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Instructional Integration of Digital Learning Games in Financial Literacy Education

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ABSTRACT

Financial literacy is commonly acknowledged as a key 21st century skill, and there is a wide range of political, practical and scientific activities intended to foster this skill within the populations. However, despite these efforts, recent meta-analyses indicate, that traditional financial literacy programs often do not reach the goals they aim. This result might be attributed to the fact that these programs are usually knowledge-centered, whereas financial decision making and behavior are mostly omitted. An additional problem is that they often do not sufficiently consider students motivation and socio-emotional needs. In this chapter, we argue that game-based learning can offer one possibility to overcome these obstacles, and thus to make financial literacy programs more effective and appealing. More specifically, we will sketch the potential benefits of learning with digital games and then briefly outline the available empirical research regarding the effects and conditions of game-based learning. We will also describe an effort to develop, implement and evaluate a set of game-based learning arrangements in a secondary school financial literacy program in Switzerland. This experience supported the claim that a well-designed and instructionally integrated digital learning game could foster learning, motivation and transfer in the context of financial education. It also showed that game-based learning in financial literacy education requires enough time as well as appropriate measures of teacher preparation. In addition, a collaborative way of developing game-based learning arrangements seems to be an essential key factor.

INSTRUCTIONAL INTEGRATION OF DIGITAL LEARNING GAMES IN FINANCIAL LITERACY EDUCATION

Carmela Aprea, Julia Schultheis, Kathleen Stolle

Introduction

Due to recent trends in society and economy (e.g., shrinking public support systems, shifting demographic profiles, changes in financial markets), financial literacy can be considered as a key skill in the 21st century, especially for underprivileged target groups (e.g., Aprea, Wuttke & Stock, 2015). Under these conditions, financial literacy represents a complex issue requiring interpretations of scholars from various disciplines including (but not limited to) finance, psychology, sociology, philosophy, and education. In addition, financial literacy education is expected to fulfill a wide range of expectations, e.g., fostering individual and collective economic well-being as well as providing possibilities for participation (cf. Lucey & Laney, 2012). These challenges cannot be adequately addressed only by family socialization but require institutionalized learning processes. The financial education community has begun to recognize the depth and difficulty of its mission. On the political level, many countries have developed national strategies, and/or have submitted surveys and tests to measure financial literacy of their populations, especially the young (e.g., OECD, 2014). On the practical level, financial literacy education programs have been implemented. Moreover, research efforts have been fostered in this field (for a comprehensive overview of the activities at the different levels see Aprea et al., 2016).

However, despite these efforts, recent empirical evidence by meta-analyses (e.g., Fernandes et al., 2014; Miller et al., 2014) indicates that traditional financial literacy education programs very often do not reach the goals they aim at (i.e., deepen understanding of financial

issues, enhance reasonable financial behavior, support participation) and are thus not as effective as they should and probably could be. This finding might be attributed to the fact that these programs are usually knowledge-centered, whereas financial decision making and behavior are mostly omitted. An additional problem is that they often do not sufficiently consider students' motivation and socio-emotional needs as well as their social practices. These needs and practices have changed drastically for the generation of the so called digital natives and their propensity towards virtuality, immediate pay-off, fantasy, play and technology (e.g., Lonka, 2012; Prensky, 2001; Wagner, 2008).

In this chapter, we argue that game-based learning can offer one possibility to overcome these obstacles, and thus to make financial literacy programs more appealing and effective. More specifically, our aim is to demonstrate how digital learning games (also known as educational or serious games) could be embedded into classroom instruction in order to support learning, motivation and transfer in the context of financial literacy education. For the purpose of this chapter, we define 'digital learning games' in accordance with Wouters et al. (2013) as

being *interactive*, based on a set of *agreed rules and constraints*, and directed toward a clear *goal* that is often set by a *challenge*. In addition, games constantly provide *feedback*, either as a score or as changes in the game world, to enable players to monitor their progress toward the goal. (p. 250; emphasis in the original)

As these authors further contend, computer games may also involve a competitive activity (against the computer, another player, or oneself). In addition, a narrative or the development of a story can be very important in a computer game (e.g., in adventure games), but both of these characteristics are not indispensable for being a computer game (e.g., action games do not necessarily require a narrative). The supplement 'serious' indicates that the primary purpose of the computer game is not to entertain the player, which would be an added value, but to use the

entertaining quality for training, education, or other mental and/or behavioral change objectives (Zyda, 2005).

