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Development of an educational simulation game and evaluation of its impact on acculturation attitudes

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ORIGINAL PUBLICATIONS

1. Männamaa, I. (2014). Simulation game: taking horses to water. In: A. Moseley & N. Whitton (Eds), *New traditional games for learning. A case book.* (119–133). New-York – Oxon: Routledge.
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4. Männamaa, I., & Leijen, Ä. (2015). The Simulated Acculturation Model in the FOUNTAINS-Game. *Simulation & Gaming*, *46*(1), 98–112. doi: 10.1177/1046878115591393
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Articles 4&5: Designing the study, formulating research questions, developing the questionnaire, implementing interventions, carrying out the data collection and analysis, and writing the paper as the main author.

1. INTRODUCTION

The dissertation is based on a practical task to develop an educational game as a means of supporting understanding of intercultural processes and promoting integration-oriented acculturation attitudes. In general, it might be said that using games as educational means is not widespread in formal education in Estonia, nor is multiculturalism a thoroughly covered topic within formal school curricula. The syllabus on civic education for upper secondary schools focuses mostly on legislative aspects connected to principles of governance of the state. Thus, a teaching aid for teachers to introduce acculturation topics in more detail was needed. In line with this, the design of the game was oriented toward acculturation strategies, focusing on integration of ethnic groups, with special attention to strategies chosen by minorities.

Raising awareness about cross-cultural issues and improving knowledge of acculturation processes is relevant to Estonian schools for several reasons. First, integration of the Russian-speaking minority population has not been as successful as expected: according to the report on integration in Estonia, their trust toward state institutions is lower and position on the labour market have found that weaker (*Eesti ühiskonna* ... 2017). Kus-Harbord and Ward (2015) have found, that Russian speakers have become a relatively deprived group, and they perceive the situation as being fairly illegitimate (Ehala & Zabrodskaja, 2011). Secondly, recent cultural conflicts both in Estonia and in other European countries provide evidence that cultural integration, whether an achievable goal or not, is a topic that should play a significant part in the education of modern society. And thirdly, since 2015 more than a million immigrants have arrived to the EU (Batha, 2017; Europe's Migration Crisis, 2016) and Estonia, among other EU countries, has to be ready to integrate a significant number of asylum seekers.

1.1. Focus of the research

This dissertation, starting with a brief overview of acculturation strategies, contains two major parts. In the first part (ch. 2), game development is described in general, while the second part (ch. 3&4) introduces the results of two studies which aimed to evaluate potential impact of the developed game on participants' attitudes on acculturation.

It has been found that plans to integrate newcomers are often met with resistance (see, e.g. Teder, 2015) as the members of the dominant group tend to react to the idea of integrating immigrants with fear and prejudice (Strabac & Listhaug, 2008) and their attitudes toward them can be described as rather suspicious in Estonia (Ainsaar & Beilmann, 2016). Still, as the previous research demonstrates, the adaptation of immigrant students to the educational system depends greatly on the attitude of peers from the dominant group (Isac,

Maslowski, & Werf, 2012; Kosic, Mannetti, & Sam, 2005). Several studies have pointed out that acculturation attitudes of the dominant groups are less favourable than those of the immigrating groups (Arends-Tóth & Van de Vijver, 2003; Ward & Masgoret, 2008; Verkuyten, Thijs, & Sierksma, 2014). The difference has been explained by the fact that representatives of the dominant culture perceive immigration as a threat, whereas perceived threat has an important role in the development of acculturation attitudes (Breugelmans & van de Vijver, 2004; Stephan, Renfro, Esses, Stephan, & Martin, 2005). Adaptation of the students from immigrant families to a new educational system has been found to be influenced by possible psychological traumas and emotional stress (McCarthy, 1998), differences between acculturation strategies of the host population and immigrant groups (Bourhis, Moise, Perreault, & Senecal, 1997; Verkuyten et al., 2014), and also by the acculturation attitudes of the co-students (Aronson & Brown, 2013).

Among interventions used to change the acculturation attitudes of the host population various methods have been used, including imagined intergroup contact and using infrahumanization literature (Vezzali, Capozza, Stathi, & Giovannini, 2012), critical incidents analysis (Herfst, van Oudenhoven, & Timmerman, 2008), and simulation games (Fowler & Pusch, 2010). Among the latter, the best-known samples are "BaFà BaFà" (Shirts, 1995) and "Barnga" (Thiagarajan, 2006), which focus on coping with problems connected to cross-cultural differences. Apart from cross-cultural differences, another aspect which needs to be considered in acculturation processes is the access of both majority and minority groups to public resources (e.g., labour markets, education, etc.). As previous games have not taken this into account, the author of the current dissertation decided to develop an original educational game with colleagues which simulates acculturation in a situation of limited resources (Männamaa, Vetik, & Liiv, 2011). In the beginning of the development process, different design models were considered. Since Richard Duke's seminal book, *Gaming: the Future's Language* (1974), several frameworks describing the design of educational games have been suggested, but the research on their effectiveness is quite fragmented (Arnab & Clarke, 2017; Hays, 2005; Kriz, 2006). Furthermore, the literature on models of game development is not persistent in use of terms and there are no agreed guidelines for a pedagogy-driven game design process.

In addressing the issues in game-based learning associated with this dissertation, the first research objective was:

1. To develop a research-grounded educational game for influencing participants' understanding of acculturation.

The general purpose of the game – promoting understanding of acculturation – is pretty wide and could be evaluated against various criteria, e.g. new knowledge acquired or even certain skills obtained. The current dissertation focuses on the domain of attitudes held by the representatives of the majority population. Therefore, the second research objective was formulated as:

2. To evaluate impact of the developed game on participants' acculturation attitudes.

   Based on the two goals, the following research questions were posed:

   1) Which design principles are important for development of a simulation game that would enhance participants' comprehension of acculturation?
   2) Does the developed simulation/game have an impact on participants' acculturation attitudes?

The dissertation introduces theoretical principles of game design, focusing on educational simulation games in particular. It describes the design of the Fountains game, which was developed according to general design-based research principles (Anderson & Shattuck, 2012; McKenney & Reeves, 2013). More specifically, we tested the game prototypes within different conditions and launched the ready-to-use game only after necessary changes and calibrations had been included in the design. Two questionnaires were developed to assess the impact of the game on acculturation attitudes: the results of the first are introduced in more detail in attached article #4 (Männamaa & Leijen, 2015), while article #5 (Männamaa, Komsaare & Leijen, 2016) provides the results of the second survey. Overall results of the study are provided and discussed in the final section of the dissertation.

1.2. Acculturation models

If intended to be meaningful, a simulation game should be based on a model describing the reference system in sufficient detail and fidelity. To describe the reference system of our game we sought an acculturation process model. Authors use different terms to describe those attitudes or biases towards acculturation, including acculturation orientations (Arends-Tóth & Van de Vijver, 2003), acculturation expectations (Van Acker & Vanbeselaere, 2011), acculturation preferences (Zagefka et al., 2014), acculturation intentions (Tartakovsky, 2012) or acculturation attitudes (Navas, Rojas, García, & Pumares, 2007). Use of these measures of attitudes by the dominant and immigrant groups and variations in the way they attempt to manage the process of acculturation have been called acculturation strategies, the implementation of which leads to cultural adaptation (Sam & Berry, 2010). In this dissertation, I use the concept of acculturation attitude pervasively and will not discuss the differences between all the above-mentioned concepts.

Development of a simulation game for educational purposes should be based on a certain model, either narrative, mathematical, conceptual, etc. Also, the model used could demonstrate either ideal, extreme, or average modes of the reference system (Klabbers, 2006, p 107). For example, while choosing a model for a game on acculturation, one could use either a model describing the worst potential situation or the ideal one: both cases could be used to initiate discussion on relevant topics.

During the initial phase of the game development several theoretical models were considered which explain immigrants' preferences for different acculturation strategies. In more detail, the models of expected payoff (Kuran & Sandholm, 2008), sociological explanation (Esser, 2006), individual difference (Safdar, Lay, & Struthers, 2003) and bi-dimensional approach (Berry, 1992) were analysed as potential backbones of the game. These have been described further in the attached article #4 (Männamaa & Leijen, 2015). The most widely known of them are the four-fold (or bi-dimensional) acculturation theories, which claim that ethnic groups can favour either the dominant culture, their own minority culture, both, or neither (Berry, 1997; Sam & Berry, 2010). Though this model seems to be too complex to be empirically tested, it was decided to be used as a backbone for the game. There were two main reasons for this choice. Firstly, this model is the most widely known among schoolteachers in Estonia and secondly, it includes acculturation strategies of both minority and majority groups. To complement the game design, some elements from other models were added to it.

The chosen model differentiates four acculturation strategies by using two orthogonal dimensions – cultural maintenance and contact participation – and is based on the observation that ethnic minorities residing in multicultural societies confront two essential questions: (1) how important it is to maintain their ethnic identities, and (2) how actively to be involved in the mainstream culture. Choices of the agents made within these two dimensions lead to the adoption of four different acculturation strategies that Berry terms assimilation, integration, separation, and marginalisation. Berry defines acculturation as a process of cultural and psychological change resulting from contact between groups of different cultural backgrounds, which either leads or does not lead to adoption of each other's behaviours, values, technologies, etc. As acculturation is a mutual process, where both host population and immigrants have to adapt to new circumstances, the attitudes of both (or more than two) groups should be considered.

2. GAMES AND SIMULATIONS

Defining game is not an easy task, as it seems to emerge in huge variety of forms and in vast areas of human (and animal) behaviour. Wittgenstein (1986), although not focusing on the phenomenon of game as such, demonstrates the difficulties of defining it well. Followers of this tradition claim that trying to find a common similarities for all games is not fruitful at all. It has been suggested that it is more reasonable to look at games with the help of features that connect some types of games, but not necessarily all of them (Arjoranta, 2014) or that the definitions of games are changing over time, following specific trends (Stenros, 2016). Johan Huizinga, who is probably the most widely referred researcher of games, has defined in his book *Homo Ludens* (originally 1938) game as a free activity, which, although seen outside regular life, still engrosses the player completely. Within this activity no additional benefit is acquired and it takes place within its own set timeframe and in its own set space, strictly following specific rules and regulations. Caillois (2001), accepting Huizinga's definition, proposes the division of games into four main categories (rubrics): competition, chance, simulation, and vertigo. He claims that no matter which game we are looking at, at least one of the four components should be present in order to generate the 'magic circle' around the player(s). Still, most authors agree upon a set of characteristics that should be included in a definition of a game as an activity; namely, it is voluntary, it is rule-based, it includes conflict or competition, and it is separated from real life (see, e.g. the review of 60 definitions of games since the 1930s by Stenros (2016)). While a game-play is not supposed to provide any material values, it has components of both entertainment and instruction. Within this dissertation, the focus is on games emphasising the learning component, where besides the fun or entertainment element, certain learning outcomes are set as a primary goal. Sauve and colleagues (2007, p 248), after analysing 98 relevant texts that discussed critical attributes of educational games and simulations, list the five most widely accepted characteristics of games: player(s), conflict, rules, predetermined goal, and its artificial nature. If the focus of the research is on educational games, the instructional nature of the game provides a sixth attribute, the pedagogical one, in their opinion. The terms *learning games* (Ke, 2016), *serious games* (Landers, 2014), or *instructional games* (Hays, 2005) have also been used to denote these types of games but the target is the same: acquisition of skills, knowledge, or attitudes and fostering cognition which is useful either in real life or academic contexts. The concept of *serious games* has sometimes been used in parallel with simulation games, but it is generally applied exclusively to digitalised games, virtual environments or mixed reality/ media exercises (Breuer & Bente, 2010; Girard, Ecalle, & Magnan, 2013).

