

MY-INVESTMENT: USING DIGITAL GAMES TO HELP CHILDREN LEARN FINANCIAL MANAGEMENT

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Although financial management is a significant issue for children, few studies offer empirical findings concerning the influences of game-based environments on children's learning. Thus, this study investigates how digital games can serve as a favorable environment to help children learn about financial management. We first develop a digital game, and then conduct a case study with 29 fifth-grade students designed to investigate the children's behaviors. The results reveal that (1) there were individual differences in their management behaviors, although their behaviors in terms of understanding and coping with overall financial investment tended to increase over time; (2) 41% of the students did not show appropriate financial management behaviors but 59% did, and most of them held a rather conservative strategy in financial management. Based on these findings, some directions for future development of game-based environments are suggested.

Keywords: Digital game; financial management; children; learning behavior.

1. Introduction

Digital games have been recognized as having the potential to assist students to develop significant capabilities and improve academic achievement. Regarding their capabilities, several studies have revealed that digital game-based learning can promote some significant capabilities, such as problem-solving and critical thinking skills (Gee, 2003), exploration and reflection skills (Kiili, 2007), and independent learning (Cagiltay, 2007). They could be because they are goal-oriented activities that attract students to discover, explore, think, and overcome a set of challenges in an active way, during which the students are demanded to learn specific skills. Thus, students' capabilities could be enhanced.

Digital games have proven their effectiveness in improving students' academic achievement in several subject domains, including math (Chang et al., 2009), language art (Chen, Liao, Chien, & Chan, 2011), software engineering (Connolly, Stansfield, & Hainey, 2007), medical education (Moreno-Ger, Burgos, Sierra, & Fernández-Manjón, 2008), and sports education (Mueller, Gibbs, Vetere, & Agamanolis, 2008). The major reason they are so effective might lie in the integration of various advanced technologies (e.g. multimedia, distributed computing, augmented reality) to offer educational opportunities in a learning-by-doing way. The students not only acquire abstract knowledge, but also have more opportunities to integrate what they have learned and what they have done, which, in turn, results in better learning outcomes.

Different perspectives on the application of digital games have been applied to maximize the potential of digital games for education, such as serious games (Abt, 1970), commercial off-the-shelf games (Sisler & Brom, 2008), and epistemic games (Shaffer, 2007). A common feature among these games lies in the shift from conceptual learning to experiential learning (Lee, 2010). Since digital games can involve students in a simulated situation that truly relates to their real-life learning experiences, such learning experiences might be helpful to their future learning transfer. However, although digital games have often been widely used in different subject domains, there have been relatively few studies investigating how digital games can help students learn in the domain of financial education. More specifically, digital games often consist of an economic system where users exchange virtual coins for game objects within the digital game, but such an economic system is seldom used as learning resources to help students learn financial management.

In addition, with the emergence of the global village and knowledge economy, financial education has recently attracted more attention, which has led to a trend of increasing opportunities for young students to learn the concept of financial management. Some studies have investigated this issue, but some of them failed either in the incompleteness of system development (Wu, Huang, Chen, Liao, & Chan, 2010) or the lack of behavior trace during learning activities (Wu, Wu, Yang, Chen, Huang, & Chan, 2010). On the other hand, digital games could represent an abstract concept into visualizable objects, which might attract children to interact with them, and further foster a better understanding. In such a vein, how digital games help young students improve

their learning in the financial literacy has become a significant research issue. In particular, since the ultimate goal of financial management is to facilitate the change of behaviors, this study regards learning as “the change of behaviors”, and aims to investigate the influences of digital games on students’ behaviors in financial management. By doing so, we could get a deeper understanding about the potentials and limitations of digital games for student learning, which could contribute to the research field of technology-enhanced learning.

To this end, a digital game system, My-Investment, is developed so that the following research questions could be addressed: (1) What are students’ management behaviors in the financial management game? (2) What are students’ behavior patterns in the financial management game? Specifically, we aim to develop a game-based environment, in which each student plays a responsible “master” to look after their virtual pets. Through eliciting students’ nature instincts of loving pets, students are encouraged to learn financial management well in the simulation game so that their pets could have happy lives. During this process, related financial management knowledge is also offered to help students learn in the game environment.