The structure of the chapter is as follows: First we will sketch the potential benefits of learning with digital games and then briefly outline the available empirical research regarding the effects and conditions of game-based learning. Next we will describe an effort to develop, implement and evaluate a set of game-based learning arrangements in a secondary school financial literacy program in Switzerland. On this basis, we will provide preliminary instructional guidelines, summarize the main issues of the chapter and make suggestions for future research and development activities.

Potential benefits of learning with digital games

Over the last 40 years, digital games – also known as computer or video games – have increasingly replaced more traditional games as leisure activities and have had a transformational impact on how people spend their leisure time (e.g., Conolly et al., 2012). This seems to be especially true for the young: For example in the United States, more than 90% of children between the ages of 2 and 17 play video games (cf. NPD Group, 2011). In addition, video games brought in over \$25 billion in 2010, more than doubling Hollywood's 2010 box office sales of \$10.8 billion in the United States and Canada (cf. Motion Picture Association of America, 2011). However, despite the enormous popularity of digital games, much of the earlier public and scientific discussion has been primarily focused on their possible detrimental effects such as aggression, isolation, addiction and depression (e.g., Gentile & Gentile, 2008; Schmierbach, 2010), and it is only more recently that popular media (e.g., Hagel & Brown, 2009; Johnson, 2006) as well as academic educational research (e.g., Gee, 2003; Squire, 2006, Prensky, 2001)

are concentrating their attention on the potential benefits that digital games may have for human development and learning. As Granic, Lobel and Engels (2014, p. 66) state, “[c]onsidering these potential benefits is important, in part, because the nature of these games has changed dramatically in the last decade, becoming increasingly complex, diverse, realistic and social in nature.” The potential benefits of digital games become particularly evident from the perspective of contemporary learning theories, notably constructivist, situated and experiential approaches (e.g., Collins, Brown & Newman, 1989; Greeno, 1998; Lave & Wenger, 1991; Moon, 2004). These theories, in turn, are inspired by tenets from pragmatism (e.g., Dewey, 1963), sociocultural and cultural-historical psychology (e.g., Vygotski, 1978) as well as fundamental findings in cognitive and motivational psychology (e.g., Malone & Lepper, 1987; Suchman, 1987). In particular, they view learning as an active, contextually bounded and socially mediated process of making meaning out of individual experiences. This process aims at the formation of a multidimensional and, first and foremost, transferable set of competencies. Teaching, in turn, is conceived as the provision of adequate learning opportunities, i.e., the design of learning arrangements which stimulate students’ active participation and guide their experiences. Within the frame of contemporary approaches, the following (non-exhaustive) advantages of digital learning games could be emphasized:

- (1) *Digital games may support domain-related knowledge construction and higher order cognitive skills.* In digital games, learning is at its essence a kind of performance, as students learn by doing within the affordances and constraints of information-rich virtual worlds, instantiated through software and social systems. The primacy of game-based learning is on experience, constantly inviting the learner to understand and manipulate complex situations, learn through failure and related feedback, and develop identities as expert problem solvers

(Squire, 2008). Thus, game-based learning provides what Barab et al. (2010: 525) call “consequential engagement”, and is particularly expected to foster the acquisition of different forms of domain-related higher order knowledge and skills, such as conceptual understanding, strategic decision making and/or problem solving.

(2) *Digital games can promote enjoyment, intrinsic motivation and positive attitudes.* Due to their entertaining qualities, digital games are believed to be personally enjoyable and thus much more attractive for learners, especially the ones from the digital native generation. This may lead to more affective involvement as well as to sustained intrinsic motivation. As already proposed by Malone (1981) and confirmed by more recent developments in motivational research (for an overview see Elliot & Dweck, 2005), the primary factors that make an activity intrinsically motivating are challenge, curiosity, control and fantasy. Digital games incorporate these factors, for example through the need to attain goals, through sensory and cognitive activation or with the help of narratives. In addition, their immersive nature may also enable the experience of flow (e.g., Csíkszentmihályi, 2008). In sum, these characteristics may positively influence attitudes towards learning both, in general and in specific domains.

