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A DIGITAL GAME FOR INTERNATIONAL STUDENTS' ADJUSTMENT

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ABSTRACT

Although digital games have been developed for various subject areas, little attention has been focused on using digital games to address international students' adjustment issues. For this reason, this paper endeavors to explore the use of a digital game in facilitating international students acquire adjustment-related information. Specifically, the objectives of this paper are twofold. One, it seeks to introduce a digital game called Digital Game for International Student Training (DGIST) which is intended to satisfy important aspects of international students' information needs through fun. Two, it seeks to perform a preliminary evaluation of DGIST in terms of its efficacy in helping international students acquire adjustment-related information through a before-and-after with control experimental design. A total of 80 participants were involved in the study. Despite a few shortcomings, the results for DGIST appeared to be promising. Statistical analyses confirmed that DGIST was more effective in helping students acquire adjustment-related information than the paper-based document. This paper concludes with some limitations and suggests a few areas for further research.

KEYWORDS

Information need, adjustment, fun, gameplay, international student

1. INTRODUCTION

One of the outcomes of globalization today is the growing number of international students who are keen to gain knowledge and professional skills in different countries. Although studying in a cross-cultural setting may be valuable, international students may experience challenges and acculturative stress in adjusting to the new environment (Poyrazli and Grahame, 2007). Consequently, the feelings of confusion, anxiety, sense of loss and isolation may arise. If not managed properly, international students' academic success, social well-being and psychological health could be in jeopardy (Hechanova-Alampay et al., 2002).

Challenges associated with adjustment faced by international students could be mitigated using digital games. Exerting positive effects on understanding, learning and practicing new knowledge, it is no surprise that digital games have been increasingly deployed for pedagogical purposes (Gee, 2003). By infusing the element of enjoyment, the barrier to learning is lowered (Li et al., 2013; Prensky, 2001). Although digital games have been developed for various subject areas ranging from information systems (Martin, 2000) to second language learning (Kongmee, et al., 2011), little attention, both in terms of research and practice, has been focused on using digital games to address international students' adjustment issues. For this reason, this paper endeavors to explore the use of a digital game in facilitating international students acquire adjustment-related information. Specifically, the objectives of this paper are twofold. One, it seeks to introduce a digital game called Digital Game for International Student Training (DGIST) which is intended to satisfy important aspects of international students' information needs through fun. Two, it seeks to perform a preliminary evaluation of DGIST in terms of its efficacy in helping international students acquire adjustment-related information. The evaluation was conducted using a before-and-after with control experimental design.

The rest of the paper is structured as follows. Section 2 describes a literature review on international students' adjustment issues and their corresponding information needs. In addition, the fun aspects to make a digital game enjoyable are reviewed. Section 3 explains the design overview of DGIST which is built on the literature described earlier. The research methodology and the evaluation process of the game are presented in section 4. The results of the evaluation are reported in Section 5 while insights drawn from evaluation are highlighted in Section 6. Finally, section 7 concludes the paper with a note for future research directions.

2. LITERATURE REVIEW

2.1 International Students' Adjustment Issues

As the demand for oversea education increases, issues related to intercontinental adjustment come to be fore (Tseng and Newton, 2002). Studying in a foreign country and experiencing sharp changes in culture, language and the surrounding environment may cause acculturative stress and adjustment problems. Extant literature suggests at least four categories of adjustment issues, namely, preliminary needs, cultural, educational and psychological challenges.

When international students move to another country, they may face some difficulties in satisfying their preliminary needs, such as finding a suitable accommodation, applying for social security ID, learning how to use transportation system, adapting to local food and being familiar with campus. If these basic information needs remain unaddressed upon arrival, international students will likely be stressed (Hechanova-Alampay et al., 2002). To deal with these preliminary adjustment problems researchers suggest different methods including a tour of the campus, orientation program, interacting with other senior overseas compatriot students (Poyrazli and Grahame, 2007) and expanding individual world view (Tseng and Newton, 2002).