As mentioned by several authors, the terminology of gaming has evolved over the years and the terms of "game" and "gaming" are also used when referring to what are today understood as role-play exercises or simulations

(Shaw, 2010; Wright-Maley, 2015). Johnson differentiates five types of educational techniques which are often labelled mistakenly: games, exercises, simulations, role-plays and so-called ambivalents, mixtures of the previous four types (Johnson, 1989, p 13). He argues that these labels should not be used interchangeably and suggests to avoid ambivalents, where components of different techniques are mixed. In his words, a game always ends with the final score; cheating is not a play but a breach of rules, and in a simulation or role play participants can cheat, lie, or steal and remain within the event, providing they are behaving with professional intent. Games must always be competitive events whereas simulations, role plays, and exercises are often cooperative events. The main difference between exercises and simulations is that in an exercise the participants have no roles. The ideal state of mind of a participant in an exercise is that of objectivity and impartiality. The participant is a problem solver, a puzzler. And again, unlike a game, the participants of an exercise are not trying to win – they are trying to solve a problem. In the debriefing the key question is not likely to be "Who won?" but "How efficient were you and why?". It has been stated that a pure simulation, differently from a game, is not necessarily a conflict or competition, and the person who uses it is not looking to win, which is the case in a game. While a simulation is a simplified model of reality, validated by its correspondence to the system it represents, a game is often developed without clear reference to reality (Sauve et al., 2007, p 253). Still, the borderline between instructional simulations and educational games is not clear-cut, and in spite of Johnson's warning the somehow ambivalent concept of *simulation game* has been used in professional literature during the last decade. On certain occasions the activity, though having all characteristics of a typical game (including competition and condition of winning), is at the same time based on direct representation of reality. Pure abstract games or those with minimal stories, for example those based on game theory, such as "Prisoner's dilemma" or "So long sucker" (see e.g., Shubik, 2002) are samples of those, but also seminal games like "Stratagem" (Meadows, 2001) and "Star-Power" (Shirts & King, 1971) are samples of activities with a specific storyline and pre-described roles which could be described both as games or simulations. One characteristic that seems to be common to such games/simulations is the need to make meaningful choices. At each stage (or turn) the participant has to choose between at least two similarly tempting choices which, firstly, have significant influence on the game process and secondly, are usually not correct or incorrect *per se,* but depend on the choices of other participants. In this sense they qualify as games according to game theory (Colman, 1999, p 3). Still, while game theory assumes that the players have defined preferences (quantifiable payoffs), this is not always the case in educational games. The term *simulation game* in this article refers to activities which have elements of both game and simulation. They are designed with a specific learning outcome in mind; they include certain elements representing reality; and they have rules which help the participants to feel playful and behave with professional intent at the same time. As an original simulation game was developed and implemented

for the intervention used in the studies described within this dissertation, the following sub-sections provide a brief overview of the basic characteristics of simulation games and introduce some reasons why such activities could serve as efficient educational means. The chapter ends with principles which could be kept in mind while designing a simulation game.

2.1. Simulation games

Most authors agree that in simulation games three crucial elements – those of simulation, game, and pedagogy – converge (e.g. Aldrich, 2005). Others stress rather agent-based decision-making as a crucial element, e.g. Wright-Maley (2015, p 70) defines educational simulation games as "pedagogically mediated activities used to reflect the dynamism of real-life events, processes, or phenomena, in which students participate as active agents whose actions are consequential to the outcome of the activity" or Kriz (2003, p 497), who sees simulation games as the simulation of the effects of decisions made by participants who assume roles that are interrelated with a system of rules and with explicit references to resources that symbolise the existing infrastructure. Sometimes the concept of simulation games has been used to denote card games, role-playing games, game design exercises, day-in-the-life simulations, or other collaborative simulations (Hofstede, de Caluwe, & Peters, 2010; Wright-Maley, 2015). The basic characteristic which differentiates simulation games from many other types of educational games is the way in which the participants behave during the game-play. They do not pretend to be somebody else (as in a typical role play) nor are they solely focused on winning (as in a typical competitive game). They, while following the rules of the game and feeling playful, are at the same time fully focused on the task. While in the sphere of a *magic circle* they still behave with the utmost *professional intent*. Another specific characteristic appears due to the logic of game theory, assuming that at any certain decision point offered by the game scenario to the participants it is necessary to evaluate (it is, to compare) the predicted results. At any turn the player should have at least two possible courses of action and usually it is not easy to decide which one of them leads to the best possible outcome.

Simulation games (henceforth s/g) could have several specific purposes, such as to analyse the existing system, to predict potential developments, to promote the learning of participants or sometimes just to motivate them. Still, as seen as a kind of mediator from a source (i.e. a specific part of a real-life system), to a target (i.e. a tacit or explicit understanding of it), an s/g is supposed to engage a participant in an activity which evokes a novel perception of the components or their interrelations in the simulated system. Duke (1974, p 49), while stating that "The primary purpose of any game is to convey gestalt", is proposing that an educational game should provide a novel perspective of the problem at hand. Authors focusing on the aspect of simulation

describe simulation games and models as complex descriptions of reality which are developed to support the exploration of multi-causal processes and help the participants to acquire insight into the interconnected structures within a particular system (Karl, 2014; Leigh & Spindler, 2004, p 54). In contrast to that, business game models are especially characterised by the emulation of reality in a substantially reduced complexity (Bell, Kanar, & Kozlowski, 2008). This reductionism is necessary and sensible for teaching purposes, but such simulation/game models can hardly be employed for a valid prediction of the behaviour of the same systems in reality.

2.1.1. Learning in simulation games context

Though games have been found to be useful learning aids, their importance has been reinvented during the last decade, mostly because of the rapid spread of video and computer games. Hardly anyone questions the importance of playing in cognitive and/or physical development in childhood, and similarly there is lots of evidence that games could be efficiently used for adults both in pre- and in-service training, such as in the healthcare (Graafland, Schraagen, & Schijven, 2012), military (Smith, 2010), engineering (Deshpande & Huang, 2011) or business sectors (Jahangirian, Eldabi, Naseer, Stergioulas, & Young, 2010). It has been suggested that simulation games are more effective than other instructional methods, as they involve trainees' affective and cognitive processes (Tennyson & Jorczak, 2008), increase level of engagement (Abdul Jabbar & Felicia, 2015) and support learning in general (Girard et al., 2013). It has been even found that simulation-based training is generally superior to conventional training methods (Experience Builders, n.d.). Although the impact of educational games has been studied in general (Abdul Jabbar & Felicia, 2015; Wainess, Koenig, & Kerr, 2011) or in specific domains, such as their impact on cognitive skills and motivation (Garris, Ahlers, & Driskell, 2002; Rieber, Smith, & Noah, 1998; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013) or attitudes (Ruben, 1999; Wainess et al., 2011; Wilcox et al., 2008), the evidence for the effectiveness of simulations is far from conclusive (Bell et al., 2008). If this is among the reasons why using games is not so widely spread in the formal education system, then it creates a demand for more explicit evaluation of educational games.

The idea that learning could be efficient in gamified contexts arises mostly due to the constructivistic paradigm which claims that knowledge is not an objective substrate but is constructed by individual learners. As Duke puts it, common to all games is a pulsing of thought or inquiry which takes several forms, "... the most common of which is rounds in which players sequentially make their decisions. Games are almost invariably cyclical, and each cycle permits iterative questions that must be resolved in the total context of the game" (Duke, 1974, p 53). Students, when presented with goals, an enriched environment, and minimal guidance will, in their idiosyncratic way, develop

shared concepts and understandings of relationships between them. Constructivistic approach assumes that the activity may lead to development of general concepts, but learning the basic concepts does not necessarily lead to following activity. Therefore, it could be assumed that having learners construct their own solutions leads to the most effective learning experience.

Similarly to other methods, the game-based learning (GBL) should lead to the ability of learners to apply the acquired knowledge in different situations and contexts. The process behind such ability is known as learning transfer (Perkins & Salomon, 2012; Simons, 1999). Learning transfer has been explained by specific criteria, such as formation of new representations by selective activation of previous knowledge (Nokes-Malach & Mestre, 2013) or as modification of the existing knowledge while solving a novel problem (Hung, 2013). In general, it has been agreed that transfer should be a crucial outcome of any learning process and therefore a core question of all educational approaches (McDaniel, 2007). Still, although studied fairly intensely during last decades, it is thus far unclear as to when and why learning transfer occurs. In spite of an increasing number of sophisticated experiments, the phenomenon of transfer still "… seems to vanish when experimenters try to pin it down" (Schoenfeld, 1999, p 7). However, especially in GBL, it is crucial that the participants can apply the knowledge and skills constructed (or acquired) during the game in a context that differs from the original.

Most researchers agree that there are two types of knowledge transfer, near and far, depending on the similarity of the transfer setting to the learning situation. Two controversies can be detected within this model. Firstly, the characteristics of knowledge transfer could be described by two overall factors: content and context. Taxonomy with such axes is suggested by Barnett and Ceci (2002), who distinguish the transfer of content (what is transferred) and context transfer (from where and to are transferred). Secondly, there is "... a common element-based approach, rationalising transfer as an effect of atomistic correspondences, and a schema-based approach, explaining transfer on the basis of conformity among relational structures" (Helfenstein, 2005, p 13). The identical-elements-based theories imply that transfer depends on the commonality of facts or the closeness of the relationship between the stimulus and response components in the learning and transfer tasks, thereby implying that only near transfer is possible (e.g. Day & Goldstone, 2012). The schema-based (or principle-based) theories rather claim that an understanding of general principles can facilitate transfer through analogy or contextually sensitive principles evolving either in similar or dissimilar domains (Rosalie & Müller, 2014). It has also been suggested that though the surface-similarity-based transfer is easier for students to recall than the schema-based one, the latter provides more support while solving a novel task (Ross, 1989). While in some simulations the transfer of context is crucial (e.g. CPR mannequins), then others focus on transfer of content. In the first case the routine of the exercise should be transferred, while the others aim at transfer of the principle necessary for task resolution (an example of those could be the Paper Fold exercise by Meadows

(1999), which introduces the principle of exponential growth). In both cases learning takes place as a result of active participation and direct experience, but besides the context *vs.* content transfer, another difference appears: while the first case (mannequin-based) focuses on acquisition of specific skills, the other aims on construction of novel knowledge.

2.1.2. Training effectiveness of simulation games

Considering the above, it could be assumed that higher-level knowledge construction and transfer of learnt to a novel context are the potential reasons why a well-designed simulation game could outperform traditional teaching methods. Still, as Hays (2005) concluded after reviewing 274 studies, empirical research on the effectiveness of instructional games is fragmented and literature is filled with poorly defined terms. Therefore, as pointed out by many authors, the assessment of learning outcomes is vitally important (Chin, Dukes, & Gamson, 2009; I. Mayer et al., 2014) and it is not enough to demonstrate whether a simulation game works but "also to show how and why it works (or fails to work) in a given context" (Kriz, 2006, p 270).

Various potential factors that could explain the effectiveness of simulation games as instructional means have been described. For example, it has been shown that using games within regular teaching practices increases both engagement of the participants in the process and their motivation to acquire new skills, knowledge, or attitudes. Another reason why simulation games are an effective tool for learning could stem from their essential characteristic of integrating cognition, emotion, and action (Hofstede et al., 2010, p 829; Wilson et al., 2008). Having these three connected leads to more reminders than traditional learning does, increasing therefore the ability of learners to solve a new problem more successfully. Garris and colleagues (2002) assume that enhanced student motivation leads to greater attention to training content and greater persistence on the task leads to improved performance. Other authors mention the more personalised and reflective understanding (Rieber et al., 1998) or arousal of questions about the relationship between a game and the reality (Shubik, 2002) as factors behind the instructional effectiveness of simulation games.

And last but not least, a simulation game serves as an excellent cause for following discussion, or as stated by Crookall (2010, p 907), the learning starts when the game ends, meaning that learning comes not from the game, but from the debriefing. Though practical experience is used as the major source of learning in game-based techniques, both doing, thinking, and verbal formalizing are required. Various authors stress that reflection on an event or activity and its subsequent analysis is the cornerstone of the experiential learning experience (Crookall, 2010; Fanning & Gaba, 2007; Hays, 2005; Van Der Meij, Leemkuil, & Li, 2013). This reflective process could be carried out in different forms, or it could be led by a facilitator, done collaboratively or individually, etc. It has

been found that a hurried or missing debriefing could be one reason for an s/g to fail (Hofstede et al., 2010, p 837), indicating that the role of a facilitator is crucial both in running the game and debriefing. It could be said that authors describing game-based learning unanimously claim that doing and thinking should be followed by verbal formalization and generalization of the acquired skills or constructed knowledge.