(3) *Digital games may foster generic abilities as well as psycho-motoric skills.* As for example Granic et al. (2014) assume, digital games may also foster more generic, often meta-cognitive abilities such as handling of complexity, or information processing under the condition of risk and uncertainty as well as persistence, ambiguity tolerance and self-efficacy. Depending on the specific game condition, they are moreover expected to support psycho-motoric skills such as speed of reaction or eye-hand-coordination.

However, as especially researchers from media psychology and instructional design (e.g., Kerres et al., 2009; Myers & Reigeluth, 2016; Petko, 2008) point out, it is quite improbable that these beneficial effects of digital games come naturally. It is rather expected that, in order to develop its full potential, game-based learning requires two key prerequisites, notably high quality game design and adequate instructional integration, i.e. learning arrangement design. With regard to the first key prerequisite, scholars in the field of game design (e.g., Adams, 2014, Bopp, 2005; Dondlinger, 2007; Mayer, 2011) highlight that a good game design should guide the learner through the game world and help him or her to understand its logic and rules. This should be preferably done as easy and immersive as possible, for example by designing game situations which afford learners to actively manipulate objects in an intended way, or by sequencing the game play according to increasing levels of difficulty. With regard to the second prerequisite, instructional integration, it is particularly emphasized that simply playing a game might not be enough for effective and sustainable learning to occur, but that these gaming experiences need to be complemented with adequate preparation, elaboration, practice, debriefing/reflection and transfer of what has been learned during the game play (e.g., Leemkuil & de Jong, 2011; Paras & Bizzocchi, 2005). As we will elaborate in the second following section, a powerful instructional remedy for guiding these processes is the design of learning tasks, mainly because of their impact on regulating students learning processes. In addition to highlighting the importance of these design issues, scholars in the field of game-based learning also underscore the need for empirically investigating the effects and conditions of using games for educational purposes. This aspect will be addressed next.

Game-based learning: Summary of the available empirical research

In the last decade, a steadily growing number of individual research studies concerning the effects and conditions of game-based learning have begun to emerge. In addition to the individual studies, around a dozen literature reviews (e.g., Boyle et al., 2015; Conolly et al., 2013; Donovan, 2012; Granic et al., 2014; Hamari et al., 2014) both, narrative and systematic, as well as a handful of meta-analyses (e.g., Clark et al., 2016; Sitzman, 2011; Vogel et al., 2006; Wouters et al., 2013) exist, which are of particular interest for our concern. Even though far from being conclusive – and, most importantly, at least to our knowledge completely omitting the domain of financial literacy education – the existing research offers important indications with regard to the questions of whether and under which circumstances digital games could be effectively used to support human learning and development. Three types of results should be highlighted here:

- (1) In terms of cognitive learning outcomes, the available empirical evidence basically seems to confirm the expected beneficial effects of digital learning games. This is corroborated by all quantitative meta-analyses, including the most recent one by Clark et al. (2016), with 69 studies from 2000-2012, spanning K-16 students, the one by Vogel et al. (2006) with 32 studies from 1986 to 2003 covering all age groups as well as the one by Wouters et al. (2013) with 39 studies from 1990 to 2012, also encompassing a wide range of age groups. All of these meta-analyses covered various types of games (e.g., adventure games, online quizzes, simulation games) and content areas (e.g., science, math, and psychology). As Ke (2009) states in her qualitative meta-analysis, the expected benefits seem to be particularly salient with regard to higher order thinking skills such as planning or reasoning. These results were also confirmed in an additional meta-analysis by Sitzman (2011) who specifically addressed

simulation games for adult workforce trainees, synthesizing results from 65 studies from 1976 to 2009. This author moreover could demonstrate positive effects of serious games on self-efficacy, i.e., a more generative ability.

- (2) However, differently than expected, the available empirical research is rather inconsistent concerning motivational and attitudinal effects. In this respect, Vogel et al. (2006) reported positive effects of serious games whereas such effects could not be found in the meta-analysis by Wouters et al. (2013), who offer three plausible reasons for this lack of evidence. The first reason pertains to the methods that are commonly used for the measurement of motivation. In this regard, it can be questioned whether it makes sense to measure affective states such as motivation and enjoyment with questionnaires and surveys after game play, when the player's motivation may be attenuated. In contrast, measures which can be collected during game play (e.g., observation, eye tracking and skin conductance) might be more valid but are yet very rarely used. This suggestion is corroborated by one exceptional study by Annetta et al., 2009 that employed the rating of observed engagement during game play as motivation measurement, and found that the game was more motivating than the instructional treatment of the comparison group who received practice and group discussion. As a second reason, the case might be that serious games are not more motivating because in instructional contexts learners do experience them as obligatory as other instructional methods. This might limit their sense of autonomy and control which, in turn, are important conditions for motivation (e.g., Ryan et al., 2006). Lastly, it is also possible that the lack of motivational appeal is – at least partly - a reflection of poor game design and poor instructional integration. This interpretation is supported by the moderator analyses from the research syntheses, which are addressed next.