2. The My-Investment System

2.1. Conceptual model

In this study, the work-oriented model, which is regarded as having significance for the development of civilization and the building of society (Ransome, 2005), is used to develop the game structure to interweave digital games into financial management. This is because the work-oriented model contains an economic cycle (i.e. need, work, and investment), which could relate students’ consumption to their work, and, in turn, involves students to invest money for satisfying their pets’ needs. The conceptual model is illustrated in Figure 1.

Regarding the “need” component, since pets possess the trait of loyalty and exhibit simple, cute, and straightforward behaviors, it is natural for children to establish an emotional attachment to their real pets (Melson, 2001) or virtual pets (Chen, 2012;

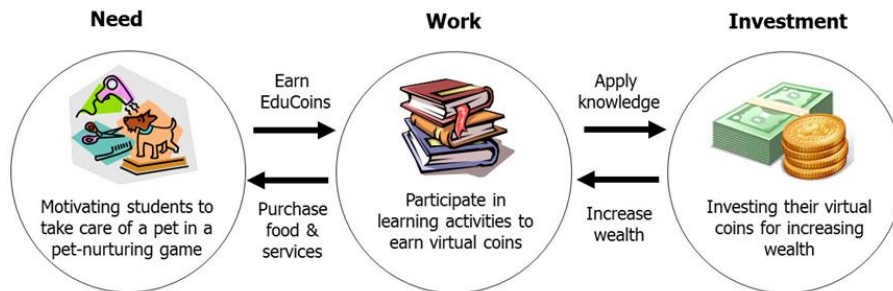


Figure 1. The conceptual diagram of work-oriented model.

Kusahara, 2000). Thus, a pet-nurturing game is developed in the component. However, to nurture the pet, the student needs to buy pet's food by EduCoin, which could be earned from the "work" component. In other words, we use EduCoin to bridge the "need" and "work" components.

Regarding the "work" component, the concept learning of financial management is regarded as a kind of work, where students can earn their salary. This is because work has a significant impact on people's beliefs, values, norms, positions, and wealth (Ransome, 2005). By doing so, this component might introduce incentives, such as earning rewards and good reputation, to the learning process, and students might develop a positive attitude toward learning.

Regarding the "investment" component, it designed to offer learning-by-doing opportunities for young students to experience what they have learned from the "work" component (i.e. concept learning of financial management). Young students tend to have little experience in investing large amounts of money, but digital games can bridge this gap within the simulated context of learning financial management, such as saving money in the bank, using a credit card to purchase goods, and investing money in the stock market.

2.2. System implementation

2.2.1. The "need" component: Creating a happy life for the pet

This component enables the students to keep a virtual pet, My-Pet, as happy and healthy as possible to enhance their participatory motivation. The short-term goal of the game is to look after the virtual pet and satisfy its basic needs, as shown in Figure 2(a). To satisfy the pet's needs, the student needs to earn virtual coins, hereafter referred to as EduCoins, with which to buy food, goods, and other services for the pets. More specifically, the attributes of the My-Pet, such as "energy", "mood", "health", and "experience" are the indices of its status. The student needs to observe these attributes and adjust their nurturing behaviors. For example, if the student observes a drop in the "energy" attribute of the pet, she/he can buy food to feed it. Similarly, the "mood", "health", and "experience" attributes can also be improved by buying associated goods at the virtual store, seeing a veterinarian at the virtual hospital, or exercising in the virtual park. Figure 2(b) shows a map of the virtual environment for the students to take good care of their pets.

In addition, the long-term goal of the game is to invest their EduCoin to have a wealthy life. In this system, a student's financial status is also represented by several indicators, such as "deposit", "cash", "credit card", and "stock." These indicators tell the students how their money is allocated. For example, the "credit card" indicator shows how much money they have spent using the credit card, and the "stock" indicator shows how much money they have invested in the stock market. These indicators improve the awareness of the students as to the composition of their property, which is the basis for adjusting their behaviors related to financial management.

Managing method Pet's status Total wealth Stock market Bank Pet' shop Learning center



Figure 2(a). Pet-keeping environment.



Figure 2(b). Map of the virtual environment.