Among the reasons that could explain effectiveness of simulation games there are at least four more potential factors. In a way, they have been neglected but are nevertheless important in the current context.

Firstly, as simulation games usually allow different modes for participation, they provide efficient learning opportunities for participants with different learning styles or habits. As adaptive systems they do not prescribe a specific routine for learning, it is rather up to the participant to decide either to start with intensive co-action or observation. This makes it easier for the participants to enter the game and most probably supports both the level of engagement and learning efficiency.

Secondly, there is a 'case versus law' theory. This approach has been re-introduced by Kahneman (2011, p 171), who refers to an earlier study by Nisbett and Borgida, where students were presented with either a surprising statistical fact or individual case that corresponded to the same statistical knowledge (in the referred study, the unexpectedly low willingness to respond to the appeal for help). In the first case the students managed to learn nothing at all, that is, they were not able to transfer the general knowledge to the specific case. When the students were surprised by individual cases they immediately made the correct transfer to the population in general. Kahneman concludes that students who are taught statistical facts about human behaviour may be impressed, but this does not mean that their understanding has really changed. Educational simulation/gaming sessions usually work contrariwise: the practical task comes first and students are expected to infer generalisations afterwards, either during the game or debriefing.

Thirdly, including certain threshold concepts or principles in the game design which might "delineate the domain of knowledge and are necessary for understanding its subject matters, objectives, finding and models" (Dudai, 2007, p 13). Dudai and colleagues stress that acquiring these is a necessary condition for understanding and implementing data around them. Other authors have described threshold concepts as virtual 'gateways' that lead to a previously inaccessible way of thinking about something (Meyer & Land, 2005). Only by acquiring these threshold concepts can a new way of understanding, interpreting, or viewing something emerge. If there is a concept or mental representation that serves as a critical node of the network, it makes sense to include it directly in game design. Without mastering that concept the learner is not able to use its neighbouring concepts – including those acquired during the game session – in different situations.

Fourthly, game-based learning, where experience in one task is supposed to contribute to the subsequent performance in a different task, requires a kind of

cross-domain shift. It has been suggested that those cross-domain abstract concepts forming knowledge are defined by metaphors, where each metaphor gives a part of the definition (Lakoff & Johnson, 1980). Duke claims that the primary purpose of any game is to create a gestalt, which "must convey an overall perspective of the problem at hand" (Duke, 1974, p 50). If these gestalts or metaphors are in the mode by which we conceptualise one of our mental domains in terms of another, then it provides another valuable line to a game-designer by which to proceed. If the abstract concepts and/or principles the participants of the simulation are supposed to acquire are defined by metaphors, then a game could benefit if it provided scaffolding via the metaphors that enable new knowledge to be acquired. This could help to overcome the obstacles arising from the cognitive overload hypothesis (Kirschner, Sweller, & Clark, 2006), which assumes that a game as a learning environment forces the learner to process information and form a variety of concepts not connected to the learning objective. As these concepts are derived from the game context only and are not necessary for the expected learning outcome, a certain part of the necessary concepts will be ignored and not stored. Even if it is true, we could assume that metaphors created by a game enable us to exploit the limited resources of our brain more efficiently. Firstly, they promote chunking of information (even if working as mere heuristics) and secondly, they serve as prompts which make it easier to retrieve the information stored during gameplay.

To sum up, previous studies demonstrate that game-based learning techniques could be efficiently used in supporting construction of knowledge, acquisition of skills, and/or changing attitudes. It has even been stated that the most intriguing games are those designed to create an awareness about a topic (Simons, 2008). Educational games could increase the motivation of participants, and, by embedding both cognitive and affective spheres, by connecting direct experience with reflection, enable achievement of expected learning outcomes. A simulation game as a specific sub-type of educational game has its certain strengths. It is based on reality-based systems which enables us to build connections between experience gathered from the game-play and real-life contexts. High motivation of the participants arising from the play element in connection with their professional intent derived by the simulation element provides a good basis for meaningful experiences. Still, as for all other game-based learning methods, the issue of learning transfer should not be neglected while designing and implementing simulation games. Also, in order to design efficient games, it is important to be aware of the potential reasons which allow for emergence of new knowledge and/or attitudes, as neglecting them in design could lead to meaningless game experience. In the following section the basic stages of game development are described in a more detailed way.

2.2. Development of a simulation game

As the use of s/g-s is spreading, several frameworks and models describing s/g design elements have been proposed by researchers. Most authors (e.g., Annetta, 2010; Harteveld, 2011) agree upon three core elements described by Plummer (1996) that should be involved for an s/g to be an efficient learning environment: *purpose, reality,* and *engagement*. Plummer declares that within a simulation game a serious educational or training purpose should be sought, stated as objectives to produce specific knowledge, skills, or attitudinal changes in behaviour. Characteristic of reality should be presented by use of operating model based on a real-world situation, while the third characteristic, engagement, means an atmosphere of playfulness or fun, or at the very least an 'exploratory' climate. Annetta (2010) describes the latter as immersion, meaning that players are engaged in the content and are intrinsically motivated to succeed.

Other authors bring along more elements, e.g. Kiili (2005, p 7) stresses the importance of feedback (the game should provide unambiguous and immediate feedback on a player's actions), sense of control (level of freedom should not be restricted too much), and challenge (the game should provide new challenges at an appropriate pace). Apart from that, the structural elements (rules, roles, resources, problems or issues, record-keeping, and others) should be developed that provide supportive conditions for human interactions within the gameplay (Pérez & Coterón, 2013).

While the number of studies describing the core elements of an efficient s/g is fairly high and the researchers almost agree on the 'top three' of these, there is much less discussion on the necessary phases or stages of s/g development. Several authors recommend making a distinction within the s/g development between design and construction, though it has been stressed that many game developers like to bypass the design phase and "jump headlong into construction" (Duke, 1974, p 92). According to Duke, relevant parts of the design phase are (1) generating a conceptual map of the reference system; (2) defining clear game objectives and a game message; and (3) ascertaining the appropriate level of abstraction, while the latter is claimed to be the most critical element of game design. Only the following construction phase includes order of processing and build components, which is construction of accounting systems, heuristics, and assembling components and calibration of the components and construction activities with test players present. The cycle of game development suggested by Duke is illustrated by a cone-shaped model (Figure 1), where the cycle starts with analysis of the (complex) reality which serves as a referent system for the simulation game. Then, through processes of abstraction, a conceptual map is created which serves as a basis for game construction. The process ends with game sessions leading to a multilogue by participants; if necessary, modifications will be made to the game design after this.

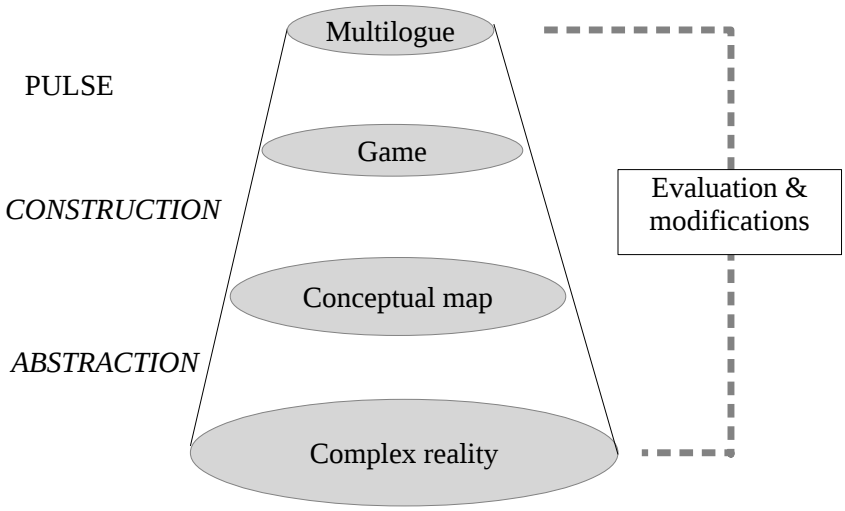

Figure 1. Steps of game development in a 'cone' model (adapted from Duke, 2014/1974)

As Duke sees s/g as a form of efficient communication, he stresses the importance of *multilogue*, a simultaneous dialogue following the game. *Pulse*, which leads to this, is a single communication objective the participants of the game are focused on and which is "pursued through dialogue by random correspondents, each representing a different perspective of the problem at hand" (ibid, p 38). With the term *conceptual map*, Duke denotes a kind of descriptive report which:

a) is an explicit, understandable, and thorough representation of the system which is being presented through the gaming/simulation (p. 81); and at the same time
b) "represents the goals of the game as a communication device, [and which] should be clearly stated by texts and graphics" (p. 90).

Many basic concepts used by Duke (*multilogue, conceptual map, pulse*) have been misinterpreted or understood differently nowadays and this begs a more explicit description of the phases of game development. While Duke differentiates design and construction, Klabbers (2003) distinguishes between broader scope of design as a form of social change and the purely instrumental design. The latter, design-in-the-small, refers to the design of simulation games as artefacts, while design-in-the-large deals with the impact of those artefacts on changing existing situations into preferred ones. He also proposes a six-stage model of s/g design phases, illustrated in Figure 2.

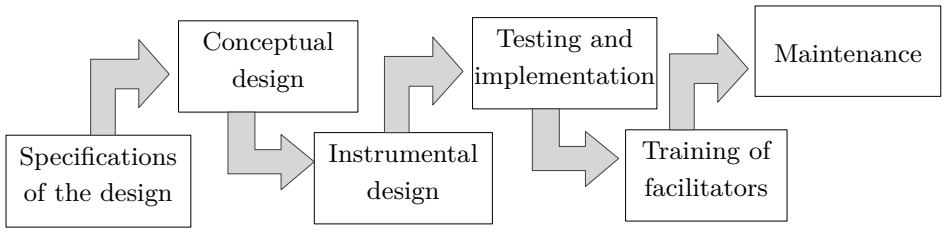

Figure 2. Stages of the iterative game design process by Klabbers (2006, p 126)

The same logic is presented by Amory (2007) who describes an educational game as consisting of a number of components, described by abstract and concrete interfaces, whereas abstract interfaces refer to all pedagogical and theoretical constructs and concrete interfaces refer to design elements. Abstract interfaces are created during the conceptualisation phase of design while these pedagogical aspects are presented by including the concrete interfaces into the design. Other authors suggest three-fold categorisation of aspects that influence the representation of the learning content; for example, Arnab and Clarke (2017, p 298) differentiate context of deployment, learner profiling, and pedagogical perspective, while Dunnigan (2011, p 28) suggests first to determine the process to be modelled and then to decide what you want it to do. And finally, how do you want the game to go about its work. Apart from that crucial design stages are mentioned which are often neglected, like that of deployment as ensuring proper use by client (Duke & Geurts, 2004, p 122), or evaluation (Klabbers, 2006, p 126). More specific models of s/g design have been developed during the last decade, focusing mostly on digital games e.g., Activity theory-based model (Carvalho et al., 2015), Game object model (Amory, 2007) and Learning Mechanics – game Mechanics model (Arnab et al., 2015). The trans-disciplinary methodology suggested by Arnab (Arnab & Clarke, 2017) breaks a cycle of serious game development into stages of pre-production, production, and post-production (see Figure 3). Though it does not include the steps of facilitator training and maintenance, it greatly corresponds with the previously suggested models.

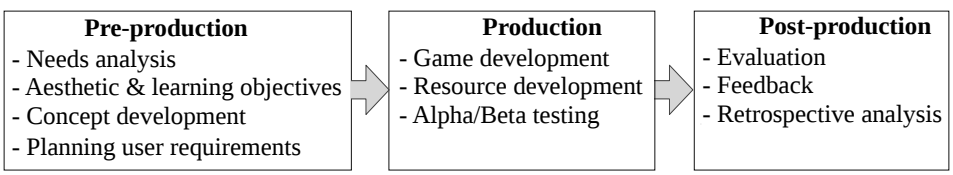

Figure 3. Cycle of trans-disciplinary model of game design (adapted from Arnab & Clarke, 2017)

Usually, it is assumed that an educational s/g, whatever is its intended message, imitates certain elements, interconnections and processes from reality and represents them in a playful way (Karl, 2014; Kriz, 2003). Therefore, it is

evident that the first stage of the s/g development is description of the referent system with the help of a model, either in mathematical, conceptual, narrative or whatever logical form. Kriz (2003), while describing gaming simulation approach and how it is integrated with design-in-large and design-in-small, proposes seven stages of the latter. Figure 4 shows the stages, implemented by reduction, application, and reflection.