(3) In particular, the moderator analyses demonstrate that games with an active involvement of the player and high control (Vogel et al., 2006; Wouters et al., 2013) as well as games with unlimited access (Sitzmann, 2011) do not only lead to significantly better learning outcomes relative to the comparison group but are also perceived as more motivating. With regard to instructional integration, the moderator analyses also reveal that games were more effective and motivating when supplemented with other instruction, when multiple training sessions were involved, and when players worked together in groups (Vogel et al., 2006; Wouters et al., 2013). In contrast to these game and instructional design characteristics, no significant differences were reported in terms of learner characteristics (e.g., age group or gender). As Vogel et al. (2006) notice,

[t]his finding is somewhat counterintuitive since it is a common assumption that children, due to shorter attention-spans, higher interest in play activities, and lower intrinsic motivation to learn, enjoy and thus learn better using computer games and interactive simulations compared to adults. (p. 237)

However, this rather surprising finding might, in our view, indicate a generalizable positive effect of digital learning games – even though this interpretation must be treated with caution because many important research questions, and especially those regarding learner-related prerequisite (e.g., prior knowledge) of effective game use, have not yet been considered. Taken together, the results of the current empirical studies thus seem to stress the affordances of games for learning as well as the key role of design beyond medium.

Development, implementation and evaluation of game-based learning arrangements in a secondary school financial literacy program in Switzerland

In this section we will illustrate how the previously depicted theoretical considerations and empirical findings were used to design, implement and evaluate a set of game-based learning

arrangements in a secondary school financial literacy program in Switzerland. To this end, we will (1) briefly delineate the background of the program, (2) describe the process of development of the game-based learning arrangements, and (3) report on an effort to implement and formatively evaluate them within the scope of a field testing.

Background of the program. The activities described in this section are part of a larger development project which has been initiated as a joint venture of two Swiss Teacher Associations (LCH Dachverband Lehrer und Lehrerinnen Schweiz and SER Syndicat des Enseignants Romands) and the Association of Swiss Cantonal Banks (VSKB Verband Schweizerischer Kantonalbanken)¹ as response to a recent reform in Swiss basic education curricula, the so called Lehrplan 21 initiative. This reform involved a shift from knowledge-oriented to competence-oriented curricula, and besides other issues also encompassed for the first time the inclusion of competencies related to financial literacy, especially in the grades 7 to 9. Given that this subject was completely new for this age group, and teachers in this kind of school usually have no formal training in finance or economics, there was an urgent need for a sound instructional approach, including instructional resources fitting to the new curriculum requirements. In order to cope with these requirements and encouraged by the above described theoretical considerations and empirical findings, the decision was made in favor of combining game and non-game instruction within an integrative approach. This approach included the development of a digital learning game and its instructional integration within game-related learning modules. Together, these instructional incidents (i.e., learning game and learning modules) form what we subsequently call ‘game-based learning arrangements’.

¹ It is important to note that in May 2016, the above mentioned associations have funded the umbrella organization “FinanceMission Association” which serves as contact platform for schools and teachers interested in using the various instructional resources presented in this part of the chapter. For further information see also <http://financemission.ch/ueber-financemission/>.