2.2.2. The “work” component: Earning rewards from concept learning

Figure 3(a) illustrates the interface of the concept learning program in My-Investment, in which there are eleven units of learning materials for students to improve their financial management knowledge. These units, which are in the form of animation, are provided by the Citi-bank Corp. and are meant to help teach the students about the key concepts of financial management. For example, Figure 3(b) shows the user interface for the first unit “what you need and what you want.” In this unit, the students are taught to distinguish between needs and wants, both of which are regarded as two fundamental factors in financial management. Knowing the discrepancy is important because students can save or invest money only when they know the difference between the concepts of “requirement” and “luxury.” Other units include “where does money come from”, “save



Figure 3(a). Eleven units of the content.



Figure 3(b). An animation within one unit.

money in the bank”, “how to invest money,” and so forth.

To motivate the students to learn the key concepts about financial management, the learning activities are regarded as a kind of “work.” The students earn EduCoins as income, after passing the assessment for these learning activities. More specifically, the students can learn the concepts from the animations associated with the eleven units. Then they are assessed by answering multiple-choice questions. If the students can pass the assessment, they can obtain EduCoins as rewards.

2.2.3. The “investment” component: Applying what has been learned

My-Investment further allows the students to use EduCoins to increase their wealth. There are four major sub-components designed in this game, including bank, credit card, stock market, and note-taking. The students can save EduCoins in the bank to earn income from interest (see Figure 4(a)). They can also withdraw money as needed. The students can apply at the bank for a credit card with which they can buy food or goods for their pets. During the process, they learn about the appropriate use of a credit card such as not exceeding the credit limit, and how to maintain a good credit rating.

A virtual stock market offers another component, in which there are four stocks with different prices. As shown in Figure 4(b), the students can buy certain stocks from the stock market. They can earn EduCoins from the stock market, but they also might lose them. The design rationale for the stock market is not for teaching detailed market operations, but rather the concept of investment risk inherent in a stock market. The students are provided with a notebook for note-taking, and the system will automatically record money transactions. These records offer the students a reference to trace items and the amount of money earned or spent, which should be helpful in financial planning and management.

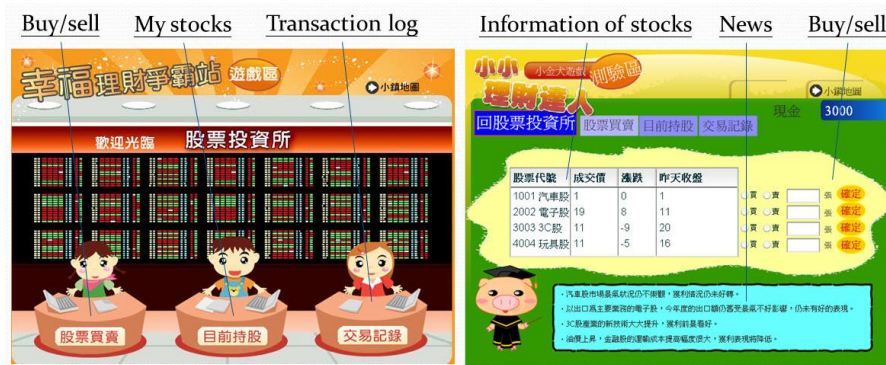


Figure 4(a). Snapshot of the bank.

Figure 4(b). Snapshot of the stock market.

3. Methodology

3.1. Participants

A case study was conducted to answer questions concerning the students' behavior patterns in the financial-management game. The participants of the case study were chosen from a suburban elementary school in Taiwan, where most students came from families with a middle or low level of socioeconomic status and had little experience in financial management. The school was selected because the findings from this case study could be widely applied to other schools. The participants were 29 fifth-grade students (aged 11 years old on average), including 16 males and 13 females.

3.2. System instruments

The My-Investment system was used as a system instrument to collect students' behaviors. Specifically, when the students login to the My-Investment system to use the three components, the system begins collecting data regarding students' behaviors in the system log. This way, further analysis can also be conducted afterward.