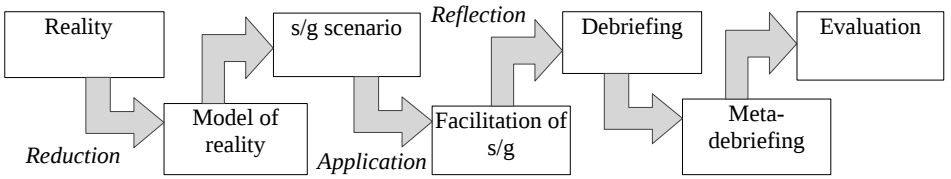

Figure 4. Game development phases in design-in-small (adapted from Kriz 2003, p 498)

Though game developers and researchers use various concepts nowadays to denote phases of game development, the main message still seems to be similar: start with a systems analysis and end with evaluation. Achieving intended learning outcomes seems to be questionable if the game development process takes another route. It may be surprising, but the promise of Rudyard Kipling to

> "... keep six honest serving-men
> (They taught me all I knew);
> Their names are What and Why and When
> And How and Where and Who...
> (*The Elephant's Child)*

mirrors the basic questions of an s/g developer. First a game developer has to decide upon the game's purpose: **why** the game has to be developed and **what** slice of reality it should represent. While **who** and **where** involve game specifications (e.g. the context and certain characteristics of the selected target group), then the question **how** describes the game design and **when** is rather connected to the phase of implementation. As communication is the ultimate purpose of an s/g, the presentation of different views and viewpoints matches well with the model proposed in Figure 5, where the oval-shaped 'lenses' denote processes and rectangles stand for their outcomes. This quite widely used model illustrates Duke's idea of presenting stages of s/g development as series of lenses: if the lenses are positioned correctly then our idea of complex reality could be turned into an efficient simulation game. Though up to hundred of such *lenses* have been proposed later (e.g., Schell, 2014), the game developer, looking through the lenses one after another, turns the presentation of complex reality into gameplay and debriefing (*multilogue* in Duke's model). The last two stages of the game development, evaluation and according changes or calibrations of the game, are mostly focused toward model used (Was the

reduction appropriate?) and rules (Was the level of fidelity appropriate?). If the results of the gameplay and/or debriefing are not in accordance with educational goals (that is, expected learning outcomes) or if the participants' choices and actions in the game differ a lot from what is happening in the real system, then either the used model or the design elements should be revised.

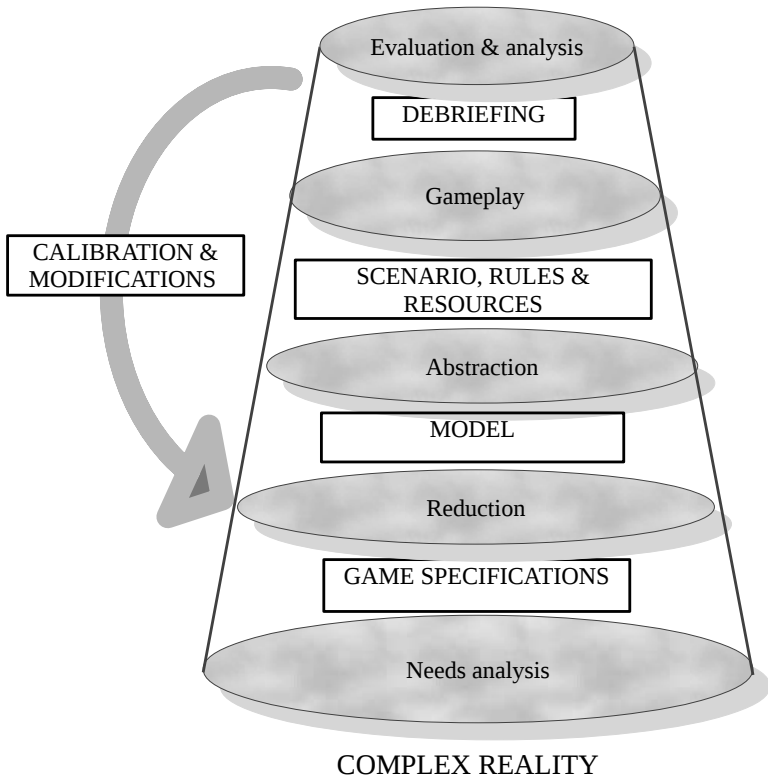

Figure 5. Proposed steps of game development in a 'lens-based' model

A simple example to illustrate the process is the case of securing shoelaces. If the game developer has answered the question as to why one has to manage to tie shoelaces (as an educational objective), then a question about reality should be answered: what kinds of shoelace knots are known at all, how do they correspond to each other, how do they fit the specific needs, etc. And only if these questions are answered should one proceed with the following questions:

a) Why and to whom is making shoelace knots difficult?
b) Who are the typical representatives of the target group, and what kind of knots should they be able to tie?
c) Do we expect explicit or tacit knowledge to occur? And finally,
n) How will the learning outcomes be evaluated?

Though several frameworks describing game development have been introduced, the concepts of development, design, and construction of a game are

usually not been specified in detail, nor has the taxonomy of these phases been clearly proposed. Duke states somehow confusingly that the "game **design** process consists of the process of **design**, construction, and use" (2014, p 80, my bold). In order to be clear with these concepts, I propose a hierarchy, where the stages of development are rather inclusive than successive (Figure 6).

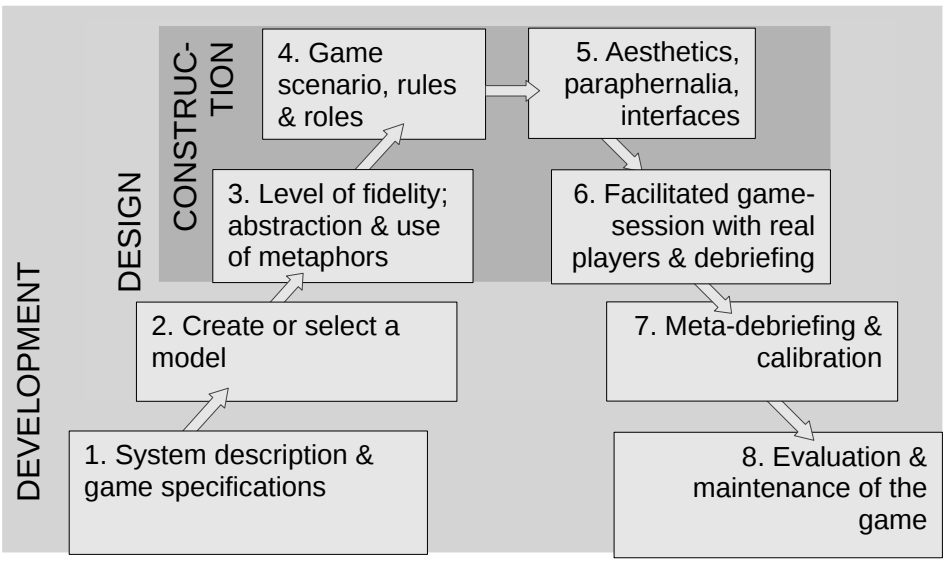

Figure 6. Phases of game development in inclusive order

Game *development* therefore denotes the overall process (starting with system analysis and ending with game evaluation), which includes the stage of *design*. The stage of design, starting with game specifications and ending with debriefing, includes the phase of *construction*, the latter meaning creation of game scenario, resources and roles, metaphors/abstractions representing them, scoring systems etc.

The Fountains game which was used as intervention for the studies described in this dissertation was developed in accordance with this model and each of the stages had its specific outcomes. Though on some occasions a good game could probably be developed with a different succession of phases or, what is often the case, working with different phases in parallel, it usually makes it harder to achieve the intended results. As pointed out by Duke, in practice the phases of design, construction, and use have been overlapped and "the subsequent confusion has resulted in a more costly product, a less satisfactory game, and a longer time between the inception of the game design process and the completion of the product" (ibid, p 80).

A game developer, following the sample of shoestring knots, has presumably to agree that the very starting point of the game development is not the same every time. Sometimes the needs of a specific target group come first, while on other occasions the problem is defined but it has not been decided yet which

target group to focus on. Sometimes the game designer has to start with detailed instructions from a client, and sometimes the client is aware of the need for change but there is no explicit understanding about who, to where and what to from to change. To sum up, before the actual construction of the game starts, the educational needs, description of the complex reality, and model illustrating it should be described and agreed upon in quite great detail. Rules and frameworks of modelling the 'slice of reality' are definitely out of the scope of the current dissertation, but a sample list of the second stage, game specifications, is provided in Table 1.

Table 1. Sample list of game specification items

Item	Description
Game purpose	Is there a communication problem? Lack-of-information problem? Lack of motivation problem? Etc. Briefly: what is the problem we are facing, who owns it and what part of the problem can the game solve. Some types of purpose: (Duke, 1974, p 78) 1) Dialogue: From professional to lay group (to transmit the knowledge) or from layman to layman (to promote communication) 2) Project: to project information in an educational context. 3) Extract: extract information or opinions from a group about the character of the system. 4) Motivate
Use of ICT	Computer-based, computer-assisted or computer-free? Accessible via smart-phones/tablets? On- or off-line? Etc.
Competitive or cooperative?	Differentiation by competitiveness (Zagal, Rick, & Hsi, 2006, p 25) 1) Competitive games require players to form strategies that directly oppose the other players in the game. The goals of the players are diametrically opposed. 2) Cooperative game models a situation where two or more individuals have interests that are "neither completely opposed nor completely coincident" (Nash, 2002, cited via Zagal et. al 2006). Opportunities exist for players to be able to work together to achieve a win-win condition. 3) Collaborative game, all the participants work together as a team, sharing the pay-offs and outcomes; if the team wins or loses, everyone wins or loses.
Game message	Attempt to define a multidimensional, systemic, and interactive situation as we want to present it to the player
Format of debriefing	Oral, written, etc. Whole-group or team-based? In-game or post-game?
Re-playability	Should it be possible and interesting to play the same game many times?
Main target group	Age, sex, etc.

Item	Description
Preferable number of participants	Single-player, multi-player, minimum and maximum number of participants
Length of game-run	How much time it takes, including briefing & debriefing
Playing context	Within regular curriculum? Stand-alone game?
Venue	In- or outdoors or mixed? How many sq. meters needed? etc.
Ethnic or religious limitations?	E.g. use of a typical set of playing cards or dice is prohibited for some religious groups?
Evaluation	How will we assess the effectiveness of the game; that is, how will we know whether game works or not and how much does it help to gain the expected results?

This list of items is far from comprehensive and it is obvious that the game specification varies from case to case, depending, for example on the choice between digital or non-digital type of game. Today, almost every author publishing a paper on game development assumes that the term *educational game* denotes a digital game, either computer-based or as an application for smart-phones, tablets, etc. It seems to be symptomatic that we do not even have special terms to differentiate digital and non-digital games any more. Two aspects allow us to handle the research on ICT or ICT-free games as one phenomenon. Firstly, within this dissertation it is assumed that general principles of development of an educational game are similar for both digital and non-digital games. Games like chess or rock-paper-scissors, either in digital or non-digital mode, provide at least somehow comparable experiences for the players. Though crucial differences could be found between digital and non-digital games (for example, save-mode or instant feedback in favour of digital games or face-to-face communication in favour of non-digital games), the basic rules of game development seem to remain the same. And secondly, the constructional aspect: most non-digital games are actually digitalisable, though sometimes it is difficult to see a reason for doing so and some qualities will certainly be lost. The contrariwise process, to develop a non-digital version of a digital game, is far more difficult to imagine. That allows suggestion that the first stages of a game development, independently from its intended form, are similar for both digital and non-digital games, and therefore no distinction between them is made in the models described in the current chapter.

