GeoplanoMob: an educational mobile game for Mathematics

Erisvaldo G. Saraiva Júnior[1], Liliane S. Machado[2], Ronei M. Moraes[3] and Rogéria G. Rego[4]

[1] Federal University of Paraiba, Brazil, erisvaldojunior@gmail.com
[2] Federal University of Paraiba, Brazil, liliane@di.ufpb.br
[3] Federal University of Paraiba, Brazil, ronei@de.ufpb.br
[4] Federal University of Paraiba, Brazil, rogeria@mat.ufpb.br

Abstract: GeoplanoMob is an educational mobile game whose purpose is to enhance the knowledge of Euclidian geometry for primary education students. It was based on the game Geoplano, developed by Caleb Gattegno in 1961. The player's goal is to solve the tasks given by a character named Geoboy. The tasks consist on drawing polygons whose areas or perimeters must fit in the values provided by two dice. The game was developed in order to entertain and motivate students and to fix concepts outside the school environment.

Keywords: Geoplano, educational games, mobile games, Mathematics education.

1. Game Conception and Development

Educational games are learning activities that involve competition and are governed by rules (Amory, 2001). They are important since they can expand the frontiers of pedagogical activities and add fun in the student learning process. In this context, the main goal of the teaching process is the significant learning, which means that the learning material should make sense for the student. This happens when a new information is based on relevant concepts of student cognitive structure (Bievenue et al., 1995).

Geoplano was created in 1961 by Dr. Caleb Gattegno as a didactic resource for the practice of Euclidean geometry concepts, teaching of fractions and other related purposes. The game is composed by a board made with wood, usually presented in a square form. In this board are inserted pins or nails that can be connected with elastics to allow the formation of plane figures. Each board is dedicated to study specific concepts related to planar geometry. Thus, a small

board can be used to learn how to work with units to draw shapes and a larger board can be used to learn plan shapes and their localization in quadrants.

GeoplanoMob is a game for mobile devices. It consists on various tasks of Geoplano, given by the Geoboy character, that must be completed in a certain amount of time. As the Euclidean Geometry is quite wide and there is a great amount of geometric polygons, it was decided to separate polygon types in modules and a module of quadrilaterals was chosen for the first version of the game. In the quadrilaterals module the student can use squares and rectangles to perform required tasks. Then, the tasks include draw figures in a mesh, according to instruction provided by the character. Activities related to area and perimeter are examples of features that can be explored. It explores the same educational content and tasks of the Geoplano game developed by Moraes et al. (2008).

To keep the game challenging and fun, the items added to the game were the time, a score and the character. The time is calculated based on the difficulty level of the task and tends to become ever smaller. Thus, each task has a maximum time to be completed. The score is a feature that encourages the player to continue in order to achieve better results. After completing each task, the player receives points based on the difficulty of task and the remaining time. When achieve a good score, the player will be asked to save his result in a top score list.

The present version of GeoplanoMob has four tasks that work the concepts of area and perimeter of quadrilaterals. Each task has as request: time to complete the task, a value given by dice and a method for verifying its accuracy. The results can be seen by screenshots in Figure 1. For a better understanding, the images have a logical sequence, giving a more concrete vision of the game: 1) The open screen is showed; 2) The player receives a task from the character; 3) The player is taken to the Mesh screen, which will have a given time to fulfill the task. After finishing the move, the system checks whether it is correct. If it is not, the player is driven to the 4) Negative Screen. If the move was correct, the player receives a Positive Screen and goes back to the Tasks screen, advancing to the next task and restarting the cycle. After four tasks, the difficulty level is increased, reducing the time to move gradually, so, in a given moment, the player can no longer move; 5) If the move was wrong, the player score is verified. If it's among the top three in database, the game system asks for the player name. Then, shows the scores table with the three highest scores in the database. As it's not possible to get an idea about the character's animations from the screens. Then, Figure 2 presents some pictures that show all character frames, for positive and negative screens.

2. Conclusion

Preliminary tests were conducted with teachers and educators, who answered a satisfaction questionnaire after playing GeoplanoMob. One unanimous response

was that the mobile version is attractive and explores the interest of mobile phones by children. Another observation is that all teachers emphasized the importance of this type of game for the educational process. Although the tests are not finished, the first questionnaires provided a first feedback of the game. It's expected that GeoplanoMob could be recognized as a useful tool for the Geometry teaching. For this, more tests must be finished and suggestions used to improve new versions of the game. The first version of the GeoplanoMob – Quadrilateros is available for free download at http://www.de.ufpb.br/~labteve. The game is registered at the National Institute of Industrial Property (INPI).
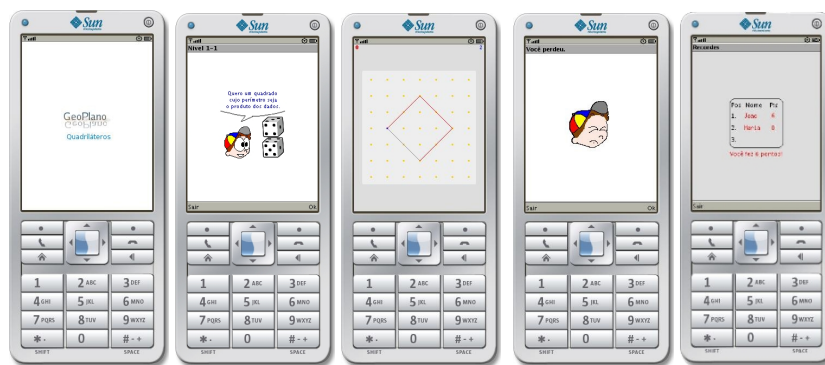
Figure 1: Screens of GeoplanoMob.

Figure 2: Positive and negative animation of the game character.

References

Amory, A.: Building an Educational Adventure Game: Theory, Design and Lessons. Journal of Interactive Learning Research, 12(23), 249-263 (2001).

Bievenue, L. A., Curtis, D.H., Thakkar, U.: Virtual Environments in K-12 Learning and Discovery:A Grand Challenge in Education?, *Computer Graphics*, 29(4), 43-44 (1995).

Moraes, M.B.S.; Dutra, D.L.; Anjos, U.U.; Rego, R.G.; Moraes, R.M.; Machado, L.S.: Geoplano: An Intelligent Educational Game for Geometry Teaching (in Portuguese). Int. Conf. on Engineering and Technology Education (Intertech'2008), 559-563 (2008).