

CHAPTER 5

AmathzingRace: A Mathematics Game for Primary School Students

Suhaila Abd Halim, Normi Abdul Hadi, Zuraida Alwadood, Norlenda Mohd Noor & Nora Baizura Mohd Isa

Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Abstract

The main objective of this work is to develop a package of mathematics games program, named as *AmathzingRace* that reflects the natural developmental progression in mathematics among primary school children. The content of the program is aimed to stimulate the children's creative thinking and maximize their ability in solving mathematics problems in fascinating approaches. The other objective is to expose the children to the real world activities where numbers are represented in societies. By having a good intuitive sense of numbers, they are expected to be able to relate them to the knowledge of written numerals taught in classrooms. They will also understand the varieties of way of representing numbers and able to match such representations with the textbook problems. *AmathzingRace* consists of five games which are *Sudoku*, *Tangram*, *Mathematics Puzzle*, *Magis Coins* and *Platonic Sum*. The program promotes excitement in learning mathematics besides reinforces the social skills of the students as they are required to produce the desired solution at the end of the games. Past studies have revealed that children of six to twelve years old are the best age to develop the interest in science and mathematics. Therefore, the package development program embarked by this research is crucial for success in primary school mathematics as the knowledge that is targeted at their level is the foundation knowledge taught in school.

Introduction

Mathematics is a crucial knowledge that needs a systematic, critical and logical mind which is important to personal development (Hassan and Aziz, 2010 & Tasir and Jamli, 2010). Children at the age of six to twelve years old begin to explore the culture through the study of history, geography, arts and mathematical sciences (Oldfield, 1991). It is common that mathematics is perceived as a difficult and unexciting course by school children. If the negative perception is set from the early stage of education, then it will lead to a misconception and wrong belief among the students at higher level of study.

In the attempt to plan the strategy to attract student's interest in mathematics, in previous research we have initiated a new interactive ways of learning mathematics involving physical teaching aid and outdoor games. The activity was named as Junior *AmathzingRace*, which was a mathematics treasure hunt game that consists of with five checkpoints. The sample students of a selected school were divided into groups and each group must complete each task at each checkpoint in order to collect points. The tasks were designed such that the students were able to realize the natural developmental progression in mathematics, appreciate how numbers are represented in societies and relate the knowledge to the written numerals taught in classrooms. At the end of the game, the marks points collected by each group was used to determine the winner of the games. The activity done has been found to be able to develop the student's interest toward mathematics as they learn the subject in a very interactive and fascinating ways.

AmathzingRace

As the continuation of the program, this project intends to develop a package, named as *AmathzingRace* that compile all the structured mathematics games which have been identified as effective games towards the natural developmental progression in mathematics among primary school children. The content of the package is designed such that it is able to stimulate the children's creative thinking and maximize their ability in solving mathematics problems. This project also intends to expose the children to the real world activities where numbers are represented in daily lives. By having a good intuitive sense of numbers, they will understand the varieties of way of representing numbers and able to match such representations with the textbook problems. The package will promote an excitement in learning mathematics among school children, besides reinforce the social skills of the students when they are required to produce the desired solution.

The *AmathzingRace* package program consists of five games which are *Sudoku*, *Tangram*, *Mathematics Puzzle*, *Magis Coins* and *Platonic Sum*. The description of each games including the objectives, game rules and the significance of the games are among the main items available in the package.

Sudoku

Sudoku is a puzzle game with compilation of numbers or objects in a certain order. In Japanese, the terminology of Sudoku is "numbers alone". The game is officially

copyright own by Nikoli Co. Ltd. The numbers in Sudoku applied only for the purpose of convenience and purely mathematical computation of the numbers that are totally irrelevant. Generally, the number of rows and column is n -squared where $n > 1$ and typical Sudoku puzzles appear in a 9×9 matrix (Luterbach et al., 2010). In some Sudoku games, instead of using numbers, symbols like circles, triangles and squares are also used, as long as the symbol differences is significant. Besides that, color differences are sometimes used. The attractiveness of the game is the non rigid rules, but the logical difficulty is required to solve the puzzle. Sudoku is recommended to increase the ability in problem solving and logical thinking. The puzzle often appears in media sources such as newspapers and books which can also be created using specific computer application programs. The objectives of the puzzle are to enhance the creative thinking of the students and train the student's patience and logical thinking. Commonly, two types of 4×4 matrices of shapes and numbers are used. Students are required to draw the shape or write the correct number in empty spaces. They are required to ensure the shapes or numbers appear only once in every column and row.

Tangram

Tangram is a tiling puzzle where the tile pieces are called tans. The puzzle requires the pieces to be put together in order to form specific shapes. The objective of the game is to enhance students' creativity to form certain objects such as geometric shapes, houses, animals, humans and others. Besides that, it is aimed to enhance the understanding of broad concept of immortality. Students are required to use only seven pieces of tans and the tans must be in contact with each other and cannot be overlapped (Tasir and Razali, 2011). They have to arrange the seven pieces of tan to form the given design. Fig. 1 shows an example of a Tangram question, together with the desired solution. Tangram game is able to build the conceptual understanding of student of mathematical concepts, develop the procedural fluency, improve the adaptive reasoning, engage the productive disposition and build the strategic competence of students (Tchoshanov, 2011).