3. RESEARCH METHOD

As described in the previous section, the development of a simulation game includes distinct phases, starting with needs analysis, design of a game as an intervention tool and ending with running the game and evaluation of the learning outcomes. In these and some other aspects the survey implemented within this dissertation is similar to an approach known as design-based research (Anderson & Shattuck, 2012). Namely, the intervention was conducted in real-life settings, it involved social interactions with participants sharing ideas, different expertise was brought to the design, and it was concerned with an impact on practice (Barab & Squire, 2004, p 4), and, it also addresses a practically significant problem (McKenney & Reeves, 2013, p 98). Still, as some other features of traditional design-based research mentioned by Anderson and Shattuck (2012) are missing in this study, such as use of differing methods and involving multiple iterations, it does not fit to a framework of typical design-based research. This chapter focuses on the main stages of the study, introducing game specifications, main elements of design of the Fountains game and evaluation results of two evaluation studies.

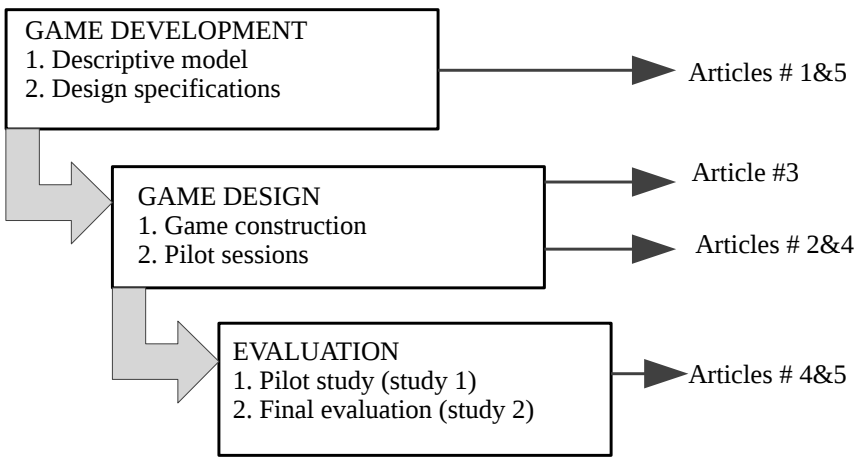

Figure 7. Structure of the research

More detailed information on development of the Fountains game can be found in the articles attached to the dissertation (Männamaa, 2015; Männamaa, Komsaare, & Leijen, 2016; Männamaa & Leijen, 2015). In the current chapter, the design specifications of the game (as a tool for intervention) will be introduced and data on the two evaluation sessions will be provided. The structure of the current study is described in Figure No. 7.

Evaluation of the learning outcomes was carried out twice. The last prototype was tested before production of the game and final evaluation took place two years after that. In both studies test and control groups were used, though

only the final evaluation included both pre- and post-tests. Basic data on the two surveys is provided in table 2.

Table 2. Two studies used within the research

Study	n Test / Control	Age (*SD*)	Items in questionnaire	Pre/post test
#1: Pilot testing	20/21	17 (*1,1*)	5	Post only
#2: Final evaluation	82/49	18,2 *(1,72)*	12	Pre & post

3.1. Development of the game

The Fountains game was developed as a study aid enhancing the comprehension of acculturation (focusing on intercultural integration), an objective which was intended to be evaluated by a change of participants' acculturation attitudes. First and foremost, the game was designed to be used in the context of regular learning activities in upper secondary schools. However, Fountains could also be played with younger learners, and naturally also with university students or in adult education. It was intended to be used in regular classroom settings without use of computers or other types of information and communication technology. Fountains was designed as a promoter of discussion on the main aspects of intercultural integration and the consideration of them from a new perspective. The experience emerging from the game experience will hopefully inspire the participants to study the topic further and provide them with some new perceptions. No specific requirements on the type of the game – should it be a role-play, simulation, game, optimisation exercise, etc. – were set before the design started and after considering several options it was decided that a specific type of educational game, a simulation game, would be the best solution.

3.1.1. Design specifications

Simulation game Fountains, as used in the current study, is designed in a way which expects the participants to use schema-based far transfer (see section 2.1.1.), as their acculturation attitudes are supposed to change as a result of acquiring the concept of integration via a rather metaphorical game. Therefore, the focus of the design was not on high fidelity (meaning exact representation of the specific elements of reality), which is the aim for several simulations, e.g. medical ones (Tun, Alinier, Tang, & Kneebone, 2015). The focus was set rather on abstraction of the interconnections of roles and rules of the referent system to the level, which carries similar meaning to the participants from quite different backgrounds. The design specifications presented in Table 3 were thoroughly discussed in the game design team, with the end-users (teachers), and with distributor of the ready-to-use game (EFMI, Estonian Foundation of Migration and Integration).

Table 3. Design specifications for Fountains

Item	Description
Game purpose	To enhance participants' understanding of various processes by which intercultural integration can be achieved. Motivate students to discuss and reflect on the factors operating in a context where preserving one's own culture depends on negotiating access to resources.
Subject	Acculturation, defined as maintaining cultural integrity and participating in decision-making, in situation of limited resources
Competitive or cooperative?	Mixed, winning condition is depending both on strategies used by every individual player and cooperation with other players. If the whole group loses, then everyone loses.
Digitalisation / Use of ICT	Without computer or other kind of ICT
Game messages	1. It is important both to stand by your beliefs and to find common ground with other parties. 2. Your access to resources may improve even if the borderlines between groups remain intact. 3. In the case of integration it is important to consider two oppositional processes – the players' rationality and emotions, e.g. (ir)rational fears. 4. The topic of integration is accompanied by controversies, e.g. between the wish to retain one's original qualities and to gain access to resources.
Format of debriefing	Oral and written mixed, whole-group post-game and team-based in-game discussions
Re-playability	Not necessary, teachers are supposed to play the game once with each group.
Main target-group	Students of upper secondary education (ages 16–20)
Their motivations for participation	The game is implemented within the regular school day.
Preferred number of participants	Up to 24. If more participants are present, two game sets should preferably be used.
Length of game-run	~100 minutes, including briefing & debriefing
Playing context	Indoors, regular classroom setting
Special needs to be considered?	No
Ethnic or religious limitations?	No
Language dependency	Rules were prepared in Estonian first, and now translated to several more languages
Evaluation	Post-game debriefing, possibility to use questionnaire on acculturation attitudes.

Some reasons behind certain specifications (e.g., purpose, game message, etc.) were basically determined by the distributor (EFMI, in the role of the client), and others (e.g., length, context, number of participants) were decided after meetings with school teachers (more details in Männamaa, 2014). After agreement on basic game specifications and choosing the model of acculturation to be used the design focused on basic structural components, which should convey the game message(s). The game had to convey the idea that access to resources could be improved by finding common ground with other parties, remaining the borderlines between groups still intact. As the decision was made to provide an average, not an ideal or exaggerated representation of the acculturation processes, we wanted to demonstrate that though strategy of integration is considered to be most favourable for all parties, the players' rationality and emotions, such as those caused by perceived threats, can make it difficult to achieve. As our intention was to keep the game paraphernalia as simple as possible, we ended up with only two structural elements: horses of different colours representing the cultural groups and fountains representing the resources available at the point where the groups will meet. A more detailed description on how the game messages were transferred to the structure and agency of the game are introduced in article 4. The following section introduces basic elements of the design, whereas a full description of the game, including guidelines to facilitator and list of rules for participants was published as a separate article (#3).

3.1.2. Game description

The macro-cycle of a game as described by Klabbers (2006) includes four basic stages. First comes the briefing that includes the introduction and formation of teams, explanation of rules, and some time for questions and explanations: depending on the number of participants, this takes 5–15 minutes in the case of *Fountains*. Second, playing the game takes about 50 minutes. The third and fourth stages – reviewing game narratives and conceptualisation – take at least 40 minutes and is known as debriefing. Thus, at least an hour and a half should be reserved for an entire game of Fountains.

To begin the game, the teacher divides the participants into six groups, each group representing one tribe and forming a team. Each tribe has horses of a different colour, and at the beginning of the game each tribe has three horses. In order to survive they need to water their horses. Teams have to position the horses at the fountains in a way that earns their team the maximum number of points. The game will be over when the number of fountains has doubled: the team who has the highest number of points after the last round is the winner.

The fountains are hexagon-shaped figures, 16 cm by diagonal, with six drinking spots at each. Horses are trapezoids, exactly half the size of the hexagon (see Fig. 8). A horse has three triangle-shaped excisions in it. There are six different colours of horses: the game could be played by six teams, each playing with the horses of their colour. The maximum number of members in a team is four, but it is also possible to play with a single-player teams.

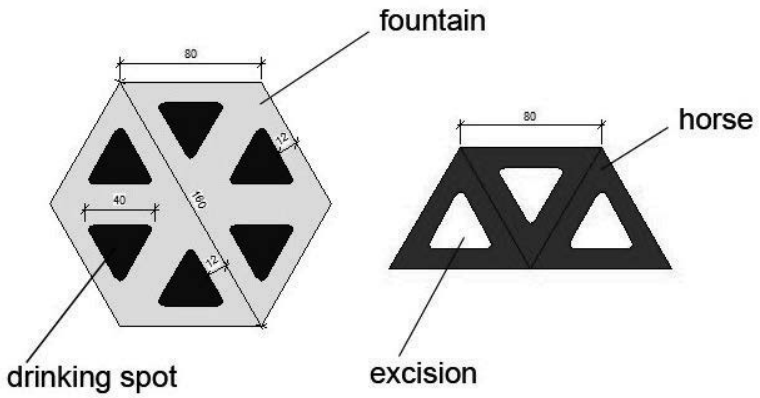

Figure 8. Game-pieces used in the final prototype of the game (measures in mm)

Up to six horses can drink at each fountain and players may take their horses to any vacant drinking spot. A horse could be positioned at the fountain in several ways; for instance, one horse can occupy up to three drinking spots. Thus, you may 'close' the fountain with only two horses. Once the fountain is closed, other players cannot bring their horses to it.

Teams get two more horses to be placed at the fountains in each round: a process mirroring the arrival or new immigration waves in the real world. The fountains serve as metaphors of social resources, e.g. the educational system, labour market, medical care, etc. The shortage of drinking spots simulates limited access to those resources. If the horses of different teams are competing for the same vacant drinking spot, then the odds of winning the competition are only slightly better than one out of four (28%). In other words, the initiation of conflict may be considered, but in most cases it ends with both parties on the losing side. This mirrors real-life situations, where conflict often jeopardises opportunities on both sides.

The patterns of horses on the board allow for metaphorical demonstration of cultural adaptation as influenced by processes of similar logic. On the one hand, the agents' rationality and pragmatic calculations influencing the decision-making process highlight the importance of maximising individual scores, and on the other hand the agents' fear and sense of security focus primarily on the factors related to identity. Though mathematically it makes no sense to set more than two horses of the same colour at one fountain, the teams typically end up with five or even six horses at a fountain. Thus, it should be emphasised that cultural integration is an essentially controversial process in which rationality and emotions are bound to compete. As it is difficult to end up with a rational solution in the game, we can infer that acculturation is equally irrational in real life. In various environmental conditions, either fear of being deceived or willingness to collaborate dominates, and thus the expression of these two principles within the game can be analysed during the discussion after the game session has ended (Männamaa, Vetik & Liiv, 2011).

3.1.3. Debriefing

In order to ensure efficient transfer of knowledge from the game to real life, the game session should always be followed by a debriefing. This phase is widely acknowledged as the most important part of a simulation game (Crookall, 1992; Peters & Vissers, 2004). Put briefly, it enables the participants to share their emotions and, if needed, step out of their roles as players; it provides a chance to go through the main events of the game and review important details or decisions. During the debriefing the lessons learnt during the game-session are conceptualised and connected with the real-life context.

In the case of FOUNTAINS it is important to demonstrate during the debriefing that the dynamics of the relations between groups is connected to their decisions – all participants make decisions in various stages of the process which come to determine the success of mutual adaptation. To enhance the learning process of the participants, it is recommended to conduct the debriefing in two phases in the *Fountains* game: inter-game and post-game.

Inter-game debriefing

For the inter-game debriefing, which takes place after every third or fourth round, the participants will be asked to formulate a general principle or ground rule which could help them to achieve success in the game. Quite often the list of responses includes statements like: “Don’t be greedy”, “Avoid occupying more resources than you need”, “Be friendly”, “Don’t start a competition when you haven’t been deceived”, or “Try to find partners and find a joint strategy”. The principles are written on sheets of paper, shown to all participants and discussed briefly, if needed. This technique allows to follow the learning process: usually the principles written down by the participants demonstrate their deepening understanding of the concept.

