der Rolle der Motivation der Teilnehmenden und dem Effekt der Motivation auf das Lernen, zu beantworten. Dies gelingt Tanja Kreitenweis jedoch und man erkennt, dass spielerisches Lernen im Kontext von Unternehmenssimulationen eben nur dann erfolgreich ist, wenn die Teilnehmenden etwa auch motiviert sind. Für die Praxis der Anwendung von Serious Games ist die vorliegende Arbeit daher wertvoll, denn es wird klar, dass die Idee des

spielerischen Lernens eben kein Selbstläufer ist, sondern nicht-kognitive Faktoren der Teilnehmenden bedacht werden müssen. Somit leisten die Arbeit und die Verfasserin einen wichtigen Beitrag zur Forschung und Praxis zukunftsfähiger Unternehmensführung. Es ist der Arbeit zu wünschen, dass sie von Forschung und Praxis gleichermaßen aufgegriffen wird.

München
2021

Univ.-Prof. Dr. Stephan Kaiser

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Im Laufe meiner Promotion habe ich schnell festgestellt, dass es sich bei einer solchen umfangreichen Arbeit um eine „Gruppenleistung“ handelt. Zwar liegt die Verantwortung bei einem selbst, Entscheidungen zu treffen und letztlich die Arbeit zu verfassen, dennoch geht es nicht ohne die Unterstützung von Vielen. Bei einigen dieser „helfenden Händen“ möchte ich mich ganz besonders bedanken.

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Abbreviations

BFI	Big Five Inventory
CVR	Covariance Ratio
GPA	Grade Point Average
IMI	Intrinsic Motivation Inventory
KMO	Kaiser-Meyer-Olkin
PISA	Programme for International Student Assessment
P-P Plot	Probability-probability Plot
SMAP	Short Measure of Adult Playfulness
VIF	Variance Inflation Factor

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Introduction

1

“Tell me and I forget. Teach me and I remember. Involve me and I learn.”

(Benjamin Franklin)

The importance of continuous and life-long learning, which has been recognized for more than sixty years, has now become essential as employees seek to remain employable (P. Jarvis, 2004, p. 29; Quendler & Lamb, 2016, p. 293). Although access to knowledge has become easier, the scope and complexity of what is to be learned has greatly increased. As well, the changes in today’s social values also suggest that ways of learning need to change (Jacob & Teuteberg, 2017a, p. 98). Recent studies show that information conveyed in a playful manner increases learners’ motivation and that such unconventional methods are valuable for learning in general (e.g., Derbali & Frasson, 2012; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013). However, while non-traditional pedagogical approaches can impart knowledge attractively, *business simulations and games* are not yet widely acknowledged teaching techniques.

Associations with games vary greatly. Some believe games are exclusively for children (Brown, 2009, p. 6)—thinking of classical board or card games. Others focus on the dangers of extreme games, namely computer games with addiction potential. *World of Warcraft*, *Pokémon Go* or *Diablo* are common examples for the latter, as large player communities have been formed within a short time (Ducheneaut, Yee, Nickell, & Moore, 2006, p. 281; Swatman, 2016). Competitive players of these games are seen as so involved in their games that they forget their surroundings, no longer walk their dogs and neglect their social relationships and work. These may be public prejudices, but they could be scientifically confirmed (Oggins & Sammis, 2012, p. 221). These examples show the influence that games

can have on both children and on adults, often with strong connotations of negative associations or childish behavior in our society. Many have given only limited thought to the value gained by sophisticated, well-thought-out games—so-called “*serious games*”—which can simulate entire systems or corporate environments and offer real and untapped value for learners of all age groups.

The many serious games being used in educational programs have become increasingly subject to investigation over the last several years. Previous studies have primarily concentrated on the learning outcomes of games as pedagogical tools or the influence these games have on their users. A broad range of learning achievements, which are often of interest in these studies, were declarative knowledge gains, coping strategies (Ronen & Eliahu, 2000, p. 14), knowledge organization (Squire, Giovanetto, Devane, & Durga, 2005, p. 41) and motivation (Wouters et al., 2013). In addition, comparative studies examined the effects of games relative to traditional types of teaching (e.g., lectures or seminars). In cognitive terms, Sitzmann (2011, p. 489) found that learning with digital games is superior; however, a meta-analysis by Wouters et al. (2013, p. 258) reported that this effect disappears in studies, when test participants are randomly assigned to a treatment and control group. Nevertheless, games were shown to be superior again when they were supplemented by further instruction methods that included several training sessions and required a group setting. Given the fact that several studies have shown that learning performance can have a lasting influence on learners’ future careers (Cheng & Furnham, 2012, p. 224; Evers & Sieverding, 2014, p. 99) and satisfaction (Gilman & Huebner, 2006, p. 317; Salmela-Aro & Tynkynen, 2010, p. 877), it makes sense that existing research has focused on the *legitimization of serious games*. Thus, statements could be made about the value of serious games and whether new didactic techniques and methods can achieve positive results for learners.

