JOURNAL OF SOCIAL AND HUMANITIES SCIENCES RESEARCH
Uluslararası Sosyal ve Beşeri Bilimler Araştırma Dergisi

ISSN:2459-1149

Article Type	Received / Makale Geliş	Published / Yayınlanma
Research Article	17.11.2019	30.01.2020

http://dx.doi.org/10.26450/jshsr.1729

***Citation*:** Ertem Akbaş, E. & Cancan, M. (2020). Problem solving experiences of mathematic students through the social family of models role play. *Journal of Social and Humanities Sciences Research, 7*(49), 140-146.

Dr. Öğr. Üyesi Elif ERTEM AKBAŞ
Van Yüzüncü Yıl University, Faculty of Education, Department of Mathematics and Science Education, Van / TURKEY,
0000-0002-4004-1697

Doç. Dr. Murat CANCAN
Van Yüzüncü Yıl University, Faculty of Education, Department of Mathematics and Science Education, Van / TURKEY,
0000-0002-8606-2274

PROBLEM SOLVING EXPERIENCES OF MATHEMATIC STUDENTS THROUGH THE SOCIAL FAMILY OF MODELS ROLE PLAY

ABSTRACT

The focus of the latest research moves from students and their understanding of teachers and preservice teachers. One of the most important reasons for this movement is the proven impact of the knowledge, skills, attitudes and beliefs teachers have on the educational decisions taken at teaching and learning environments. In light of this fact, the aim is to familiarize mathematic students with the process of mathematics teaching with role play and to help them re-examine their traditional views of mathematics learning and teaching. The mathematic students made effective use of their mathematical knowledge and ideas when they played their role in problem solving. They also began to realize that if they behave in a slightly different way, others may also modify their behavior, and problems become easier to solve.
Keywords: problem solving experiences, mathematic students, role play, fibonacci sequence.

1. INTRODUCTION

It is widely accepted that mathematics teachers make a decision about mathematics and any innovation in mathematics curriculum according to the conceptions which they hold (Ball, 1990). These conceptions have been shaped by teacher status within society and the educational system and student roles in the mathematics classroom (Ertem Akbas, Cancan & Kilic, 2019). These factors create implicit notions of teaching and learning of student teachers (Baki, 2000).

There are two basic reasons why a teacher might decide to use role playing with a group of children. One is to begin a systematic program of social education, the second reason is to counsel a group of children to deal with an immediate human relations problem (Joyce, Weil & Calholin, 2005).

The role-playing model is extremely versatile and applicable to several important educational objectives (Elizalde, 2006). Through role playing, students can increase their abilities to recognize their own and other people's feelings, they can acquire new for handling previously difficult situations, and they can improve their problem-solving skills.

Thus, the aim of the model to accept all students responses in a nonevaluative manner. Help students explore the various side of the problem situation and compare alternative views. Increase students' awareness of their own views and feelings by reflecting, paraphrasing, and summarizing their responses. Shortly, emphasize that there are alternative ways to resolve a problem.

2. METHODOLOGY

In recent years, the conviction has been growing that cases or stories may be more helpful than theoretical expositions to people who need to learn to think in new ways about complex, content-dependent domains like teaching.

It is important teachers use precise mathematical language, and that they teach students precise definitions for mathematical vocabulary, especially those words with less-precise non-mathematical

meanings. Experiences with the power of using precise mathematical language are important for students to develop effective mathematical communication skills.

This study examines the following questions.

2.1. The Research Questions

- Is the model of "role play" useful for teaching sequence which is mathematic's topic also "Fibonacci problem"?
- Is there a significant difference between learning with role play and traditional learning?

2.2. The Participants And The Setting

This study includes the eleventh grade which has been designed with the aim of providing a model for classroom practice at private school. So it responds to a need educational researcher. Additionally, including classroom observation and teacher interviews, along with teaching practice and beliefs.

To teach mathematics effectively, teachers need far more knowledge than merely how to do the math work asked of students. In the work of this study, this knowledge framework affects what I notice, what I take to be significant, and what I identify as challenging my current understandings.

The representation standard in principles and standards for school mathematics states on instructional programs through grade 11 should enable all students to:

- Create and use representations to organize, record, and communicate mathematical ideas;
- Select, apply, and translate among mathematical representations to solve problems; use representations to model and interpret physical, social, and mathematical phenomena.

2.3. Case Study

Schifter (1996) espouses the use of case study in examining teacher change: "In recent years, the conviction has been growing that cases or stories may be more helpful than theoretical expositions to people in new ways about teaching".