Post-game debriefing

After participants have had the opportunity to share their feelings and discuss problematic situations in the game, the facilitator can ask them to think about the strategies which lead to success in the game: “Why was the score of some teams higher than that of others?” or “What were their decisions based on?”. Often, it appears that the teams that end up with the higher scores tried to make coalitions for mutual interest and did not fight for limited resources.

In the test sessions the topic of the game – acculturation – was not announced to the participants beforehand. During the debriefing, we asked the participants about the possible parallels they could draw between the game and real life. As soon as the attention of participants was drawn to the game board, covered with horses of different colours gathering around fountains, they quickly came up with responses referring to the behaviour of ethnic groups in multi-national regions or countries.

The questions to be posed during the debriefing could be broadly characterised by two categories: drawing parallels with real life (transfer) and

articulation of acquired knowledge (generalisation). Transfer of knowledge could be facilitated by questions like “What does the image created on the board by the end of the game tell us? Which processes and phenomena in real life does it remind you of?” or “What do the horses and fountains in the game stand for? How can we improve everyone’s access to resources in our daily life?”. Articulation of acquired knowledge might be supported by questions such as: “Why is it important to reach a consensus with other parties? Why is it so difficult? What can we do to improve the situation in real life?”. As the background of the participants of different groups varies widely, the content and style of questions asked during the debriefing depends greatly upon the group and intentions of the facilitator. As a general rule, it still makes sense for the facilitator to prepare a set of possible questions beforehand.

What often happens in the game is that the players who have their turn first will occupy all the drinking spots and the last team or two have no other choice than to start competing. This kind of result is pretty symptomatic and can lead to interesting generalisations during the debriefing. Firstly, it pinpoints the fact that it is not always easy to identify the initiator of the competition. The team in the game, or an ethnic group in real life, is sometimes only put into a position where there is no other option than the competition left for them. Secondly, the rules governing the competition are set in a way that on almost three occasions out of four the initiators of the competition will lose their horse. Even so, this doesn’t seem to reduce the temptation to compete: even a small chance to defeat a co-player outweighs the much bigger risk of losing one’s own resources. As the rules of competition in *Fountains* are working against the interest of both competitors, the facilitator has a pile of ‘dead’ horses on the table by the end of the game. This pile has turned out to be a powerful metaphor during the debriefing. Questions include “If such a huge amount of resources has been lost during the game, then is it possible that similar waste is happening during acculturation in the real world?” or “If that is true, then what kind of decisions could be made in order to change the situation?”, etc.

3.2. Evaluation

As noted earlier, evaluation of the final prototype is an essential part of game development. Though both the number and the quality of such evaluations are increasing, we lack an overarching methodology for s/g research (Abdul Jabbar & Felicia, 2015; Kriz, 2006; Mayer, Dale, Fraccastoro, & Moss, 2011). Based on a comparison on various papers, Peters and colleagues differentiate nine ways the concept of *evaluation* is used in a simulation games context (V. Peters, Westelaken, & Everwijn, 2014). For example, effectiveness, quality of the design, performance of participants, or efficiency of the simulation game could be assessed. While the latter aims to find out whether the s/g is the most efficient instrument to bring the intended outcomes, then the first – evaluation of effectiveness – tries to assess how successful a certain game is in causing the

desired changes in participants' behaviour, knowledge or attitudes (ibid. p 174). As the aim of this study was to evaluate the impact of the Fountains game on acculturation attitudes, two studies focusing on the evaluation of effectiveness were carried out, the method and results of which will be presented in the following sections.

Apart from effectiveness, the functionality of the game was assessed during the test sessions of the first prototypes. Various scoring systems, probability distributions, different shapes, and even materials used for game pieces and many other game elements were thoroughly tested. The final prototype was evaluated by the experts who were asked to observe (incl. representatives of foreign embassies in Estonia) or participate in the game-run (incl. participants of scientific conferences like ISAGA, ECGBL and APSA), and the feedback they gave was carefully considered. The final prototype was also introduced to 62 teachers of civic education as the end-users. They participated in a half-day training, followed by a game session, and besides providing specific feedback on usability, they were asked to evaluate the face validity of the game – does the game 'look like' it will work? According to their feedback, the game manual was complemented and some instructions rephrased to avoid ambiguity, but no changes were needed in the rules and paraphernalia of the game.

3.2.1. Pilot evaluation (Study 1)

Learning outcomes of the game were assessed using a five-item questionnaire focusing on acculturation attitudes. The statements in the questionnaire corresponded to the game messages (see table 3), but were not directly connected to the scenario of the game, nor were they specifically discussed during the debriefing. Participants (pupils attending the game session) were asked whether they agreed or disagreed with the given statements. A rating from 0 to 10 was used on a likert scale, from strongly agree to strongly disagree. A total of 41 students were included in the study, and the sample consisted of 11^{th}-year pupils (aged ~17) from the same school. Two groups were compared: one participated in the Fountains game (test group, n=20), whereas the other attended the same lessons, but instead of taking part in the game attended a regular classroom (control group, n=21). The formation of the groups was not randomised but both groups had attended the same civic education classes previously and had similar socio-cultural backgrounds. Members of the test group completed the questionnaire immediately after the game.

3.2.2. Final evaluation (Study 2)

To assess the impact of the game, a quasi-experimental design was used and the preliminary questionnaire was complemented with additional items. Both pre-test and post-test were conducted; six groups of participants attended the game

sessions. In total, the data of 131 participants was used (see Table 4). Members of the test and control groups came from the same schools; three of them were from urban and three from rural areas.

Table 4. Participants of Study 2

Group	*n*	Student groups	Age *M* (*SD*)	Sex (M/F)
Test	82	6	18.5 *(1.61)*	22/60
Control	49	4	17.8 *(1.66)*	17/32
Total	131	10	18.2 *(1.72)*	39/92

3.2.3. Procedure

As the game was intended to be used within the regular classroom and in context of school curriculum, the evaluation sessions were also carried out in regular classroom context. The pre-test used for evaluation was launched briefly before the game session, which took approximately 90 minutes. Each group whose data is used in the study played the game once. Class teachers observed but did not intervene in the session. Participants of the game were intentionally not informed that the questionnaire was directly connected to the game session.

Participants were divided into playing teams randomly. Game facilitators used identical game kits and the procedures for briefing, game session and debriefing were similar for all the groups. The post-test was carried out 10–14 days after the game session, and questionnaires were delivered to students by teachers within their regular courses. Neither goals nor research questions of the study were introduced to the teachers in detail before the results were analysed.

The questionnaire used in the pilot study was dilated by adding complementary statements, resulting in a 12-item test (three statements for each of the game messages). New statements were added in order to present each of the game messages from the viewpoint of both minority and majority groups. A likert scale from one to ten was used (with the extremes "Totally disagree" and "Totally agree"); filling out the questionnaire took approximately 10 minutes. Five statements out of 12 were presented in reversed form. Four categories were used; each category represented one of the game messages, whereas each category included three statements.

- Category 1: It is important both to stand by your beliefs and to find common ground with other parties. (Sample statement: "To ensure the efficient performance of the country it is important to find and satisfy the joint interests of the /majority group/ and minority groups.");
- Category 2. Your access to resources may improve even if the borderlines between groups remain intact. (Reversed sample statement: "If the child does not speak the /majority group's/ language fluently, his/her further chances on the labour market will be lower.");

- Category 3. In the case of integration, it is important to consider two oppositional processes – the players' rationality and emotions, e.g. (ir)rational fears. (Reversed sample statement: "If the minority groups would participate in deciding the questions of nation-wide importance, then the interests of the /majority group/ will be endangered.");
- Category 4. The topic of integration is accompanied by controversy, e.g. between the wish to retain one's original qualities and to gain access to resources. (Sample statement: "If access to some public goods is accessible mostly to /the majority nation/, it could cause ethnic conflict.").

To find out whether the twelve statements have commonalities, exploratory principal components analysis was conducted. Furthermore, comparing the results of test and control groups by components provides additional information on educational effectiveness of the game. To find principal components, the responses of the pre-tests were analysed. As it was likely that items are related, oblique rotation was used. To compare the pre-test/post-test results, a pairwise t-test was used; test-group/control group results were compared by Welch's two-sample test. One reason for using as simple methods as possible for analysis was the idea that it could encourage further users of the game (or some other intervention) to use similar methods. Tools for launching t-tests are now available in several freeware table-calculation programs; in the current studies statistical package R (R Core Team, 2013) was used for all data analysis and Wilcoxon non-parametric tests were used to confirm the results.

4. RESULTS OF EMPIRICAL STUDY

4.1. Study 1

To evaluate the impact of the game on participants' acculturation attitudes the results of the test and control group were compared with Welch's two-sample test; distribution of data was not different from the normality curve according to Shapiro-Wilk normality test ($p>0.15$). As this was the first step in the evaluation, no pre-test was used in this study. The results showed a difference in relation to the students' attitudes towards statements on acculturation ($t=1.99$, $df=38.061$, $p<.03$). The average score of the test group ($M=33.3$; $SD=6.6$) exceeded the results of the control group ($M=29.0$; $SD=6.9$), and density estimation demonstrates a shift towards the integration-supportive end of the scale of the scores of the test group (Figure 8).

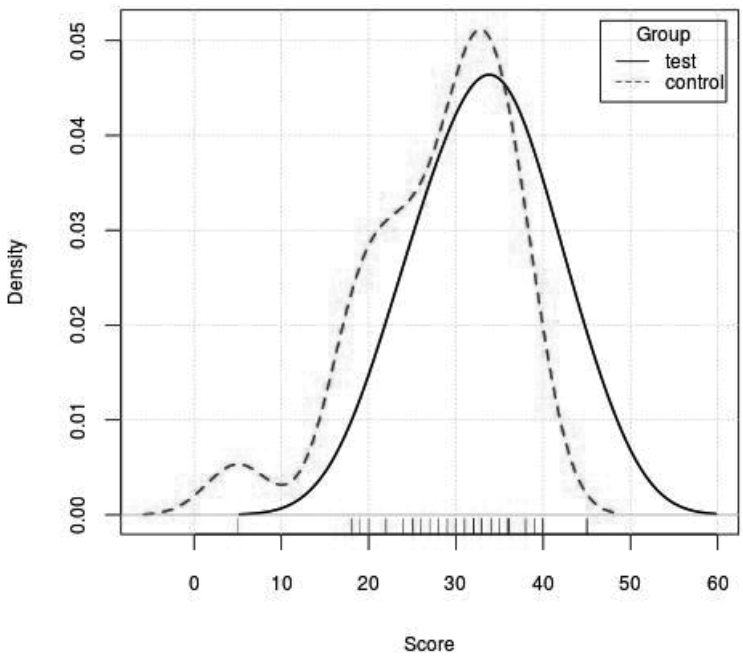

Figure 9. Density estimation of the scores of the first study

Though the results of the first study were promising, it was necessary to proceed the research in two reasons. Firstly, within the first study the questionnaire was filled in right after the game session, which did not allow any conclusions to be drawn on the potential long-term effects of the game. Secondly, the first study did not include the pre-test phase, which brought along relevant limitations. It was not possible to estimate the pre-test/post-test reliability, nor was the base-level similarity of the test and control groups confirmed. Therefore, it was decided to proceed the research with a more thorough study.

4.2. Study 2

The first goal within this study was to test a ready-to-use educational game: does it have impact on participants' acculturation attitudes and, if so, then are the changes in the attitudes towards the intended direction, i.e. closer to a strategy for integration. The questionnaire used in the pilot study was expanded by adding complementary statements and a quasi-experiment was carried out (the sample was not randomised). Internal reliability of the questionnaire used was high ($\alpha = .78$), results of pre- and post-tests correlated moderately ($r = .61$); all data was analysed with R-program (R Core Team, 2013). The total score of the questionnaire was calculated for all participants; the percentage on the score indicates that the scores are approximately normally distributed (W=.98, p>.28). A pairwise t-test was used to compare the scores of pre- and post-tests, Welch's two-sample test was used to compare the results of test and control groups, and the results do not indicate differences between pre-test results of the two groups ($t = .62$, $df = 87.56$, $p > .53$). Comparisons of the pre- and post-test are presented in Table 5.