Indeed, related to the statements of Hattie (2015, p. 48), the influence of *teaching methods* on learning achievements is important, however essential effects “on educational achievement are due to psychological (i.e., within-persons) non-cognitive individual differences variables” (Stankov, 2013, p. 731) as well. Since the 1990s, scholars have demanded that research focus both on *cognitive factors* and *non-cognitive factors* to further comprehend the mechanisms underlying successful training and further teaching methods to induce learning (Cannon-Bowers, Rhodenizer, Salas, & Bowers, 1998, p. 316; Magnusson & Stattin, 1998, p. 404; Salas & Kozlowski, 2010, p. 463). Duckworth, Peterson, Matthews, and Kelly (2007, pp. 1087–1088) even argue that an individual’s success rates are determined by different non-cognitive factor capacities (e.g., creativity, self-confidence or perseverance), which exceed beyond one’s cognitive disposition. In the 2000s,

Heckman (2000) as well as Heckman and Rubinstein (2001, p. 149) quantified and established the relevance of non-cognitive factors by a large-scale survey and argued that neither cognition or intelligence alone is enough to succeed academically. The importance of non-cognitive factors also became clear in the Programme for International Student Assessment¹, which included different behavioral and dispositional variables (e.g., self-efficacy or self-concept) in recent years (Stankov & Lee, 2014, p. 1). Finally, the long-lasting belief that intelligence is primarily accountable for academic success could be dispelled by empirical evidences (e.g., Kappe & van der Flier, 2012, p. 613; Nofle & Robins, 2007, p. 116; Poropat, 2009).

For *business simulations*, a subcategory of serious games, only a few studies have examined the role of non-cognitive factors on learning or rather students' *skills and knowledge development* after playing such a game. This limited research could be due to the novelty of the teaching method's discourse.

Aiming at addressing this gap, the present work investigates the hypothesized positive influence of non-cognitive factors (primarily motivational skills, openness, positive affect, grit and playfulness) on learners' skills and knowledge states in a business simulation environment. Therefore, the empirical study is embedded in a pre- and post-experience survey which utilizes *SysTeamsChange*—a *haptic business simulation* lasting one and a half days. *SysTeamsChange* seeks to convey change management skills and knowledge. For the data collection, undergraduate business administration students of a cooperative state university in Germany filled in a *paper-pencil-questionnaire* before and after *SysTeamsChange* was played.

In traditional learning environments, numerous research articles have already investigated the effects of non-cognitive factors on academic achievement (e.g., Everaert, Opdecam, & Maussen, 2017; Richardson, Abraham, & Bond, 2012; Zuffianò et al., 2013). However, there are hardly any studies focusing on these skills in an *experiential learning environment* or, in particular, a serious gaming or business simulation setting (e.g., Baker, Underwood, & Thakur, 2017; Pavlas, Heyne, Bedwell, Lazzara, & Salas, 2010). The emphasis of existing research on serious games is on two limited study areas. Several scholars focused on the examination of relevant design elements for “functioning” serious games (e.g.,

¹ PISA is the well-known abbreviation for this and is the OECD's Programme for International Student Assessment. Every three years it tests 15-year-old students from all over the world in reading, mathematics and science. The tests are designed to gauge how well students master key subjects in order to be prepared for real-life situations in the adult world. In particular, this should serve the development of human capital, which is seen as the knowledge, skills and competencies relevant to personal, social and economic well-being (OECD, 2019).

Catalano, Luccini, & Mortara, 2014; Kriz & Manahl, 2016), while others examined these games' influence, for example, on team cohesiveness, learning or the enhancement of non-cognitive factors (e.g., Bozanta, Kutlu, Nowlan, & Shirmohammadi, 2016; Giessen, 2015; Santamaria et al., 2011). As a result, studies focusing on learners' non-cognitive factors and their interaction with the experiential learning environment are scarce and thus in need of foundational research. Therefore, this work seeks to combine well-researched discourses in the form of non-cognitive factors with the less explored discourse of business simulations. The arguments of Hattie (2015, pp. 48 f.) and Stankov (2013, p. 731) show the importance of linking and deepening the topics of teaching methods and non-cognitive factors, so that the following research questions are raised:

- (1) How can a potential increase in skills and knowledge due to a business simulation environment be measured?
- (2) Do learners, who participate in a business simulation, increase their skills and knowledge states?
- (3) Which non-cognitive factors predict learners' skills and knowledge states in a business simulation environment?