Development of the game-based learning arrangements. Due to the innovative character of including financial education in the Swiss secondary school context, the project activities have been inspired by a design-based research approach (e.g., DBRC, 2003), and encompassed the close collaboration of a team of interdisciplinary experts (notably researchers from media psychology, business and economics education, economics, behavioral and household finance, and business ethics), game designers, media designers and secondary school teachers. In addition, students, parents and other relevant stakeholders were involved, and an accompanying steering committee was constituted. In accordance with the design-based research approach, different but interrelated cycles of analysis, design, testing and re-design were carried out. More specifically, the following steps were conducted:

(1) *Needs analysis.* In order to be able to respond to the needs and concerns of the persons directly or indirectly affected by the game-based learning arrangements, a pre-study was accomplished, including four preparatory focus group workshops with (i) students, (ii) teachers, (iii) parents, and (iv) professionals from the fields of credit counseling, consumer protection, youth work and the finance sector, respectively. In these workshops, participants were first invited to express what they spontaneously associate with the notion of financial literacy education for secondary school students. Then, they were asked (a) to describe typical and critical situations in which, in their experience, young people get in touch with money and finance issues, and (b) to specify which competencies they consider important to successfully deal with these situations. The workshops were complemented with semi-structured interviews with further representatives of the Swiss educational field (e.g., the president of the parents association or the head of the secondary school section within the teacher association). All workshops and interviews were held in summer and autumn 2014.

Moreover, in depth content analyses of the new curriculum documents and additional reviews of the literature on financial literacy education in other age groups and countries were conducted. These activities led to (i) a detailed description of situations, tasks and contents which could possibly be focused by the game-based learning arrangements, and (ii) a first list of requirements for the game and the related modules. This list included issues such as compatibility with the new curriculum and with the technical possibilities in schools, or avoidance of violence to humans or animals. The results of the pre-study were discussed in the team of experts and the steering committee. It was then decided to focus on budgeting (including avoidance of excessive indebtedness), and a model of related contents was built. Moreover, additional content-related, technical and organizational requirements were identified. All these information were merged into a tender specification.

(2) *Development of the digital learning game.* Based on the tender specification, a dedicated team of game designers was selected in December 2014 and commissioned with the development of a corresponding digital learning game.² The game was developed as a rogue-like action-adventure game, and has a classical super-hero plot with ten levels of increasing difficulty. It is located in a fictive town where the local bank has been hacked by hostile robots. For this reason, the savings of all inhabitants and even the class kitty are in danger. Players are invited to step into the shoes of a game character which can be customized in terms of visual style, and whose mission is to rescue the savings by overcoming the robots. The robot scenario was chosen in order to satisfy the demand of minimizing violence or damage, especially to living beings. The game incorporates an immersive approach, i.e., it is designed in a way that makes planning of money and time obligatory. Moreover, it provides

² Selection criteria included, among others: Originality and appeal of the game concept, fidelity to the contents that should be covered, experience and references of the design team, feasibility in terms of available budget and technical requirements.

ample opportunities for autonomous choices and control: Money can be earned either by conquering the robots and/or by pursuing a part-time job.³ Thus, at the beginning of every mission, the player has to decide how much time to spend with each of these activities. In this context, he or she has also to plan enough time for learning in order to avoid a decline of school grades. To prepare for the mission, the player can then buy equipment in a shop, such as special clothing to inhibit losing energy, drinks to improve attacking skills, and various “weapons” such as a frypan or a swab. With regard to these weapons, a humoristic approach was chosen, again to prevent glorification of violent behavior to humans or animals. Besides the money that the player spends for buying the equipment, he or she may also lose it by being defeated during the game. At the end of each round, a detailed account of incomes and expenses is provided, together with some advice on how to optimize financial decision making. Besides these design elements, the game also includes a tutorial device which is supposed to familiarize students with the game world and mission. The game contains no in-app purchases, and can be downloaded for free. Unlimited access is thus guaranteed.

During the game development process, various consultative meetings were held with the game designers on the one hand, and the experts and the steering committee on the other. In order to optimize the communication flow and ensure appropriateness for the application context, a group of four secondary school teachers as well as one faculty staff from a teacher education college were occasionally involved. These were the same persons as those who collaborated in the development of the accompanying learning modules (see next bullet point). In addition, previous versions of the game were tested with selected samples of secondary school students with regard to usability, appeal etc.

³ Incurring debts is also possible, but only at higher levels of difficulty.

