Mobile Interactive *DaMath* Game for Basic Numeracy Exercise

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Abstract: *DaMath* is an educational game that embodies the concept of a local strategic game, dama, combined with mathematics, by adding computational values on its chips. This game has been promoted in the Philippines to be a collaborative endeavor in increasing the awareness of learning mathematics especially on students. However, certain game requirements like board, chips and counter player are a hindrance to game portability and easy accessibility. Mobile gaming technology satisfies much of the matter and to back it up, the percentage of mobile phone users is significantly increasing every day. The application had been found functional as a whole and served its purpose insofar as eliminating the hassles of having to carry around the game's board and chips.

Keywords: Interactive, Mobile Game, Numeracy, DaMath

1. Introduction

Learning basic mathematical concepts and skills should be fun and exciting rather than a tedious task for the students. In the Philippines, a board game known as *DaMath* was created by Jesus Huenda in late 1970s due to his difficulties in teaching students math basics. His aim was to transform mathematics into an enjoyable and educational subject for the students. The game has become a highly addictive game in the country and the inventor received a presidential merit award for his educational project [1]. The local game has been widely promoted in schools nationwide for it was seen to be a good training material in the field of mathematics. *DaMath* is composed of chips, which signifies numbers, and a board similar to chess but with the basic mathematical symbols in it. The invention of *DaMath* contributed techniques for educators to improve numeracy skills among students, specifically on primary and secondary education.

With the recent advancement of technology, the use of mobile phones has increased significantly. And with the capabilities of current mobile phones, issues related to portability and accessibility of the conventional *DaMath* game has been addressed. To play the game, a player needs a *DaMath* board, chips and an opposing player, which may not be readily available at all times. Making *DaMath* a mobile game could provide the players with mobility, accessibility and ease of use to boost the interest of today's youngsters. In this paper, we present the mobile interactive *DaMath* game, which can be played by the students through their mobile phones.

2. Background of the Study

Being aware of the impact of mobile technology on today's generation will push us to find ways to incorporate learning and training on what the present youth take pleasure in, which are the games they play.

Students nowadays are no longer the youth our educational system was designed to teach [2]. The 21st century students have been introduced to technologies which provide education type of entertainment. One evident example is the integration of learning with gaming. By making learning fun, it motivates students and helps them to pay attention and stay focused on the subject. The success of game-based learning strategies owes to active participation and interaction being at the center of the experience, and signals that current educational methods are not engaging students enough[3]. The benefits of effective use of game-based learning are considerable, but as studies have shown use is often most effective with particular learners who enjoy learning with games [4][5]. Moreover, mobile devices have been used in both learning and gaming. Mobile learning calls for 'environment and time independent pedagogy', informal and spontaneous, and lends itself to situated learning in real-life settings[6].In *Augmented Learning*, Eric Klopfer describes the largely untapped potential of mobile learning games—games played on such handheld devices to make a substantial impact on learning. Klopfer argues that the strengths of the mobile platform—its portability, context sensitivity, connectivity, and ubiquity—make it ideal for learning games in elementary, secondary, university, and lifelong education[7].

The implementation of *DaMath* game for mobile phones could provide mobility, broad-reach ability, ubiquity, convenience and localization.

3. Implementation

The interactive mobile *DaMath* game was developed using Java™ 2 Platform, Micro Edition (J2ME™), Connected Limited Device Configuration (CLDC) 1.1, and Mobile Information Device Profile (MIDP) 2.0, which was initially developed to support Nokia Series 40 and is now also compatible with Nokia Series 60 mobile phones. In addition, the game uses Java API for Bluetooth (JSR-82) to enable the needed Bluetooth connectivity function for the application. The game was compiled, ran, and tested with the Sun Java Wireless Toolkit 2.5.2 emulator, before it was loaded and installed to mobile phones.

With the conventional DaMath game, an opponent may not be available at all times. In the mobile version, an AI component was created to allow single player or standalone mode. The AI design of the DaMath game implemented alpha-beta pruning procedure in Minimax algorithm to improve the efficacy of search of two-player game. In the case of two players, the user can play with a human opponent provided that both have the game installed in their respective mobile phones and are connected via Bluetooth connection.

4. Results and Discussions

A mobile interactive *DaMath* game was developed to further support mobile game-learning environment. The mobile version of the game allows students to play *DaMath* anytime and anywhere with an AI opponent or with another human opponent through Bluetooth connection. The mobile version of *DaMath* was tested by few elementary students. The students enjoyed playing with the AI opponent than with other human opponent. Like the conventional game, students aimed at getting the higher point over the AI opponent by carefully selecting a chip to move. In this game, capturing the opponent's dama chips is

strategically planned such that a player would target a chip representing high number. The game becomes a combination of strategic higher order thinking skills and basic mathematical operations [1]. According to the students, they enjoyed playing the game because it's in a mobile environment but with same set of original rules except for the game's time duration which is reduced to 10 minutes from 20 minutes. The game's GUI received a satisfactory rating though there were recommendations presented with regards to the navigation of chips. In terms of game duration, game flow and over-all fun, users found the game satisfactorily enjoyable and effective as a whole. Figure 1 shows a screenshot of the game.
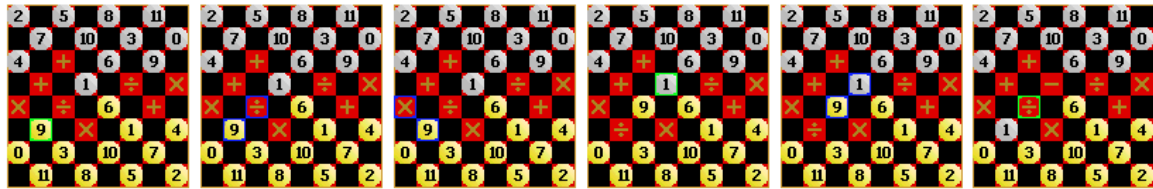

Figure 1—*left to right*. (a) Current chip with green selection indicator; (b) and (c) Active chip with blue indicator, ready to move to the right or left diagonal position; (d) Opponent's current chip with green selection indicator; (e) Opponent's active chip with blue indicator, ready to tackle; (f) Yellow chip has been tackled.

5. Conclusion & Recommendations

Mobile implementation is an effective way to address portability and mobility of the *DaMath* game as well as making it an easy and appealing tool for training and learning mathematics. The evaluation on its efficacy was not determined during the study, however, the development of it mobile version will highly benefit the students as the game can be accessible at all times. For further studies, the game will be improved to provide specific features that will increase player's experience with *DaMath* game (e.g. hints, best moves) and user-interface interaction.

Acknowledgements

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