Fig. 1 An example of Tangram question (left) and its corresponding solution (right)

Platonic Sum

Platonic sum games consist of a combination of basic geometric shapes consisting of triangles, circles and squares that are used to form geometrical structures such as tetrahedron (four sides), hexahedron (six sides), octahedron (eight sides), dodecahedron

(twelve sides) and icosahedron (twenty sides). The objectives of the games are to expose the students to the basic of geometrical shapes and also to increase their thinking level. Normally, there are two cones given where each of them consist of a unique mathematical question. Student needs to throw a rattan hoop into these cones. The cone with the highest number of rattan hoops will be selected and called as "Platonic sum" zone. Students have to answer the question in the zone consists of three geometric shapes of triangle, square and circle. In addition, students are also required to calculate the number of corresponding shape in the given question.

Magic Coin

It is a game that intends to test the students' efficiency in the aspect of valuing Malaysian Ringgit currency. The students are given a set of real coins as the instrument to assist their counting process. The main objective of the game is to boost the creativity and agility of the students in forming a set of coin amounting to RM2.50. The other objective is to enhance the students' ability in managing money and spend wisely in their daily financial matters. Students are given 10 minutes to form a total of RM2.50 using the sets of 50 cents, 20 cents, 10 cents and 5 cents coins, which are given to them as the game instrument. The game rule has restricted that the total number of coin should be exactly 20 pieces. There is actually more than one possible combination of coins in the solution set. Beside the time taken to answer the question, marks are also given based on the cooperation and teamwork spirit among the group members.

Mathematics Puzzle

In general, puzzle is an exercise for brain in which the player has to reassemble a set of irregularly shaped pieces to form into a complete whole picture which arrangement is placed on a cardboard. In the aspect of education, the game is able to stimulate the coordination between eyes and hand during the process of pieces arrangement. In the aspect of mathematics, the game involves a geometrical efficiency of the player because he or she has to play around with the geometrical position of the pieces, so as to place them in a right interlocking direction. Mathematics Puzzle is an extension of the common jigsaw puzzle. Each and every puzzle piece contains a mathematics question at its back, while its correct position on the cardboard contains the answer. Therefore, the player can choose to solve the mathematics question in order to be able to locate the right position of the puzzle piece on the cardboard. The mathematics scope of the question only covers simple addition, subtraction, and multiplication and division problem. The main objective of the game is to stimulate the players' eyes and hands coordination in putting together pieces in a logical way to come up with the desired solution. The game also intends to enhance the students' inductive reasoning aptitude as the game requires recognizing patterns and creating order. Other than that, the game is able to foster a spirit of coordination and helping each others, among the students. In the activity, each group was given 10 minutes to solve two sets of 50-piece Mathematics Puzzle. Marks were given based on the correct position of the puzzle pieces.

Bonus Question

It is an additional problem-solving question that intends to analyze the students' ability to solve a real-life mathematical problem. The question demands the students' knowledge in calculating route distance involving the meter and kilometer units. The question paper was cut into five small pieces. They have to collect all the five pieces given to them at each check-point, in order to view the complete diagram and question. Once it is done, they need to solve the problem given. Marks are given based on correct answer, either in meter or kilometer unit.

Conclusion

This *AmathzingRace* project is an extension to our research done on the potential of game playing for primary students. As the research was found to be able to develop the student's interest toward mathematics, this project intends to connect the mathematics formal education with the social activities of primary students in order to stimulate their interest in mathematics. To materialize the intention, this project has developed a package of mathematics games program, named as *AmathzingRace* which consists of the natural developmental progression in mathematics and aims to expose the children to the mathematical idea within the real world activities. The *AmathzingRace* consists of five games which are *Sudoku*, *Tangram*, *Mathematics Puzzle*, *Magis Coins* and *Platonic Sum*. The description of each game including the objectives, game rules and the significance of the games are among the main items available in the package. The development of the package embarked by this research is a significant motivation to ensure success in mathematics among the primary school students. The package program does not only able to reinforce the foundation mathematics knowledge taught in school, but also improve their self development in terms of their independency and strategic thinking.

References

- Hassan J. & Aziz N. A. (2011). Faktor-faktor yang mempengaruhi minat terhadap matematik di kalangan pelajar sekolah menengah. unspecified, 1–7.
- Luterbach K. J., Rodriguez D. & Milling S. (2010). Spreadsheets in Education. (eJSiE), 3, 1.
- Oldfield B. J. (1991). Games in the learning of mathematics. *Mathematics in School* 20, 41–43.
- Tasir Z. & Jamli Z. (2010). Pembangunan Laman Web Geometri Pepejal Matematik Tingkatan Dua Berasaskan Permainan. *Journal of Education of Science and Mathematics*, 1, 44 - 54.
- Tasir Z. & Razali N. A. M. (2011). Pembangunan perisian multimedia berasaskan pendekatan permainan peringkat prasekolah bagi tajuk Konsep Nombor, unspecified, 1–7.

Tchoshanov M. (2011). Building students' mathematical proficiency: Connecting mathematical ideas using the tangram. *Learning and Teaching Mathematics* 10, 16–23.