Given the increasing popularity of the case study, it is worth examining existing "cases" in mathematics education more detail (Smith, 2008). The subjects of case studies in mathematics education research are quite varied. That's why, the case study is a good choice when investigating complex phenomena in a bounded system, by collecting multiple forms of in-depth data.

This case study deals with only one problem-solving worksheet (Appendix-1) and the second problem to complete for homework (Appendix-2) through using the social family of models (role play) during the 2-hour lesson session. The research process began with interview teacher-student to the warm-up student and problem-solving worksheet.

3. DISCOVERIES

3.1. Description of Problem-Solving Process

First 1-hour lesson; I observed traditional learning on group work and I wanted to warm-up students for the main topic.

Through group work, the student mathematics teachers were encouraged to verbalize what they already knew about the problem. This also promoted reflection that helped them making their thinking explict and justifying their own strategies to determine if they were appropriate to solve the problem. Throughout the lesson, while working in small groups on the problem, the pairs of student discussed their solutions and their views on the problem, and then came together as a whole class to explain their methods of inquiry and generalizations to their classmates. During this problem-solving activity, my role was essentially a non-judgmental one rather than an authoritarian.

I began by passing out a worksheet with seven sequences and asked students to fill in the next three blanks for each pattern. Even though I told them they may work quietly in groups, almost all of students work alone, in silence. After ten minutes of silent student work, I had volunteers write their solutions on

the board. For each student, I asked him or her "How did you do it?" Figure-1 shows the patterns from the worksheet, along with students' verbal descriptions; not included are the next three terms of each that students wrote on the board.

I deliberately included Fibonacci-like patterns (3 and 6). For problem number six, there is some disagreement over the numbers İlayda filled in (she had originally added incorrectly), but no disagreement about her pattern of adding three numbers to get the next number. No students were able to figure out the pattern for problem number seven until I gave them a few hints. Emre tried to explain why his solution is correct; he saw 31, 28, 31, followed by 30, 31, 30 so decided the next three numbers would be 29, 34, 29 (first and third match, and go down by ones, middle goes up by three from one set to the next). Mathematically, this solution is a legitimate way to continue the pattern; however, I was looking for a different pattern and saw only one correct answer for each of these exercises. When I started writing "Jan, Feb, Mar, Apr" on the board, Betül out, "31 days" and Levent interrupted "in a month!" At that point, students figure out my answer to problem seven, although a few complain they did not know how many days are in a month, so could not have figured this one out.

Number Sequence Pattern (Student Description)

1) 3, 6, 9, 12, 15 "I plussed three."

2) 2, 4, 8, 16, 32 "Double."

3) 5, 3, 8, 11, 19, 30 "Add them up like 5+3=8."

4) 72, 66, 60, 54 "Down by six."

5) 270, 90, 30 "They were all divided three."

6) 2, 3, 4, 9, 16, 29, 54 "I added those three together."

7) 31, 28, 31, 30, 31, 30 "Days of the months."

Figure – 1

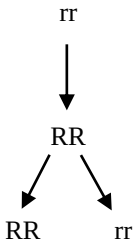
Second 1-hour lesson; I moved into the main part of the lesson, bypassing out a worksheet and read it to students. The worksheet contained the first Fibonacci problem (Appendix-1). I told students I would help them get started. On the board, I draw the chart that is also on the worksheet I passed out:

Time in Months	Start	1	2	3	4	5	6	7
Number of Pairs	1	1	2					

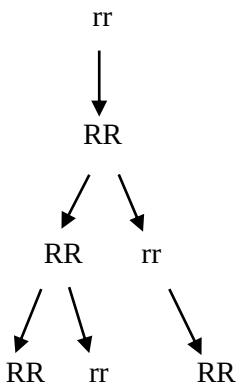
İlayda asked if students can chart their problem differently than the chart on the board. I said, "yes" and proceeded to demonstrate what she called the family three methods. I then told students they can use either method like role play, or use the family tree (small concept poison about bunnies in the problem that are red on pair bunnies and yellow on other pairs of adult bunnies) or can make up their own way.

For this, I started to select participants. I told students "Each group will consist of two people. One of these people will be the male baby rabbit, and the other person will be the female baby rabbit. The other than two will be the audience. But in the end when a group which first finish this problem truely, will start to role play on the board."