Cultural differences are one of the most significant adjustment challenges for international students (Zhai, 2004). In particular, unfamiliarity with cultural references, idioms, sarcasm, slang and missing cultural specific cues, such as verbal and non-verbal messages affect overseas students' tendency to seek out social interaction in the host culture (Olivas and Li, 2006). An effective way to overcome these issues is to connect to the host people or participate in their cultural activities (Tseng and Newton, 2002). Creating social interaction with local students is another way to foster cultural adaption. In parallel, international students who positively adjust should be encouraged to offer help to new incomers (Olivas and Li, 2006).

Although academic systems are fairly comparable all over the world, they are not completely identical (Ridley, 2004). Conceivably, international students in their first year of study face more educational challenges than their local counter-parts (Zhao et al., 2005). Furthermore, language barrier in the academic environment can aggravate the situation. International students can overcome these educational challenges by asking for help from other students or faculty (Tseng and Newton, 2002). Also, the role of orientation programs in transferring university information should not be ignored.

International students experience some inevitable psychological challenges such as acculturative stress, homesickness, loneliness, frustration, depression or isolation and feelings of worthlessness (Olivas and Li, 2006; Tseng and Newton, 2002). Since they are far from their family and friends, they experience less social support vis-à-vis local students (Hechanova-Alampay et al., 2002). Communicating with other students and creating a social network may mitigate their need for social support (Poyrazli and Grahame, 2007).

2.2 Fun Principles in Digital Games

Games are a subset of play and fun (Prensky, 2001). People play games because they are seeking fun (Bartle, 2004). As an organized play, digital games not only offer enjoyment but could be used to heighten the motivation for learning and improve academic achievement (Kebritchia, et al., 2010).

To unravel the amorphous concept of fun in digital games, a theoretical framework which comprises three main factors, namely, immersion, challenges and social interaction has been developed as shown in Table 1. Each of these factors comprises overlapping sub-factors.

Immersion refers to the extent to which a player is engaged with a game (McMahan, 2003). Factors that lead to immersion include deep involvement, emotion and control. *Deep involvement* is a psychological state

that occurs when the related set of activities or events in the game are solely in focus (Witmer and Singer, 1998). Players become oblivious to their surrounding (Johnson and Wiles, 2003; Brown and Cairns, 2004), and lose their sense of time and concern over everyday life (Klug and Schell, 2006). Yet, involvement is crucial for learning. It can be used to transfer knowledge and information efficiently (Csikszentmihalyi, 1990). The other factor that leads to immersion is *emotion.* Players could sometimes be emotionally affected by their progress in the game (Brown and Cairns, 2004). Narration, sound (Sweetser and Johnson 2004) and features of fantasy (Li et al., 2013) are elements that endear players to the game. Furthermore, immersion is not achievable unless players have appropriate *control* over the game. The game control should be simple to learn and easily customizable (Gee, 2003; Johnson and Wiles 2003).

Challenge refers to the differential between a player's skills and the current demands imposed by the game. Existence of a variety of difficulty levels, clear goals and appropriate rewards are necessary ingredients for a game to be deemed challenging. Games' *difficulty levels* should be varied and gradually increased based on players' development to keep their interest. Appropriate pacing is required to keep the players engaged (Pagulayan et al., 2003). Furthermore, completing difficult tasks and surpassing opponents satisfy the players and lead to pleasure and a sense of accomplishment (Vorderer et al., 2003; Poyrazli and Grahame, 2007; Lazzaro, 2009). Also, each level of game should have its own clear *goals* (Csikszentmihalyi, 1990; Pagulayan et al., 2003). Moreover, players must be *rewarded* sufficiently and equitably to their expended effort to sustain their interest in the game (Pagulayan et al., 2003; Brown and Cairns, 2004).