The study will also explore the underlying conditions of SysTeamsChange in regard to the teaching methods of business simulations. Business simulations often require learners to *work in teams* to solve the tasks set (Levant, Coulmont, & Sandu, 2016, p. 327). According to Vygotsky (1980, p. 25, 87–88), such a social context allows interaction and dialogue and fosters learners' skill development and knowledge acquisition. When playing the business simulation SysTeamsChange, learners must be part of a team; playing alone is not an option. For this reason, the influence of learners' preference to work in a team is explored as it is of interest to investigate the *circumstances of a learning environment* (Trautwein, Lüdtke, Köller, & Baumert, 2006, p. 334). Such circumstances might strengthen or weaken the effects raised in research question three, that is between learners' non-cognitive factors and their skills and knowledge states.

Based on the considerations outlined above, the following explorative research question is posed:

- (4) How do learners' preferences to work in a team moderate the relationship between non-cognitive factors and learners' skills and knowledge states in a business simulation environment?

Contributions of this Study

The present work extends the limited business simulation literature on non-cognitive factors and provides educators (e.g., instructors, teachers, trainers) and decision-makers of training plans with new insights about learners' non-cognitive factors that can promote better learning. As well, this study explores the situation of learning in teams by considering learners' team preferences.

So far, the majority of the existing studies about serious games focuses on the effects these games might have on learners (e.g., enhancing self-efficacy) and what kind of skills (e.g., increasing mobility in elderly) can be learned. The importance of learners' non-cognitive factors has been rarely addressed. This work centers on the learners' initial non-cognitive factors:

Facilitating cross-continental comparisons. Most quantitative studies concerning skills development and knowledge acquisition with business simulations are conducted in Australia, USA or China. This work explores learning experiences in a central-European university, facilitating cross-continent comparisons.

Enhancing skills and knowledge with a haptic business simulation. The applied business simulation refers to the field of change management, which requires empathy and soft skills to drive change without defining "change success". This is different from regular business simulations, which result in winners and losers, since the success of the game (e.g., number of market shares or profit) can be clearly determined. In addition, this work focuses on a non-digital business simulation—learners are working explicitly on a haptic game board—without computers. This is different from the majority of recent serious gaming studies because the growing gaming community emphasizes the development of digital serious games and hence the community consists increasingly of information technology scholars. The latter publish studies, for example, with a focus on specific areas such as game development and design approaches. The present work contributes to the barely developed discourse of haptic simulation games.

Including control variables. The relationship between non-cognitive factors and learning, in the form of learners' skills and knowledge states, are studied empirically.

Gender and prior perceived knowledge and skills are taken into account for these relationships, which are often missing in previous studies (Everaert et al., 2017, p. 81).

Measuring skills and knowledge states subjectively and objectively. Learning is examined both subjectively and objectively to overcome drawbacks only from applying one of these. Newly developed measures are applied to identify skills and knowledge states based on the business simulation. General performance measures like Grade Point Averages (GPA) or exam grades are inappropriate because they typically include bias (e.g., evaluation of grammar and spelling or the trainer's overall impression of the student). Such biased measures evaluate a learner's "recall abilities". However, business simulations aim at providing participants both with skills and knowledge which are transferable to real-life activities.

Enhancing experiential learning research. This work contributes to the body of experiential learning research. The selected non-cognitive factors are found mostly in the field of internships, training or service learning in this research stream. Thus, the findings of this study will help to embed business simulations in the body of the literature of experiential learning.

Exploring the moderating effect of team preference. This study will take into account learners' team preferences and investigate any moderating effects.

Structure of this Study

The aims of this study are manifold: It will develop a measurement for potential increases in learners' skills and knowledge in a business simulation environment and investigate whether an increase has occurred. Additionally, it will identify which non-cognitive factors are associated with any skills and knowledge increases in such a setting and explore the moderating effect of team preference. To accomplish these goals, the work is organized as follows.

Chapter 2 provides the reader with the theoretical basis of serious games and experiential learning. It embeds serious games in experiential learning theory as described by D. A. Kolb (2015) and synthesizes the research on experiential learning, business simulations and non-cognitive factors. This chapter presents the derived hypotheses of this work and theoretical rationale of the explorative moderation analysis. For this purpose, it outlines the basic structure of the game and incorporates the findings from the interviews conducted, which are presented in more detail in *Chapter 3*.