A Study On Problem Posing-Solving in the Taxicab Geometry and Applying Simcity Computer Game

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Abstract
Problem-posing is recognized as an important component in the nature of mathematical thinking (Kilpatrick, 1987). More recently, there is an increased emphasis on giving students opportunities with problem posing in mathematics classroom (English& Grove, 1998). These research has shown that instructional activities as having students generate problems as a means of improving ability of problem solving and their attitude toward mathematics (Winograd, 1991). In this study, teaching Taxicab Geometry which is a non-Euclidean geometry is aimed to mathematics teacher candidates by means of computer game-Simcity- using real life problems posing. This studies' participants are forty mathematics teacher candidates taking geometry course. Because of using Simcity computer game, this game is based on Taxicab Geometry. Firstly, students had been given Taxicab geometry theory for two weeks and then seperated six each of groups. Each of groups is wanted to posing problem and solving from real life problems at Taxicab geometry. In addition to, students applied to problem solving at Simcity computer game. Studens were model into Simcity game. They founded ideal city, healty village, university campus, holiday village, etc. interesting of each others.

Introduction

Problem-posing is recognized as an important component in the nature of mathematical thinking (Kilpatrick, 1987). More recently, there is an increased emphasis on giving students opportunities with problem posing in mathematics classroom (English & Hoalford, 1995; Stoyanova, 1998). These research has shown that instructional activities as having students generate problems as a means of improving ability of problem solving and their attitude toward mathematics (Winograd, 1991). Nevertheless, such reform requires first a commitment to creating an environment in which problem posing is a natural process of mathematics learning. Second, it requires teachers figure out the strategies for helping students posing meaningful and enticing problems. Thus, there is a need to support teachers with a collaborative team whose students engage in problem-posing activities. This can only be achieved by establishing an assessment team who support mutually by providing them with dialogues on critical assessment issues related to instruction. Problem-posing involves generating new problems and reformatting a given problems (Silver, 1994). Generating new problems is not on the solution but on creating a new problem. The quality of problems in which students generated depends on the given tasks (Leung & Silver, 1997). Research on problem posing has increased attention to the effect of problem posing on students' mathematical ability and the effect of task formats on problem posing (Leung & Silver, 1997).

Problem posing is becoming recognized in the United States as a necessary component of mathematics teaching and learning (NCTM, 2000; Silver, 1994). Allowing students to pose their own mathematics problems can influence, among other things, attitudes towards mathematics, ownership of mathematics and mathematics achievement (Brown, S. I. & M. I. Walter. 1993, Silver, 1994). As stated by Silver, "contemporary constructivist theories of teaching and learning require that we acknowledge the importance of student-generated problem posing as a component of instructional activity (Silver, 1994)." Researchers and educators have begun to incorporate problem posing into mathematics teaching and learning Brown, & Walter, 1993; Silver, 1994). Leung and Silver showed that prospective elementary school teachers were able to pose mathematical problems but in many cases their problems lacked mathematical complexity. As problem posing is beginning to be incorporated into mathematics classrooms it is important to continue to document students capabilities as problem posers. Problem solving is widely regarded as playing a fundamental part in the learning and understanding of mathematics (NCTM, 2000; Schoenfeld, 1985; Polya, 1973). NCTM defines problem solving as "engaging in a task for which the solution method is not known in advance," and suggests that "solving problems is not only a goal of learning mathematics but also a major means of doing so" (2000, p. 52). Schoenfeld (1985) points out, what might be a significant task for one student could be routine or second-nature for another. Here lies one challenge for the mathematics teacher:

picking quality problems whose solution strategies are not immediately known to each student, but which are within each student's grasp (cited in, Perrin, 2007). Freire contrasted problem-posing education with teacher-dominated education, which he deemed as "banking" education (Lewis at all, 1998). The core of mathematical investigations and scientific research entails problem posing and solving activities. Beside this problem posing being an important component of problem solving process lies at the hearth of mathematical activities (Kilpatrick, 1987). Problem posing is defined as reformulating given problems and generating new problems (Silver, 1994). Problem posing is not limited to generating new problems from given mathematical situations or by changing the conditions of given problems**.** Problem posing also entails reformulating given problems and generalization for the solution. Problem posing is not independent from problem solving (Silver,1994; Cai & Hwang, 2002; English, 2003; Silver & Cai, 1996; Lewis, 1998). There is a close relationship between problem posing and solving as a cognitive process (Lowrie, 2002). Problem posing is most closely associated with the "looking back" stage of Polya's four steps to problem solving. This is considered by Polya to be the most important step (Silver, Mamona-Downs, Leung, Shukkwan, & Kenney, 1996). In scientific inquiry formulating a good problem can be more important than discovering a solution for the problem (Einstein & Infeld, 1938; Cai & Hwang, 2003). One of the important consensuses in mathematics education is to provide opportunites to students in mathematics lessons for developing their problem posing skills (Brown & Walter, 2005; NCTM, 2000).