Social interaction is another factor that contributes to fun. In the context of a game, social interaction takes the form of *competition, cooperation* and *connection* (Lazzaro, 2009), each of which caters to a different player profile. Players with a strong desire to win or hinder other players from winning will find competitive elements in the game gratifying (Brathwaite and Schreiber, 2008). Players who prefer to work together to improve their standing in the game will find cooperative elements appealing (Salen and Zimmerman, 2004). Players who engage in a game not solely for gameplay but for social reasons likely to enjoy the connection forged with fellow players both inside and outside of the game (Lazzaro, 2009).

Table 1. Fun framework

Fun factors	Dimensions	Description
Immersion	Deep involvement	▪ Psychological state happened by focusing (Witmer and Singer, 1998) ▪ Oblivious to their surrounding environment (Johnson and Wiles, 2003; Brown and Cairns, 2004) ▪ Loss concern without effort (Klug and Schell, 2006)
	Emotion	▪ Affected by the player progress in the game (Brown and Cairns, 2004) ▪ Affected by narration, sound (Sweetser and Johnson, 2004) and features of fantasy (Li et al., 2013)
	Control	▪ Basic controls features (Gee, 2003; Johnson and Wiles, 2003) ▪ Easily customizable (Gee, 2003; Johnson and Wiles, 2003)
Challenges	Difficulty level	▪ Different challenges' level based on player progress (Pagulayan et al., 2003) ▪ New challenges at an appropriate Pace (Pagulayan et al., 2003) ▪ Satisfaction from accomplishing difficult level and surpassing opponents (Vorderer et al., 2003; Poyrazli and Grahame, 2007; Lazzaro, 2009)
	Goals	▪ Clear goals (Csikszentmihalyi, 1990; Pagulayan et al., 2003) ▪ Multiple goals in each level (Csikszentmihalyi, 1990; Pagulayan et al., 2003)
	Rewards	▪ Efforts should be rewarded (Brown & Cairns 2004; Pagulayan et al., 2003) ▪ Encourage players to continue (Brown and Cairns, 2004; Pagulayan et al., 2003)
Social interaction	Competition	▪ Some players enjoy fighting and beating each other (Lazzaro, 2009) ▪ It is an effective motivation to continue playing (Brathwaite and Schreiber, 2008)
	Cooperation	▪ Emphasize is on fun rather than competition (Salen and Zimmerman, 2004) ▪ Work toghether to improve their standing in the game (Salen and Zimmerman, 2004)
	Connection	▪ Some players play not solely for gameplay but for social reasons (Lazzaro, 2004) ▪ Social connection inside and outside the game (Lazzaro, 2009)

3. DGIST – DESIGN OVERVIEW

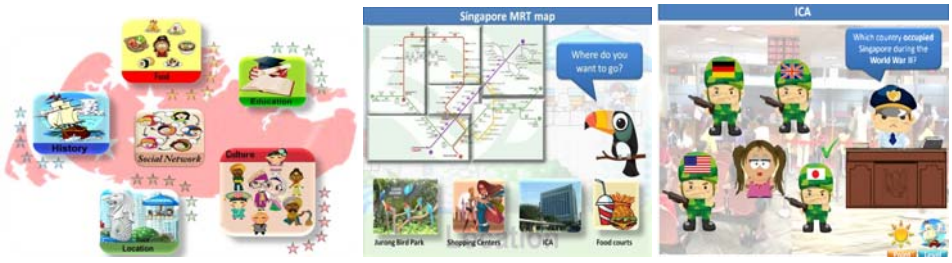
DGIST (Digital Game for International Student Training) is a desktop online multiplayer game built on design principles related to international students' information needs and the fun aspects of games. It is designed to combine learning and entertainment. The scenario of DGIST is the story of an international student (represented by an avatar) who comes to a host country (Singapore) to study at a local university. During this journey, the avatar is required to navigate in a virtual environment to acquire adjustment's information.

The main goal of DGIST is to facilitate international students acquire adjustment-related information through fun. The game features six different spaces, namely, Location, Food, History, Culture, Education and Social Networking. These spaces are intended to meet the four adjustment-related information needs, as shown in Table 2.