Table 5. Differences in total scores by groups after intervention

Group	*n*	Pre-test M (*SD*)	Post-test *M* (*SD*)	*t*	*df*	*P*
Test	82	5.78 (1.18)	5.97 (1.23)	–1.73	81	.04
Control	49	5.63 (1.41)	5.55 (1.35)	0.44	48	.67

On average, acculturation attitudes of the participants in the test group changed towards the dimension of integration, ($p < .05$), whereas no significant differences appeared in the attitudes of the control group ($p > .66$). Exploratory principal components analysis (*oblimin*-rotation) was carried out to find factors behind the statements. Kaiser's criterion allows differentiation of three components which could be labelled as (1) ethnic majority; (2) immigrants; and (3) knowledge, where the latter describes statements which are based rather on knowledge than attitude.

Loadings of the statements to the components are presented in Table 6. As estimating the quality of the model was not the primary task of this study, it was accepted that only two statements are loading to component 3. Analysing the statements loading to this component rather reveals that this component is based mostly on specific knowledge and not so much on attitudes of the respondents. Further analysis of this could indicate the need to revise the questionnaire.

Table 6. Loading of questionnaire statements to components (exploratory analysis; loadings >.52).

item	TC1 majority	TC2 immigrants	TC3 knowledge	commonality
4	0.82			1.1
9	0.69			1.2
1	0.67			1.1
10	0.64			1.7
5	0.55			1.0
3		0.74		1.6
6		0.68		1.2
8		0.66		1.0
12		0.62		1.5
7		0.53		2.1
11			0.64	1.3
2			0.55	1.7
SS loadings	2.63	2.28	1.38	
Cumulative Var	0.22	0.41	0.52	
Proportion Expl	0.42	0.36	0.22	

Comparing the results of the test and control group by components demonstrates that significant changes took place within component 2, *immigrants* ($t = –2.077$, $df = 81$, $p < .02$), while components 1 and 3 did not reveal significant differences (see Table 7). Participation in the game seems to promote the integration-oriented attitudes and weaken the assumption that the access of immigrant groups to public resources and decision-making processes should be limited, or that they have to abandon certain characteristics of their own culture.

Table 7. Changes in attitudes after intervention.

Group		Pre-test *M* (*SD*)	Post-test *M* (*SD*)	*t*	*p*
Test (*df* = 81)	Majority	17.32 (5.67)	18.18 (5.94)	–1.47	.07
	Immigrants	19.38 (4.50)	20.26 (4.33)	–2.08	**.02**
	Knowledge	7.78 (2.06)	7.59 (1.65)	0.81	.79
Control (*df* = 48)	Majority	15.75 (6.42)	15.14 (5.94)	0.65	.52
	Immigrants	20.11 (5.60)	20.27 (4.78)	–0.22	.82
	Knowledge	7.42 (2.08)	7.22 (2.06)	0.59	.57

In current context this demonstrates that participation in the game promotes understanding that the position of the minority group is not necessarily weakened or will even be improved if the integration-oriented strategy of acculturation is implemented. Though the pre- and post-test means of component 1 (*majority*) of the test group indicates also a change of attitudes towards the position of the host population; the probability level (p=.07) permits to claim of only marginal change within this component.

The findings indicate that the positive role of integration-oriented strategies is recognised better after participation in the game. The third component (*knowledge*) includes two statements which may indicate knowledge of cause-effect relationships, e.g. statement No. 2 ("If access to some public goods is accessible mostly to /the majority nation/, it could cause ethnic conflict"). Neither comparison by groups nor pre- and post-test results permits a statement of any significant change within this component.

5. DISCUSSION

The study had two main objectives: to develop a ready-to-use educational game and to evaluate its impact on participants' acculturation attitudes. The research question about the design phases which are important to develop an educational simulation game was quite a practical one, and in the theoretical part of the dissertation an overview was made of the stages suggested by different authors (Arnab & Clarke, 2017; e.g., Duke, 1974; Klabbers, 2003). Somewhat surprisingly it appears that the concept of *design*, which has been used most widely in this context, denotes quite different things for different authors, and there is no clear agreement on what we mean by that concept. According to the model suggested in this dissertation (see Figure 6), the above-mentioned stages (development, design, and construction) are not necessarily in a successive but rather in an inclusive relationship to each other. Development of the game, meaning the full process in the current context, includes the stage of design, which, apart from some other steps, includes the stage of construction. Though this kind of terminological clarification in itself rarely helps to develop better games, it enables more explicit discussions on the topic(s) at hand.

As has been stated by several authors (Duke, 1974; Klabbers, 2006; Kriz, 2003), developing an efficient game should include certain phases, in the absence of which a game could end up with low or even no impact on learning outcomes. Before actual construction of a game, the referent-system should be described in sufficient detail, careful reduction and abstraction is needed, and, last but not least, thorough evaluation of the final prototype is unavoidable (Dunnigan, 2011; Hofstede et al., 2010; Peters, Vissers, & Heijne, 1996). The development cycle of the Fountains game included all of the phases and that could be one more reason why the results were in accordance with our expectations. No relevant research conducted up to now claims that a mere game-experience, without the following debriefing, could serve as a sufficient learning aid (Fanning & Gaba, 2007; Hays, 2005). Furthermore, using in-game debriefing, which means including a part of the debriefing or collecting data for the debriefing in the design of the game, has been mentioned as a useful method (Charsky, 2010; Crookall, 2010; Peters & Vissers, 2004). The game used for this study includes an in-game debriefing as a part of the game-cycle and this could be an additional reason why the intended learning outcome – a change in acculturation attitudes – appears.

All the necessary stages of game development were included in the development of Fountains: an educational game was developed and validated by a pilot study, and impact of the game was evaluated by an additional study. In total 172 participants were involved in the studies, 102 belonging to the test groups and 70 to the control groups. Comparison of the results of the groups showed that acculturation attitudes of the students who participated in the game session had changed while no significant differences were found in the results of the control group. The results are in accordance with previous which have demonstrated the

effectiveness of educational games (Girard et al., 2013; Plass, Homer, & Kinzer, 2015; Qian & Clark, 2016). Suggestions of the authors who claim that game-based learning could have no effect, either due to cognitive overload (e.g., Kirschner et al., 2006) or some other reasons, were not confirmed.

Various potential factors which could explain the effectiveness of simulation games as instructional means have been described earlier, such as enhanced student motivation leading to greater attention to training content and greater persistence on the task leading to improved performance (Garris et al., 2002), or integration of cognition, emotion, and action, or reproduction of social life (Hofstede et al., 2010; Wilson et al., 2008) can explain effectiveness of simulation games. This study recommends paying attention to a few more beneficial characteristics of simulation games, such as the adaptivity, which provides the participants an option to enter the game with different learning styles (Kolb, 1984), or characteristic of games to create meaningful metaphors serving as retrieval-supporting prompts afterwards (For example, a student who has been faced with the Meadows' (1999) Paper Fold task would quite probably recall the idea behind the general concept of exponential growth, etc.). As the game used in the study is also highly metaphorical and does not include elements similar to the reality around acculturation known to the participants, the assumption that the surface similarity of two systems (that is, game-play and real life) should be present when one expects learning transfer to appear (Day & Goldstone, 2011) was not confirmed. The differences of pre- and post-test results permit the claim that structural (or schema-based) similarity (Helfenstein, 2005) is practicable for a learning transfer in a game-based learning context.

Though there were no major methodological differences with other learning transfer studies (see. e.g., MacRae & Skinner, 2011; Mayer et al., 2011), it should be noted that in the current study the practical experience (game-play) was conducted first and transfer was expected to appear in theoretical generalisation afterwards. In the majority of previous research focusing on learning transfer (see e.g. Barnett & Ceci, 2002) the experiment is carried out contrariwise: participants are first introduced to a theoretical concept or algorithm and further on they are supposed to transfer the acquired skill/knowledge to a practical task. The intervention used in this study was launched in a different order: game session provided a personally experienced case and generalisation of a wider understanding was expected to appear afterwards.

While in general it should be agreed that using mixed gaming techniques (role-plays with simulations, etc.) in design should be preferably avoided (Johnson, 1989), the current study proves that mixing both game and simulation elements in parallel could be fruitful. In this specific case it could be explained by the fact that the facilitators of the game sessions were acquainted in great detail both with the theoretical model and corresponding elements used in the game design and construction. Though it is not easy to achieve for every educational game, it could provide further ideas for implementation of game-based techniques.

5.1. Limitations

The fact that the facilitators of the test sessions were well informed both about the theoretical model behind the game and game dynamics could also be seen as one limitation of this study. As this kind of thorough knowledge of the game is difficult to achieve with wider groups of regular end-users, the results may differ greatly by facilitators of the game sessions.

Secondly, it is important to keep in mind that the research was launched in a period where both mass- and social-media provided news which could have a significant effect on acculturation attitudes (the immigrants crisis in Europe, arrival of the first refugees to Estonia, terrorist attacks in various European cities, occupation of Crimea by Russia), etc. It is possible that in more stable situations the inter-group differences would have been smaller. As the case presented by the game was followed by cases from real life in the current study, the connections between lessons learnt from the game and from real life were easier to appear.

Thirdly, the evaluation tool (questionnaire), though with high internal reliability and test/post-test reliability and sufficient face-validity, has not been validated against other methods. Though expert evaluations on the validity of the questionnaire were supportive, it is not clear which specific aspects of acculturation attitudes the questionnaire is assessing. As the sample size was on a lower acceptable limit for a factor analysis by the subjects to variables ratio = 10.9 (see e.g. Zhao, 2009) the components found do not allow to make wider generalisations.

Finally, as the same questionnaire was used both for the pre- and post test, then it is possible that the questionnaire itself served as a prompt, which led the members of the test group to retrieve the integration-supporting experience and lessons learnt from the game session.

5.2. Implications

The tangible practical result of the studies described within this dissertation is a ready-to-use educational game which could promote acculturation attitudes. Though there are thousands of descriptions of educational games available today, either for a fee or free, only very few of them provide all the necessary information needed for efficient implementation. Namely, apart from operational rules, the description of the model behind the game, guidelines for debriefing, and evaluation results are required components.

If developers of an educational game assume the end-users to facilitate the game session in a manner that enables achievement of expected learning outcomes, they have to provide a full description of the elements used in game design and construction. All according steps of game development – reduction, abstraction, etc. – have to be explained in sufficient detail. If the end users do not know the reasons why some elements of the reference system were included

in the game and others not, or if they are not aware of the connections between abstractions used in the game with elements of real-life structures, it makes it difficult for them to run a meaningful game session.

While planning the game development it is crucial to consider carefully whether the target group needs a simulation game of high fidelity or of high metaphorical power. The first seems to be preferable if we expect the learning transfer to appear in contextually similar situations, and the latter is recommended if the participants have different backgrounds and are going to use their new knowledge/attitudes in different contexts. As suggested in this dissertation, the level of abstraction should be decided before the actual construction of the game starts.

And last but not least, if the game is targeted at end-users who are interested in real learning outcomes (and not just making the learning process more playful), then they should be informed about evaluation methods the designers have used and results they have received.

Scientific implications

The current study supports the findings that an adequately developed simulation game could be used as an effective instructional aid if it the meets necessary prerequisites, including sufficient instructions for debriefing. The previous research literature on game development is not persistent with using terms denoting stages of game development and I recommend to differentiating between phases of design and construction as specific stages of the full cycle of development.

The game used in the current study served as a practical sample or case, and the participants were expected to review their theoretical attitudes after that. As the impact was significant, it provides some support to the assumption that students are rather learning from case-to-law than contrariwise. These findings are encouraging, and further studies could explore the more widespread application of this principle. If we know that knowing a law or regularity does not influence the students' ability to analyse a specific case, but knowing the case could help them to recognise the regularity, then why not implement this knowledge in educational practice?