3.3. Procedure

Prior to using the My-Investment system, a 5-minute introduction session was conducted to explain how to use it, including the functions of shopping for/feeding their pets, saving/withdrawing money from bank, and buying/selling stocks on the market. In addition, to enhance the validity of the collected data, before the session, the students were told that they could freely use the My-Investment system so that they would interact with the system in a more natural way. Then, every student had four 50-minute usage sessions to use the My-Investment system in the school computer laboratory over the period of a month, during which their learning behaviors were recorded for later in-depth data analysis.

3.4. Data collection and analysis

During all of the usage sessions, the students' behaviors within the My-Investment were recorded as system logs for later in-depth data analysis. The collected data included the timestamps and specific behaviors, such as spending money in pet-raising, saving their money in the bank, and investing their money in the stock market.

Moreover, two levels of data analysis are used to obtain a comprehensive understanding of the students' management behaviors: macro-perspective and micro-perspective. The purpose of the macro-perspective aspect is to explore the overall students' behaviors and their learning tendencies during the four sessions. To this end, students' management methods were categorized into four different types according to how the students allocate their capital: (1) pet-raising, (2) cash-on-hand, (3) bank deposit, and (4) stock market. For example, if students invest most of their capital in pet-raising,

Table 1. The conditions for the behavior patterns.

Behavior pattern	Condition
Pet-dominant-investment	The majority of the money is in investment
No-investment	The majority of the money is in on-hand cash
Conservative-investment	(1)The majority of the money is in investment and (2)the money in the stock market < the money in the bank deposit
Moderate-investment	(1)The majority of the money is in investment and (2)the money in the stock market = the money in the bank deposit
Aggressive-investment	(1)The majority of the money is in investment and (2)the money in the stock market > the money in the bank deposit

their management methods are then categorized in the “pet-raising” type. This way, how all the students manage their money could be investigated.

In addition, the purpose of the micro-perspective aspect is to investigate the behavior pattern of each student. To this end, we further classified their behaviors into five behavior patterns according to the following conditions (see Table 1) in the final session (i.e. the fourth session). For example, if a student put the majority of her/his capital into investment and money in the stock market is larger than deposited in the bank, the behavior pattern of the student is then classified as the “aggressive-investment” type. In this way the investment strategies applied by each student in the learning environment could be further investigated.

3.5. Results

3.5.1. Macro-perspective: Overall students' behaviors and tendency

Table 2 illustrates how the students spent their virtual money in the four sessions. It is found that in session one, the pet-raising behavior (42%) dominates the four categories. In other words, most students spent the majority of their money in nurturing their pets. The result seemed to suggest that the virtual pets played the role of a motivator in the management game in this session. One possible reason is that virtual pets elicited an emotional response in the children (Kusahara, 2000). Thus, the students were willing to look after their virtual pets and spend money on them.

Table 2. How students spent their virtual money in the four sessions.

	Pet-raising	Cash-on-hand	Bank deposits	Stock market
Session 1	42%	23%	31%	4%
Session 2	17%	28%	49%	6%
Session 3	13%	17%	45%	25%
Session 4	6%	12%	35%	47%

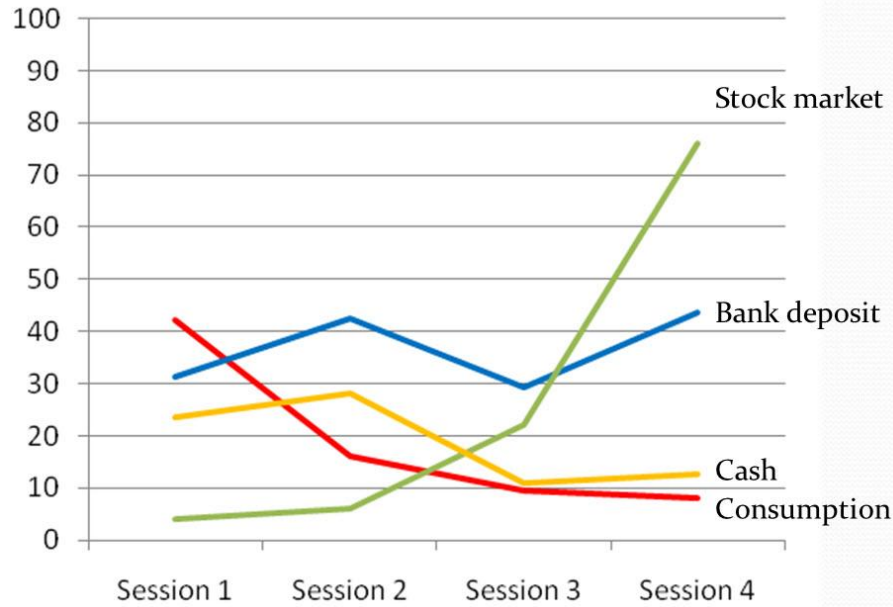


Figure 5. Trend of students' management behaviors in the four sessions.