Table 2. Spaces in DGIST

Spaces in DGIST	Description	Adjustment-related information needs
Location	▪ Introduces important locations ▪ Shows the way they can be reached	Preliminary Needs
Food	▪ Introduces local food and drinks ▪ Teaches how to prepare local foods and drinks	
History	▪ Offers Singapore historical information by narration ▪ Asks historical questions	Cultural Needs
Culture	▪ Introduces some aspects of Chinese, Indian and Malay cultures ▪ Introduces some local idiom and phrases	
Education	▪ Introduces the local university facilities and rules	Educational needs
Social Networking	▪ Allows virtual clubs to be created ▪ Supports connection via chatting tool or bilboard ▪ Allows competition and cooperation in virtual clubs	Psychological needs

Difficulty level of each space is increased gradually based on the progress of the player. Figure 1 shows some screen shots of DGIST. A brief description of each space is as follows.



(a) (b) (c)

Figure. 1. (a) DGIST's main menu (b) Jigsaw Puzzle in *Location* space (c) Question/answer in *History* space

The DGIST's *Location* space is designed to familiarize players with important locations in Singapore and how they can reach there. In this space players are presented with a set of Jigsaw puzzles and question/answer games. For example, to learn how to get to the Immigration & Checkpoint Authority (ICA), players solve the Mass Rapid Transit (MRT) jigsaw puzzle to know where the nearest MRT station to ICA is.

To make international students familiar with the host country's food, DGIST introduces some local food and drinks. In *Food* space, players learn how to prepare local food and drinks by selecting their ingredients and adding them to pot or solving word puzzle to be acquainted with the names of local food.

History space offers Singapore's historical information through narration and question/answer game. For instance, though having a student's pass is essential for international students to stay in Singapore; the player is guided how to get it via narration. He/she should find out where to go and answers historical question to gain enough points and get the student pass as a reward.

Singapore is a multi-racial society which comprises three distinct ethnic groups: Chinese, Indian and Malay. In the DGIST's *Culture* space, players become familiarize with some salient aspects of these three cultures, for instance the appropriate form of greeting or gift-giving. Although English is the official language in Singapore, some idiom and phrases used locally are derived from Chinese or Malay languages. The most common use of these phrases and their meaning are also covered in *Culture* space. In addition, since DGIST was designed for a local university, specific university's facilities and rules are introduced in *Educational* space.

Social interaction during the gameplay is facilitated through chatting and virtual communities. New players are required to enter some information such as program of study and nationality. Thereafter, players can create a virtual club and named it based on their countries or program of study to make a domicile for others with similar profiles. DGIST's virtual clubs serve as a social platform that allows students to plan activities in its virtual environment or in the real world. For instance, club members can set an online chess competition or arrange playing basketball at weekend in the school's court. All club members can create preferred event on the billboard while others can add further comments on these events. Players can register in different clubs. To encourage the expansion of social networks, DGIST allocates points for inviting friends to the clubs. Each club shows its online and offline members.

Mentioned earlier, the fun framework is considered in the design of DGIST to make it entertaining. For instance, jigsaw puzzle game, question/answer, cooperation and competition in virtual clubs have been incorporated into DGIST to create an immersive experience for players. Narration and sound effects are used as features to influence emotion. Also, DGIST offers the sense of control by letting players choose their avatars, the activities they prefer to be involved in their virtual club and the part of the game they want to proceed.

Challenges, another factor, is achieved in DGIST by defining different levels of difficulty with various goals in each space. For example, in the basic level question/answer game offers multiple choices while in more advanced level, players are required to submit their answers in free-text format. Also, rewards players receive in DGIST commesurate with the different levels of difficulty.

Based on the fun framework social interaction is another key element that leads to enjoyment in the game. *Social Network* space of DGIST is designed for this reason, and its chatting tool and virtual clubs with bilboards are used to create competition, cooperation and social connection between players. Table 3 illustrates how fun factors have been incorporated into DGIST.