In this study, teaching Taxicab Geometry which is a non-Euclidean geometry is aimed to mathematics teacher candidates by means of computer game-Simcity- using real life problems posing. Simcity is used as a tool is based on Taxicab geometry. Maxis has published a set of resources for teachers on its website, he said that *SimCity* 3000 could be used in the classroom to enhance just about any instructional unit. It could stand alone as an enrichment computer activity, or it could be used as a pivotal activity connected to other activities and projects done before, during, or after using the computer program. Use the lessons in this guide to integrate *SimCity 3000* into your curriculum, with minimal preparation, or to create custom lessons to suit your needs. As Doug Church commented at the 2002 Electronic Entertainment Exposition, most people who have played SimCity recognize that it can be an excellent resource for understanding urban planning, most people would also not want to live in a real city designed by someone who has only played SimCity. As urban planner Kenneth Kolson points out, *SimCity* potentially teaches the player that mayors are omnipotent and that politics, ethnicity, and race play no role in urban planning (Kolson, 1996).

In this study of teacher candidates to see Simcity game to provide the educational side and can be used in teaching Taxicab geometry is a suitable tool is intended to realize.

Objects of the study

1) Exploring differences between Euclidean geometry and non-Euclidean geometry.

2) can be realized while Euclidean Geometry appears to be a good model of the "natural" world, Taxicab Geometry is a better model of the artificial urban world that man has built.

3.) Setting up to perform research and activities of information gathering required problem posing.

4) to transfer problem solving at Simcity computer game.

Process of the Study

Researchers had described Taxicab geometry to mathematics teacher candidates for two weeks. E F. Krause has defined a new geometry, the *Taxicab Geometry* in 1975, by using the metric $d_T(A,B) = |a_1 - b_1| + |a_2 - b_2|$ for , $A=(a_1,a_2), B=(b_1,b_2)$ the Euclidean plane. This equation means count of blocks that would have to travel horizaontally and vertically to get from A to B. In taxicab geometry, all the streets are assumed to run straight north and south or straight east and west; streets are assumed to have no width; buildings are assumed to be of point size. By using the geometry, the teacher candidates had been asked to do posing ,solving and modeling a problem , in real life a living space. Students were divided into six groups. Finding the solution using Taxicab and Euclidean geometry were expected to place on Simcity game. These groups of teacher candidates from each other interesting,

creative living areas are modeled. In particular, consider the needs of society , the ideal cities, holiday resorts, university campuses, completely equipped health resorts have been prepared by students were given examples of these models. One of the examples is given below :

For the establishment of an ideal holiday island for 50 blocks and 50 blocks of the size of an island in the shape of the taxicab circle with tender was received by the company Island. The company Island, a 6-person team of mathematicians has wanted to be. The 3-4-5 team was established for. This team reviews the results of the blood reaching the ground was not solid. Therefore, multi-storey buildings will be constructed not. Holiday island by using the taxicab geometry was decided to prepare the layout plan. There will be three pools and holiday island will be constructed for them.

1) Pools which in the holiday island will be installed are purple, red and black, and this name is designated as the area is divided. The center of the purple pool (-12, -20), the red center of the pool (16.8), black pool center (-4, -20) coordinates were established. Accordingly, let it KEMBID holiday island that you go to each client's own the nearest swimming pool and construct point to the administration building of finding the region 's place.

2) We limitted Holiday island with a taxicab circle. What are the coordinates of the holiday island KEMBID accordingly?

3) This holiday island is building 15 hotels, 1 bar, 1 health center, 1 football, 1 basketball, boutique, children's playground, cafe, discotheque, health center, 3 security center, 1 meeting room, 1 fitness and 1 beauty salon will be constructed. You construct this center coordinates the most appropriate place.

4) Buket and her family have come to the island KEMBID holiday. Becauseof Buket in this holiday on the island of meeting her father to perform the job, there have chosen. Moreover, because of her mother's health problems will remain to be close to the hotel's health center. for a vacation and more comfortable, health centers and meeting rooms is equal to the distance and the nearest the pool they want to stay at a hotel. What are the coordinates of this hotel? Accordingly which pool Buket should go to?

5) Melek taking a holiday vacation island KEMBID prefer not like to walk. Therefore, the of the hotel will be 15 blocks from the beauty center and the pool is to be at a distance of no more than 5 blocks. Accordingly, management should direct it to the hotel?