In sessions two and three, there was an increase in the bank-deposit behavior as the dominant part of their capital (49% and 45%, respectively). The results indicated that in these sessions the students did not spend as much money on their pets as in session one. Instead, they started to deposit the money they earned in the bank. In other words, students attempted to adjust the allocation of their income and expenses. Saving their money in the bank to earn interest was the major motivation for the bank deposits. One possible explanation is that most of the students gradually realized that depositing money in the bank was a safer and more stable way to earn more money.

Finally, compared with the other sessions, the results for session four showed that the stock market (47%) became the major method for financial management. This indicates that the students not only chose a stable method (i.e. bank deposits), but also tried a more active method (i.e. stock market) to manage their money. One possible explanation is that the students tended to explore other methods to maximize their money when they had accumulated enough funds to invest in the stock market.

In short, Figure 5 illustrates a trend in the students' financial management behaviors: the amount of "pet-raising" (the red line) and "cash-on-hand" (the orange line) tends to decline, whereas "stock market" (the green line) tends to go up, while "bank deposit" (the blue line) seems to remain steady over the sessions. In general, students' behaviors seemed to be consisted with the two levels of goals. To achieve the short-term goal, students in the beginning spent much money in satisfying the needs of their pets.

Gradually, they had more and more money. The students kept a relatively large portion of their money in the bank, a stable method to save money. Then, the students changed their strategy. They decreased their allocation of cash, and tried to invest their money in the stock market, which is connected with the pursuing of the long-term goal (i.e. invest their EduCoin to have a wealthy life).

3.5.2. *Micro-perspective: Behavior patterns for individual student*

Table 3 illustrates the behavior patterns demonstrating how each student spent her/his money in session four. Several interesting results can be found. (1) First of all, even with the intervention of the My-Investment system, 41% (12 = 5+7) of the students did not show appropriate financial management behaviors in the end. Specifically, the five students showing the “pet-raising” pattern spent a large proportion of their money on their pets. They needed to learn how to reduce their expenses and save money, either by investment in the bank or in the stock market. In addition, the seven students demonstrating the “cash-on-hand” pattern did not acquire the core concept of financial management: properly allocating a suitable proportion of their money for investment. They kept too much cash on hand. They needed to learn how to redistribute their cash and utilize different investment strategies.

(2) Regarding the cases of successfully learning financial management, 59% (17 = 11+2+4) of the students did demonstrate better financial management behaviors, but most (n = 11) adopted a conservative-investment strategy, placing most of their money in the bank. In contrast, several students (n = 4) allocated most of their money to the stock market, i.e. adopting a more aggressive investment strategy as their major financial management method. Only two students (n = 2) used a more balanced strategy to manage their money. They kept some money on hand, saved some in the bank, and also invested some in the stock market.

(3) The gender difference showed that the boys were more likely to adopt a more aggressive strategy to invest their money. In contrast, the girls tended to use a more conservative strategy (n = 6), even keeping their money just in case (n = 5). In other words, the boys seemed to be more likely to take risks in stock investment than the girls. This finding implies that there are gender differences in financial management behaviors.

Table 3. Patterns of students spending in session four.