The dissertation follows the approach which claims that the educational impact of any game-based learning method, including simulation games, could and should be proved. Though Kriz (2006) is obviously right in stating that it is also necessary to show "how does the game work", we still do not have many cases at hand that we could analyse. In order to start analysing the potential reasons for success, we need a sufficient number of games which have been evaluated from the viewpoint of measurable learning outcomes and not just self-reported evaluations of participants. Still, assuming that it might even be impossible to provide a comprehensive list of features which parsimoniously define a game as such (Arjoranta, 2014), it might similarly be a mission impossible to provide a list of features which ensure the effectiveness of every

simulation game. Certain features are sufficient and necessary for some types of games, but not necessarily for all of them.

The latter is especially true in light of the suggestion to differentiate stages of design and construction within the whole cycle of game development, as presented in this dissertation. Development of a simulation game asks for multi-professionality not only from the team of developers, it also requires a combination of handicraft for construction, arts for design, and science for development of contents and use of pedagogics of the game. Knowing that the mixture of these three is a *sine qua non* prerequisite in game development helps to understand why the current terminology in the field is rather ill defined, but from the other hand it may open fruitful perspectives for further, multi-disciplinary research.

5.3. Conclusion

The results of the current study permit the claim that an educational game could be used as a teaching aid promoting acculturation attitudes. Although mixing the elements characteristic of a typical game and those of a simulation is not always recommended, it could be used if the game development includes all necessary stages and the facilitators are well acquainted with both simulation and gaming techniques. Assuming that an educational simulation game enables structure-based transfer of learning, additional studies might help to understand what are the necessary conditions behind that (e.g. a meaningful case presented by the game, metaphors serving as heuristics, emotional engagement, etc.) and how to increase the effectiveness of other game-based learning techniques.

The Fountains-game was developed by a team led by the author of the current dissertation; members of the team included Professor Raivo Vetik and Assistant Professor Innar Liiv. All relevant phases of game development were included in the process, starting with the game specification and ending with evaluation (see Fig. 6). Feedback of the school teachers on the usability of the game, received during the post-game debriefing, was encouraging and referred to the face value of the game as an educational tool. More than 100 ready-to-use game kits have been delivered to Estonian schools, and by the end of 2016 the game rules were translated to eleven languages. The game has been introduced at several international conferences; both participant and facilitator's guidelines have been published in professional journals.

It could be said that the developed game supports acquisition of intended learning outcomes, which, within this study, means that participating in the game has an impact on participants' acculturation attitudes. Still, as pointed out by several authors, we need to know which game attributes lead to learning outcomes (Wilson et al., 2008), and therefore the evaluation does not merely have to prove that a simulation game works but also to show how and why it works (Kriz, 2006). Although various attempts have been made to list these attributes, it rather seems that pinpointing sufficient and necessary prerequisites

for an efficient educational game is as impossible as to find joint characteristics for all games as such. It sounds like a cliché, but construction of new knowledge or attitudes is an extremely idiosyncratic process. Each student uses different strategies and the learning outcomes will obviously differ at least a bit. While agreeing on that, one could easily conclude that the real strength of a simulation game is hidden in its multi-faceted character. Being fully aware that Kolb's idea of distinct (and persistent) learning styles (Kolb, 1984) has been heavily criticised (Bergsteiner, Avery, & Neumann, 2010), it seems to be obvious that a simulation game as a learning aid benefits from its openness to different learning approaches. One participant, at certain period of time, acquires the lesson via observation, another via active participation, and the third, supposedly, via planning or reflection. And even if we do not dig deep into the mechanics of social learning, situational learning, or peer-to-peer learning we can easily follow the logic of efficient learning within a simulation game: differently from more traditional methods of teaching, it provides students with a variety of options. A distinctive character of a simulation game is the need to make decisions and predict their outcomes within given circumstances. One could start with active participation and move to observations and conceptualisations afterwards, but it is also possible to join the process in a different order, which, assuming that subsequent research will confirm the findings of this study, provides the teachers and trainers with a teaching aid with proven impact and a variety of options to individualise the educational process.

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SUMMARY IN ESTONIAN

Haridusliku mudeldusmängu koostamine ning selle mõju hindamine akulturatsioonihoiakutele

Kokkuvõte

Dissertatsiooni aluseks on praktiline vajadus leida gümnaasiumiastmele mõeldud mänguline abivahend kuultuuridevahelise koostoimimise tutvustamiseks ja integratsiooni toetavate hoiakute kujundamiseks. Töö uurimuslik osa keskendub väljatöötatud mängu mõju hindamisele. Võib tõdeda, et hariduslike mängude kasutamine formaalhariduses ei ole Eestis kuigi levinud, ka ei sisalda gümnaasiumi riiklik õppekava olulisel määral multikultuursusega seotud teemasid. Sellest johtuvalt kerkis vajadus algupärase õppevahendi järele, mis hõlbustaks akulturatsiooniteema põhjalikumat käsitamist. Integratsiooni sihtasutuse (www.meis.ee) ettepanekul koostati õpiotstarbeline mudeldusmäng „Allikad"(ingl. *simulation game Fountains)*, mis ilmestab kultuurigruppide koostööd, keskendudes integratsiooni võimalustele piiratud ressursside tingimustes.

Kultuuride lõimumise alane teadlikkus on Eestis oluline mitmel põhjusel. Eesti senised kogemused vähemuste lõimimisel ei ole olnud nii edukad kui oodatud: venekeelse elanikkonna usaldus riiklike asutiste vastu on madalam ja nende positsioon tööturul nõrgem kui põliselanikkonnal (Eesti ühiskonna ... 2017, p 99). Muukeelsete elanike võimalused on uuringute kahaselt ahtamad (Kus-Harbord & Ward, 2015) ning nad ise tajuvad seda situatsiooni ebaõiglasena (Ehala & Zabrodskaja, 2011). Hiljutised kultuurikonfliktidest tingitud terrorirünnakud Euroopas annavad alust arvata, et kultuuridevahelisele lõimumisele ning selle kitsaskohtadele tuleb tänapäevases haridussüsteemis senisest enam tähelepanu pöörata. Uuringud näitavad, et sisserändajate integreerimiseks kavandatud sammud ei leia alati põliselanikkonna poolehoidu (vt nt Ainsaar & Beilmann, 2016; Teder, 2015) ning immigrantide vastuvõtmine kutsub esile hirme ja võimendab seniseid eelarvamusi (Strabac & Listhaug, 2008). On arvata, et Euroopa põgenikekriisi järel on Eestisse oodata üha enam sisserändajaid (Batha, 2017; Europe's Migration Crisis, 2016), mis nõuab meilt valmisolekut ka teistest riikidest pärit kooliõpilaste vastuvõtmiseks. Saabujatel tuleb aga Eestile omase kultuuri ja väärtussüsteemiga kohaneda: see ongi protsess, mida nimetatakse akulturatsiooniks. Samal ajal on teada, et immigrantperede laste kohanemine kooliga sõltub muude faktorite kõrval suuresti ka enamusgruppi kuuluvate koolikaaslaste akulturatsioonihoiakutest (Aronson & Brown, 2013; Isac et al., 2012; Kosic et al., 2005).

Kultuuride kokkupuuted on ka mitmete varasemate mudeldusmängude teemaks (vt nt Fowler & Pusch, 2010) end enamasti on selliste mängude pearõhk asetatud kultuuriliste erinevuste mõistmisele (nt „BaFà BaFà", vt Shirts, 1995) või toimetulekule kultuurišokiga (nt „Barnga", vt Thiagarajan, 2006). Akulturatsiooni puhul tuleb aga lisaks toimetulekule kultuuriliste erinevustega arvestada ka kultuurigruppide ligipääsu avalikele ressurssidele ning osalemist

otsustusprotsessis. See tingis vajaduse töötada välja algupärane mudeldusmäng, mis aitab tavapärase õppetöö raames käsitleda kultuurilise integratsiooni teemasid ning on suunatud ka akulturatsioonihoiakute kujundamisele. Alates Richard Duke teedarajavast raamatust *Gaming: the Future's Language* (1974) on kirjeldatud mitmeid haridusliku mängu väljatöötamiseks kasutatud mudeleid, ent esitatud pole kuigi palju andmeid nende kasutusväärtuse kohta (Arnab & Clarke, 2017; Hays, 2005; Kriz, 2006), terminoloogia kasutamine on ühtlustamata ning puudub ühtne arusaam pedagoogilisi eesmärke püstitava mängu koostamise sammudest.

Käesolevat dissertatsiooni kavandades seati eeltoodust johtuvalt kaks eesmärki:

1. Koostada hariduslik mudeldusmäng, mis aitab arendada osalejate arusaamist akulturatsiooniprotsessist.
2. Hinnata mängu mõju osalejate akulturatsioonihoiakute muutumisele.
   Lähtudes nimetatud eesmärkidest püstitati järgmised uurimisküsimused:
   – Milliseid samme tuleb rakendada mudeldusmängu loomisel, kui eesmärgiks on suurendada osalejate arusaamist akulturatsiooni põhiprintsiipidest?
   – Kas eeltoodud sammude põhjal koostatud mudeldusmäng avaldab mõju osalejate akulturatsioonihoiakutele?

Dissertatsioon annab sissejuhatuses põgusa ülevaate akulturatsioonistrateegiate tunnustest ning tutvustab teises peatükis mudeldusmängu loomise aluseid. Kolmas peatükk kirjeldades spetsifikatsiooni, mille alusel koostati mudeldusmäng „Allikad", ning teeb kokkuvõtte mängu käigust. Dissertatsiooni neljas peatükk tutvustab metoodikaid, mille abil viidi läbi loodud mudeldusmängu mõju hindamine. Mängu mõju esmaseks hindamiseks kasutati viiest akulturatsiooni puudutavast väitest koosnevat küsimustikku, vastused esitati Likerti skaalal. Katse- ja kontroll-grupi võrdlemisel selgus, et mängus osalenud õpilaste hoiakud olid muutunud, ent mitteosalenud õpilaste omad mitte. Esialgsed tulemused lubasid püstitada hüpoteesi, mille kohaselt loodud mudeldusmängul on osalejate akulturatsioonihoiakutele mõju, mis kallutab neid integratsioonistrateegiaid toetavas suunas. Teises uuringus kasutati kvaasieksperimenti, kus nii katse- kui kontroll-grupi liikmetel tuli küsimustik täita nii enne kui pärast sekkumist. Valimisse kuulus 131 gümnaasiumiõpilast, keskmine vanus 18 aastat. Kasutati 12-st väitest koosnevat küsimustikku, millele vastamiseks kulus osalejatel umbes 10 minutit. Vastamisel kasutati Likerti skaalat vahemikus 1–10 („Üldse pole nõus" ja „Täiesti nõus" kui äärmuspunktid). Kasutatud väited jagunesid akulturatsiooni põhidimensioonide alusel nelja kategooriasse. Uuring põhineb eel- ja järeltesti meetodil, sekkumine (mäng) toimus vahetult peale eeltesti sooritamist. Kokku korraldati kuus mängusessiooni, eel- ja järeltestis oli kasutusel sama küsimustik.

Andmeanalüüsis kasutati esmalt küsimustiku üldskoori. Küsimustiku sisereliaablus oli kõrge ($\alpha = 0{,}78$), eel- ja järeltesti korrelatsioon keskmine ($r = 0{,}61$). Eel- ja järeltesti võrdlus rühmade kaupa osutab katserühma liikmete hoiakute muutmisele peale mängu ($p < 0{,}05$), ent kontrollrühma eel- ja järeltesti

tulemuste vahel erinevust ei ilmne ($p > 0,66$). Selline tulemus viitab sisuliselt sellele, et osalejate akulturatsioonihoiakud on mängu mõjul muutunud integratsioonistrateegia suhtes pooldavamaks, seejuures ilmnes olulisim erinevus väidete puhul, mis puudutasid immigrantide integratsioonivõimalusi. Läbiviidud uuring lubab väita, et dissertatsioonis esitatud mudeldusmängu koostamise mudel on rakendatav ning selle alusel koostatud mäng mõjutab osalejate akulturatsioonihoiakuid soovitavas suunas. Käesolevaks ajaks on mudeldusmäng „Allikad" tõlgitud enam kui kümnesse keelde ja loodetavasti annavad saadud tulemused alust jätkuvateks uuringuteks ja praktilisteks lahendusteks haakuvates valdkondades.

PUBLICATIONS

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