(3) *Development of the game-related learning modules.* Parallel to the game development activities, a total of five learning modules were created in close cooperation between experts, designers and practitioners. In particular, three researchers from economics education, two professional media designers and the already mentioned group of four secondary school teachers as well as the teacher educator were mainly involved in this part of the project. In addition, one person from the game designer team was regularly consulted in order to support reciprocal update and feedback between the two design teams (i.e. game designers and learning module designers). The activities for developing the game-related learning modules encompassed a two hour kick-off meeting and two half-day face-to-face workshops with all the above mentioned participants and several Skype meetings between some of them, especially between the media designers and the economics education researchers. In the kick-off meeting, which was held in June 2015, the background of the project as well as the basic idea of the game was explained, and organizational issues of the workshops were elaborated. The first workshop then took place in September 2015. In this workshop, a beta-version of the game was presented, and relevant theoretical considerations and empirical findings (see previous sections of this chapter) were briefly summarized in order to provide a conceptual background for developing the game-based learning arrangements. Moreover, key objectives (so called superordinate competencies) and learning goals were specified according to the new curriculum requirements, and discussed with the teachers. Given the pivotal role of learning tasks for guiding students' learning processes, it was decided that the accompanying learning modules should be focused on the provision of game-related task assignments. To support teachers to create such assignments, six different types of learning tasks with different instructional functions⁴ were also presented during the first workshop. These tasks

⁴ This differentiation of task types is inspired by and adapted from a classification scheme proposed by Luthiger et

include: (1) introduction tasks which intend to familiarize students with a situation or problem, (2) elaboration tasks which support students to develop the knowledge and skills relevant for coping with the situation or problem, (3) exploration tasks which invite students to try out different approaches and solutions, (4) practice tasks which are designed to deepen knowledge or automatize skills, (5) reflection tasks which are expected to stimulate students critical thinking, and (6) transfer tasks which should encourage processes of decontextualizing and recontextualizing knowledge and skills in different application settings. The teachers were asked to develop learning arrangements which are centered on the game and include the different task types. Their suggestions were supposed to be brought to the second workshop in October 2015, discussed with the colleagues, the researchers and the media designers, and then reviewed according to the feedbacks which resulted from these discussions. Initially the teachers were not at ease with their task, and tended to propose rather detached task assignments that had nothing to do with the learning game. So, this further opportunity for reciprocal exchange and feedback was indispensable. In addition to this, the second workshop addressed questions regarding the implementation and evaluation of the game-based learning arrangements. The products which resulted from this process (i.e. sequences of learning tasks and respective worksheets) were then submitted to a field testing, and subsequently revised and fine-tuned according to the evaluation results (cf. next section). Revision and fine-tuning were done by the media designers in close cooperation with the economics education experts. As depicted in table 1, in the final version (i.e., after the evaluation results have been incorporated), the learning modules comprise between two and four lessons, with one lesson corresponding to 45 minutes. Basically, they are offered as best practice models which have to be adapted by any given teacher who uses them to meet the

circumstances of a specific class. The modules include a description of learning goals and contents, activity outlines, and worksheets with concrete task assignments. In addition, some suggestions regarding the implementation of the respective module are given. Two out of the five modules are most suitable for use in grade 7 or at the beginning of grade 8, respectively, whereas the other three were constructed for older students (i.e., end of grade 8 or grade 9). Each of the modules can be used individually or be combined with one another. Table 1 also summarizes the contents and the superordinate competencies of the five game-based learning modules.

Table 1: Duration, contents and superordinate competencies of the five game-based learning modules

	grade 7-8 module 1	grade 7-8 module 2	grade 8-9 module 1	grade 8-9 module 2	grade 8-9 module 3
Contents	(3 lessons) -Incomes / expenses -Functions of a budget -Goods and costs	(2 lessons) -Personal buying behavior -Purchase and financing decisions	(4 lessons) -Durable and non-durable consumer goods, luxury goods -Purchasing and follow-up costs -Functions of a budget	(3 lessons) -Consumer behavior and financial decisions -Risk and safety -Borrowing -Costs, return, interest	(4 lessons) -Financial strategies -Probability of success and risk -Impact of purchasing decisions on budget
Superordinate competencies	Learners are able to draw up a budget and to consider it when making purchase decisions.	Learners are able to critically reflect their purchase and financial decisions.	Learners are able to estimate purchasing and follow-up costs of different durable and non-durable consumer goods. They are able to draw up a budget and to consider it when making purchase decisions.	Learners are able to critically reflect their purchase and financial decisions.	Learners are able to choose proper financial strategies for specific purchases.