Table 3. Fun framework & corresponding DGIST features

Fun factors	Dimensions	DGIST's Features
Immersion	▪ Deep involvement ▪ Emotion ▪ Control	▪ Puzzle game, question/answer, cooperation/ competition in virtual clubs ▪ Narration and sound effects ▪ Choosing avatars, activities in virtual club, ingame navigation
Challenges	▪ Difficulty level ▪ Goals ▪ Rewards	▪ Different levels of challenges that increased gradually ▪ Various goals in each level ▪ Specific rewards that are designed for each level.
Social interaction	▪ Competition ▪ Cooperation ▪ Connection	▪ Chatting tool ▪ Virtual clubs ▪ Bilboards

4. METHODOLOGY

A total of 80 graduate international students in a local university in Singapore were invited as part of the study. With an average age of 26 years old, all had arrived in Singapore for less than a year. They came from nine countries, including China, India, Iran, Spain, Italy, Sweden, Indonesia, Kazakhstan and Myanmar.

Before-and-After with control experimental design was used to evaluate the effectiveness of DGIST (Kothari, 2004). The 80 participants were randomly and equally divided into the control and experimental group. In the pre-test, all 80 participants in both groups were asked to answer a questionnaire which comprises 39 multiple-choice questions about Singapore's location, food, history, culture as well as University's rules and facilities. All questions have only one correct answer. The purpose of the pre-test was to assess participants' familiarity with adjustment-related information before treatment.

Thereafter, during the treatment phase, participants in the control group were given a six pages paper-based document which contained a combination of text and images, not unlike a typical travel guidebook. It includes the required information to answer all the questions in the questionnaire. In contrast, participants in the experimental group played DGIST to acquire the same information. Based on a pilot study which was done before post-test, five minutes was deemed sufficient to scan the document or play DGIST. Thus, the treatment phase lasted for five minutes for all participants to ensure that both groups were exposed to similar conditions in the study (Kothari, 2004).

In the post-test, participants in both groups were requested to revisit the questionnaire, and amend any answers they felt to be erroneous. However, control group participants were not allowed to refer back to the paper-based document while experimental group participants were denied access to DGIST. To differentiate markings made during the pre-test and the post-test, participants used a different colored pen. To capture participants' experiences from the control and experimental group, qualitative feedback was collected via face-to-face interviews. Specifically, participants were asked how they were able to retain adjustment-related information and what improvement could be made to enhance the acquisition of such information.

To compare the effectiveness between the paper-based document and DGIST in helping participants acquire adjustment-related information, the paired t-test was used to check for any differences between the improvements of the two groups.

5. RESULTS AND DISCUSSION

5.1 Analysis of Pre-Test and Post-Test Scores

Scores obtained from all participants were normalized to 100 for easy computation. In the pre-test, the mean score of the control group was 44.29 ± 13.24 and that for the experimental group was 44.35 ± 13.99 At 5% level of significance, there was no statistical difference between the two group. This means that participants in both groups were comparable in terms of their knowledge on adjustment-related information.

In the post-test, the control group obtained a mean score of 57.88 ± 15.78 points. The mean improvement is 13.59 ± 8.33. At 5% level of significance, the pre-test scores and the post-test scores of the control group were found to have unequal variances ($t(39)=10.31$, $p < 0.001$). This indicates that the paper-based document had been effective in helping participants in the control group acquire adjustment-related information.

The experimental group, however, obtained a markedly higher mean score of 84.16 ± 12.03 in the post-test. The mean improvement is 39.81±12.48. At 5% level of significance, the pre-test scores and the post-test scores of the experimental group were found to have unequal variances ($t(39)=20.15$, $p < 0.001$). This indicates that DGIST had been effective in the experimental group to acquire adjustment-related information.