Patterns	# (boy:girl)	Students
Pet-raising	5 (1:4)	b15, g4, g5, g6, g8
Cash-on-hand	7 (2:5)	b7, b9, b13, b14, g1, g10, g11
Conservative-strategy	11 (5:6)	b2, b3, b4, b8, b10, g2, g3, g7, g9, g12, g13
Moderate-strategy	2 (2:0)	b5, b6
Aggressive-strategy	4 (4:0)	b1, b11, b12, b16

4. Suggestions for the Future Design of Management Games

4.1. Dynamically adjusting pedagogical strategies in game-based learning

The results of this study show that 41% of students showed no improvement in financial management behaviors—either spending too much money or keeping too much money as cash. This result stimulates reflection about re-thinking the pedagogical design of game-based learning environments learning how to balance the “experience” and “instruction” approaches. If the objective of financial management education is to facilitate the development of a balanced strategy, the learning environment should be designed to help students understand the benefits and possible risks of different investment methods. On one hand, it is better to let students “experience” these methods in a learning situation, instead of simply “telling” them abstract knowledge. On the other hand, a learning system should help the students who cannot acquire the correct management knowledge from the learning task. One possible way to take the two aspects into account is to make the game-based environment serve as a situated data-collector for understanding students’ management behaviors, and to further adjust the pedagogical strategy between “experience” and “instruction” strategies. This is because students’ behaviors collected from such an environment would be closer to those in authentic situations compared to other data collecting methods (e.g. paper-based questionnaires).

Moreover, such dynamic adjustment should not decrease students’ engagement in gameplay. This is because the affective aspect might have a great impact on students’ cognitive aspect (Pintrich & Schunk, 1996). An obvious feature of game-based learning is to immerse and engage students in an enhanced environment. From the perspective of the students, they are just playing a game rather than learning some skills. Their learning occurs naturally in efforts to accomplish the goal of the game-based environment. Once the cognitive design (e.g. dynamically adjusting among different pedagogical strategies) compromises the students’ affective perception (e.g. their immersion and engagement), the students’ behaviors might also be influenced. When both affective and cognitive aspects are included in the design, the students should have an enjoyable and effective learning experience, which is one of the ultimate goals in game-based learning.

4.2. Considering individual differences in game-based learning

The results of this study also showed that there were individual differences in their management behaviors although the overall investment behaviors tended to increase. For instance, some students tended to save money in the bank while others liked to keep it on hand as cash. This results gives rise a significant issue: How should we tackle the individual differences in a game-based environment? It has been suggested that this issue could be addressed by providing adaptive guidelines or individualized scaffoldings customized to different behaviors (Wolf, 2009). More specifically, what the students who spent too much money in pet-raising need to learn might be different from what those who saved a great deal of money in the bank. Similarly, this would differ from those who invested too much money in the stock market. What students need might be quite

different. Thus, future work involves continual improvement of such a system as an adaptive game-based learning environment according to individual differences.

There are two reasons supporting the utilization of adaptive guidelines or individualized scaffoldings in the design of a game-based financial management system. First, it is easier to collect data when situations are closer to authentic situations through seamlessly embedding the relevant diagnostic mechanisms into the game-based environments. This collected data can further become a key reference for system interactions and feedback. Second, digital games with adaptive guidelines or individualized scaffoldings might also have enhanced capabilities to engage the students. Matching the student's ability with the level of task difficulty could be helpful for an optimal engagement experience (Csikszentmihalyi, 1990). Individualized technologies emphasize the adjustment of system reactions according to the student's status, which facilitates the matching between ability and the difficulty of a task.

5. Conclusions

The research questions examined in this study are (1) What are students' management behaviors in the financial management game? and (2) What are students' behavior patterns in the financial management game? Regarding the first question, the findings from this study reveal that the students tended to keep relatively large portions of their money in the bank, which is often considered a more stable method to save money. In addition, they gradually decreased their cash on hand and spending, and placed more money in the stock market, a more aggressive way to invest their money.

Regarding the second question, the findings indicated that 41% of the students did not demonstrate the expected financial management behaviors, whereas 59% of the students did, although most of them still held to the conservative-strategy. In addition, the findings also suggested a gender difference with boys being likely more willing to take risks in financial management than girls.

However, due to the limitations of this work, some further studies are required. First, this study investigates student behaviors in four 50-minute sessions over the period of a month, but this is still a short-term study. The long-term effects are unclear and should be addressed in future. Second, in this study the influences of the system were evaluated through the quantitative analysis of students' behaviors. More research approaches (e.g. interview, questionnaire, observation, etc.) and multiple resources should be also used to obtain a more comprehensive understanding of the impacts of such a game-based learning system.

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