Implementation and formative evaluation of the game-based learning arrangements. In order to optimize the game-based learning arrangements and to locate possible shortcomings, a field testing with a total of 60 secondary school students was conducted between January and February 2016. All students came from the classes of the four participating teachers. Therefore, they might be considered as convenience sample. In the field testing, the three game-based learning modules for grade 8-9 and one of the grade 7-8 modules were implemented and evaluated with 36 and 24 students, respectively. Module 1 in grade 7/8 could not be tested due to illness of the respective teacher.

Given the formative intent of the evaluation, we were especially interested in gathering information on the practicability of the game-based learning modules in general, and of the usability of the learning tasks in particular, both in terms of temporal feasibility and perceived difficulty by teachers and students. In addition, we wanted to get some first impressions concerning the motivational appeal of the game-based learning arrangements as well as their perceived effectiveness for supporting learning and transfer. For this purpose, the following evaluation instruments were used: Teachers were asked to observe students during the accomplishment of the tasks, to take notes of their observations and to use these notes to fill in a questionnaire. This questionnaire included general questions concerning the learning arrangement. Teachers were asked to judge how easy or difficult they found (i) to handle the learning module, both in terms of content and time, and (ii) to explain the game and the game-related learning tasks to the students. Additionally, the teachers should state (iii) to what extent they think that students have enjoyed the lessons, and have learned what is specified in the learning goals, respectively. Besides these general questions, specific questions regarding the learning tasks were included. To get an accurate picture on what needs to be enhanced, these

questions were customized for the single learning modules. All questions (i.e. the general and specific ones) were open-ended and explicitly invited the respondents to make suggestions for improvements in case of inconsistencies or problems. At the end of the questionnaire, they were also asked if they had any other kind of observation, proposal or advice. The utterances of the teachers were analyzed qualitatively by collecting themes that emerged in their answers. All answers were read, interpreted and discussed by at least two researchers. Then, the interpretations were cross-checked by the teachers and corrections were made where necessary.

To minimize disruptions of the learning processes, but nevertheless obtain informative statements from the students, their worksheets were prepared with a traffic light for every learning task, so that they just had to tick if they fully understood (green), partially understood (yellow) or not understood (red) what the task assignment asked them to do. Additionally, they had to answer a few questions which asked them if and to what extent they enjoyed playing the game and completing the tasks, and if and to what extent these instructional resources helped them to understand the respective financial literacy contents in such a way that they could explain them to a friend. With regard to these questions, students were asked to indicate whether they totally agree, agree to some extent or do not agree, and to provide a brief explanation of their respective judgment. Finally, they were also invited to express further concerns or ideas regarding the experienced game-based learning arrangements. Note that in order to avoid students to answer in a socially desirable manner all of their data were collected anonymously. In addition to analyzing the students' perceptions, we also conducted a first analysis of their solutions of the learning tasks. Students' ratings and number of correct task solutions were then submitted to frequency analysis. In case of open-ended questions, again, emerging themes were distilled.

With respect to the practicability of the learning arrangements, time pressure was the main concern expressed by the teachers, and according to them, the possible reasons for this concern are twofold. One reason was the fact that at the date of the field testing the game was not yet accessible to the public, so all preparatory activities to familiarize students with the game had to be done during class hours, which was quite time consuming. A second reason they mentioned had to do with the temporal feasibility, and partially also the difficulty of the learning tasks. In this regard, it could be stated that introduction tasks – unsurprisingly – were implemented in all modules. Even though they caused no particular problems in terms of difficulty, two of the four introduction tasks took longer than planned. Thus, the time specifications had to be adapted in the module descriptions. The elaboration tasks led to more problems. In two of the four learning arrangements the teachers articulated that these tasks were too difficult, and that students needed more support. They suggested explaining the respective task assignments orally because this is easier for students to understand. The exploration tasks, the reflection tasks and the transfer tasks posed the greatest challenge in all four tested learning arrangements. The reflection tasks were realized in three of the four cases. However, additional help from the teacher was needed in each case. Exploration tasks were employed in two classes, but worked out properly only in one of them. A transfer task was put into practice only once and also required further assistance from the teacher.