6) Demet, Emel and Kubra is 3 friends. Demet, entertainment tooth, , Emel and Kubra, prefer the pool to swim in the sea instead. Accordingly, the hotel will be 8 blocks away to the disco and at the nearest point to the sea must have. Accordingly, what is the coordinates of this hotel?

7) A sports school building was decided at a distance equal to sports field (tennis courts, basketball and football field). Set your coordinates.

8) To easily take advantage of the holiday island equal to the distance to the center and meeting rooms in library is required to be established. Determine the location of the library

9) Irmak, with the family to spend holiday vacation, have come to the island. Her son wants to play basketball and Irmak wants to use the library for complete her thesis work They want to put in to a hotel, for this, equal to the distance from the library and the sports school. Which hotel should they prefer?

10) The water plant will be constructed in three to meet the needs of the island and the pool water. These water plants asked to be placed distance equal to two pools and away from the center of the island. Where these plants should be established?

11) You solve these questions in the Euclid geometry and compare with the results of Taxicab geometry.

Solving of Problem

The above posing problems and solving the student group at the taxicab geometry is done in Euclidean Geometry. These solutions have drawn graphics. Figure 1 and Figure 2 in 7th solution of the problem as an example of the graph is given.

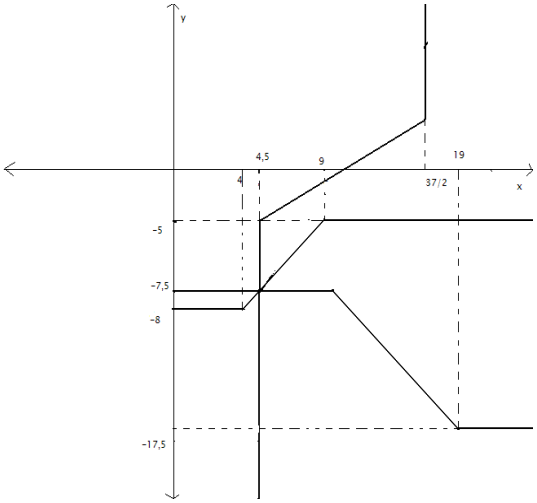

Figure1: graphy of solution the question 7 in Taxicab geometry

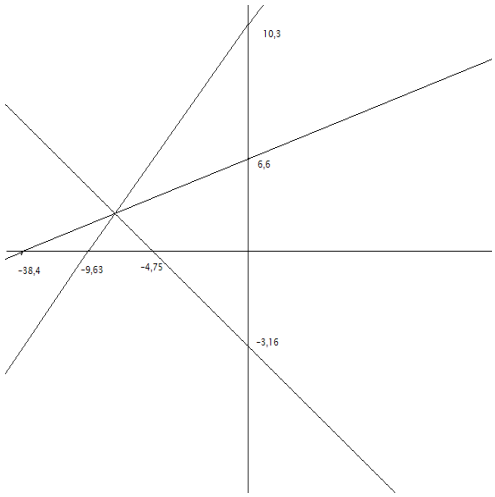

Figure2: graphy of solution the question 7 in Euclidean geometry

Moreover, 7th question on the model of the problem with SimCity game in Figure 3 can be seen. All problems resulting from the graphical model is given in Figure 4 also.

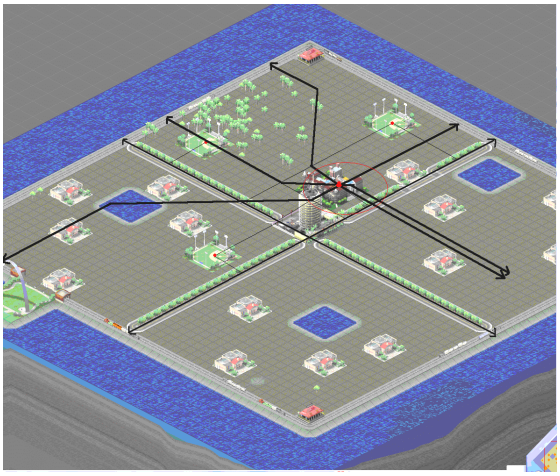

Figure3: graphy of solution the question 7 in Simcity

Figure4 : graphy of solutions all of the questions in Simcity

Conclusions

At the and of the study, mathematics teacher candidates learnt a new geometry "Taxicab geometry" different from Euclid Geometry and saw difference between Taxicab and Euclid geometry using Simcity computer game. By means of this study, mathematics teacher candidates realised Simcity is a educational game based on Taxicab Geometry.

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