To compare the efficiency of document and game based training, the improvements in scores of all participants in each group were evaluated. The mean of this improvement in control group is 13.59 and in experimental group it is 39.81. At 5% level of significance, the improvement scores between the control group and that of the experimental group were found to have unequal variances ($t(78)=11.95$, $p < 0.001$). This shows that the effectiveness of the two approaches is significantly different. In particular, DGIST appeared to be more effective compared to the paper-based document approach in helping international students acquire adjustment-related information.

5.2 Qualitative Feedback from Participants

Fun could be one of the features of DGIST that contributed to its effectiveness. The participants in experimental group were able to acquire information easily through gameplay. For example, Participant 1 indicated that "*it was helpful and fun, I won't forget the information I learned and it was much better than reading stuff*". Moreover, social interaction in DGIST is the way of overcoming psychological challenges. Participant 10 mentioned that "*being part of the DGIST's virtual communities helps to create sense of belongingness*". The graphic, sound effects and fun aspects of DGIST enabled players to be deeply involved in the game. For example, Participant 28 smiled after he saw the Malay lady character in *Culture* space and commented that "*this cute Malay lady helps me to distinguish Malay women easier*".

When asked what improvements could be made to DGIST, a few suggestions were made. For instance, some players mentioned that after they acquired information on DGIST, they were less motivated to persist in the game. In particular, Participant 15 mentioned that *"I wish to see different questions each time I play question/answer game"*. This was due to the limited set of questions/answer at each level of difficulty in DGIST. Next, players suggested that DGIST be deployed as a mobile game. Participant 35 indicated *"I want to have DGIST on my mobile devices to play it while I am on the way to school"*. Another suggestion was to allow for greater interaction among players during gameplay. Participant 17 mentioned that *"I wish I could input comments in each space and share my experiences about how to answer questions and do puzzles with my friends"*.

While the document-based method was also effective in helping participants acquire adjustment-related information, it may be difficult to sustain attention from participants. Most of the participants in control group showed little interest to read the document and found it boring. For instance, Participant 48 said "*this document reminds me of my exam days*". When asked on the improvements to be made to enhance information acquisition, participants were generally averse to the use of paper-based document. In fact, as digital devices become ubiquitous, using a paper-based document was considered a nightmare. Participant 61 commented that "*I really miss Ctr+F function key*".

Thus, although both paper-based document and DGIST could be used for adjustment-related information acquisition, the latter was found to be more effective. In particular, the entertainment features in DGIST not only sustained participants' interests, but contributed to better information retention.

6. CONCLUSION

To help international students cope with adjustment issues, this paper seeks a two-fold objectives. The first is to introduce DGIST as a means to satisfy important aspects of international students' information needs through fun. The second is to perform a preliminary evaluation of DGIST in terms of its efficacy in helping international students acquire adjustment-related information. To address the first objective, DGIST was developed on the basis of the literature. The game features six different spaces, namely, Location, Food, History, Culture, Education and Social Networking, which are intended to meet the preliminary needs, cultural needs, educational needs and psychological needs of international students. To address the second objective, a before-and-after with control experimental design was used to compare the efficacy between DGIST and a paper-based document. A total of 80 participants were involved in the study. Despite a few shortcomings, the results for DGIST appeared promising. Statistical analyses confirmed that DGIST was more effective in helping students acquire adjustment-related information than the paper-based document.

Nonetheless, some limitations should be acknowledged in this study. First, the findings must be interpreted in light of the limited sample size of 80 participants. The second limitation is related to DGIST. Its design was confined to Singapore's culture and one of its local universities. Thus, it is only applicable to a specific context.

Therefore, expanding the number of participants and inviting more international students from different universities can be considered as a future work to make the results more reliable. The other possible extension to the current work is to broaden DGIST's design to cover more cultures and educational rules. In addition, knowledge sharing functionalities can be incorporated into DGIST to encourage players to be more helpful and interactive. Also, increasing the complexity of the game and adapt it based on players proficiency level will be considered as a future work to make it more attractive for players.

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