In the main, the teachers' evaluations of task difficulty were also mirrored by the task-related judgments from the students as well as by the first analysis of the task solutions which they proposed. As this analysis shows, only about half of the tasks were executed correctly. However, despite these problems, the ratings regarding the motivational appeal and the effectiveness of the game-based learning arrangements were very positive. Here, the evaluation

results indicate that in three of four learning arrangements students unequivocally stated that they have enjoyed playing the game, and also have liked to process the learning tasks. This conviction was largely confirmed by the observations of the teachers. In case of the fourth arrangement, it happened that the respective topic had already been treated in class. Thus, those students found the lessons somewhat repetitive and boring, but nonetheless appreciated the game approach. In addition to their perceptions regarding the motivational appeal of the game-based learning arrangements, most of the students stated that they had understood the financial literacy content treated in the respective learning module, and that they would be able to explain it to a friend. This seems to be in some contradiction with the analysis of students' solutions to the learning tasks, and interestingly enough those who answered all questions correctly rated their knowledge lower than the ones who answered only half of the questions correctly. However, such inconsistencies in the objective and subjective ratings of competencies are quite common in financial literacy assessments (e.g., Aprea & Wuttke, 2016), and may point to a nontrivial lack of proficiency in adequately judging one's own abilities in this domain. All suggestions for improvements derived from the field testing were incorporated into the revised version of the game-based learning modules, or reported to the game designers, if they concerned the game, respectively.

Preliminary guidelines for integrating learning games into financial literacy education

The results from the evaluation, together with our experiences in the process of developing the game and the learning modules, offer a potential for suggesting some preliminary guidelines concerning the integration of digital games into financial literacy education. First, there seems to be no indication that the expected beneficial effects of game-based learning do not

apply to the domain of financial literacy which, so far, has been neglected. In addition, the results also support the pivotal role of adequate design, both in terms of game design and instructional design. Relating to the former, it can be assumed that an immersive approach, with high autonomy and control to the player is a recommended design strategy also for digital games in financial literacy education. With regard to instructional design, we would like to underline the need to integrate the game with the non-game instruction as well as the need to guide students' game-related activities with the help of respective learning tasks in the classroom setting. Both, the alternation between game and non-game instruction, have to be carefully planned, and teachers as well as students need sufficient time to familiarize themselves with the respective requirements. However, as our experiences also reveal, such planning is not achieved automatically, but needs to be supported through appropriate measures of teacher education and/or teachers' professional development (for a similar concern see Lucey, 2016). This is especially required if teachers have to react to new curriculum demands and/or if they have no formal education in the related field, as it is very often the case in financial literacy education. Finally, we would like to stress an organizational aspect which is concerned with the way in which the game and the learning modules were developed. Concerning this matter, we would conclude that the close collaboration with the teachers as well as the exchange between the design teams and the contact with all stakeholders can be considered a key element for ensuring the effectiveness of the process and supporting the acceptance of the resulting products.

Summary and outlook

Given the importance of financial literacy as a key 21st century skill, in this chapter, we argued that game-based learning can offer one possibility to overcome the shortcomings of

currently available financial literacy programs by making financial education more effective with regard to the demands of financial decision making and more appealing with regard to the needs and preferences of the target group. More specifically, our aim was to demonstrate how digital learning games could be instructionally embedded in order to support learning, motivation and transfer in the context of financial education. For that purpose, we sketched the potential benefits of learning with digital learning games, summarized the available empirical research regarding the effects and conditions of game-based learning, and described an effort to develop, implement and evaluate a set of game-based learning arrangements in a secondary school financial literacy program in Switzerland within the scope of a field testing. On the basis of the results and experiences from this field testing, we finally provided suggestions for guidelines concerning the integration of digital games into financial literacy education.

Our study was a first attempt to formatively evaluate the practicability and usability as well as the perceived motivational appeal and learning effectiveness of the game-based learning arrangements in a financial education program in Switzerland. This attempt showed that well designed digital games could be productively used in secondary school financial literacy education. It additionally showed the value of a integrating game and non-game instruction. However, of course, we are aware that this attempt has its limitations, particularly with regard to methodological issues such as the convenience sample, the limited number of participants and the instrumentation. Given these limitations, further research and development activities are warranted. These activities should, among others, specifically address the following aspects: (1) additional formative evaluation studies to further optimize the game-based learning arrangements (e.g. with regard to the sequencing and the assignments of the game-related learning tasks), possibly with a more systematic sample of teachers and students; (2) implementation studies to

locate the organizational conditions for an effective use of the game-based learning arrangements, and (3) summative evaluation studies with randomized field trials to determine the comparative effectiveness of the game-based learning arrangements in financial literacy education as well as the generalizability of the results.

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