My first draws faces for my family tree, and then I switched to "rr" for pair bunnies and "RR" for pairs of adult bunnies:

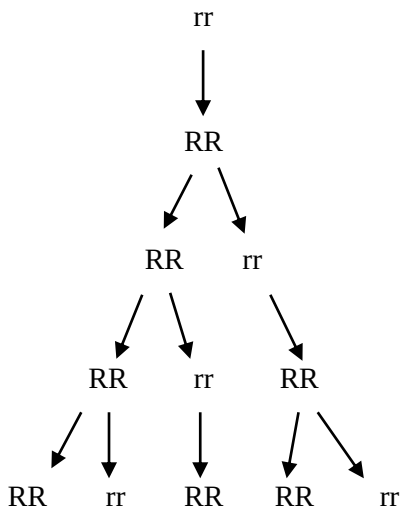


I told students they should work in their "table groups" – working with the other three students sitting in a row with them. Then, before having students start working in groups, I decided to add month three to my family tree:



I told through how I had created each row of the family tree, emphasizing the pairs of adult rabbits still being there each month. I remained students to think about grown up bunnies and what will happen each month. Several students decided to use family tree like role play. Students were working in groups. As I wandered around to see what students were doing, I told İlayda I needed to be drawing pictures to show what I was doing:

After several minutes of working, some groups were starting to get off task and talk about other things. This seemed to happen especially with groups on the other side of the room wherever I was standing. I remained students to do one small step at a time. An adult leads to a baby and an adult. A baby leads to an adult. I told student this was too hard to do in their heads so they needed to be writing something. I circled some of the relationships between month three and month four to highlight what I wanted students to be noticed as they moved from one month to the next



I also told students I had to do it carefully. Didn't try to look at a line and did it all at once. I told to group to start working again. As I wandered around, I saw several students on the right side of the room have filled in their charts correctly. I told them to try to find a pattern. The group in the back row on the right side did find a pattern. Tuğçe, sitting near the middle of the room, had finished her chart did not appear to be trying to find a pattern, but instead seems to see herself as having completed the work. I wrote month five on the board and then month six, adding rows to the family tree. I emphasized the procedure of looking at one row, drawing pairs of adults and babies under each pair of adults, and pairs of adults under each pair of babies.

After that, if students answers were correct, I pointed out which parts the student have correct and which parts are incorrect. By now, one of these groups moved around the room to chat with friends and showed their sketch.

First of all, they started with two friends who is a pair of baby rabbits, holding each other's hands. After one minute (as one month gestation period) this pair of students went near the other friends and they took a pair of friends among students (as the first pair of baby rabbits start reproducing because we assumed that rabbits cannot reproduce until they have a one- month old, they produce a pair of bunnies each month and one of each sex and also no pair ever dies). This rule of sketch continued until the seventh minute (as the seventh month). While practising this sketch the other students except for participants (audiences) listened to the sketch and observed their conclusions. They would be analyzing what clues were given to reveal the solution of the problem and how would they generalize this situation.

3.2. Teacher And Students' Discussion And General Solution

After all of the sketch is completed, I asked each of the groups to support their conclusions. At this time I also asked the audience to voice their observations. The groups were evaluated on their ability to find the correct result about the sequence. As a teacher, they recorded each conclusion and completed the chart:

Time in Months	Start	1	2	3	4	5	6	7	8	9
Number of Pairs	1	1	2	**3**	**5**	**8**	**13**	**21**	**34**	**55**

Having filled in the first eight terms of the chart, one looked for a pattern and noticed that beginning two months after the start, the number of pairs of bunnies for that month equals the sum of the previous two months. Based on previous experience with the Fibonacci Sequence. That is if n is the time since the start (in months), and P is the number of pairs of rabbits in that month, $P_n = P_{n-1} + P_{n-2}$.

At the end of this lesson, I assigned the second problem (Appendix-2) to complete for homework. I said that if they want to complete this homework they will be searching on the computer. Thus the students will be rotating between the computer and the homework problems for the remaining class period.

4. CONCLUDING REMARKS

It must be emphasized that this case study did not add new facts to the world of mathematics. Of course, this was not the point. The point that the teaching model was new to the students and the student teachers. There is a real tension for teachers between teaching the content represented on the board and teaching mathematical processes (Baki, 2006; Baki & Gokcek, 2007) such as problem solving (Baki, 2004) with role play.

The students had already accomplished to role play for solving the Fibonnacci problem. The mathematic students made effective use of their mathematical knowledge and ideas when they played their role (Ertem Akbas, 2018) in problem solving. Every student was exhilarated by this creative work (role play) more than traditional learning. And also they were familiarized with the process of mathematics teaching with role play and began to realize that if they behave in a slightly different way, others may also modify their behaviour, so problems become easier to solve (Elizalde, 2006; Ertem Akbas & Kilic, 2019).

Results of the study showed that this model (role play) can encourage students to take care of responsibility for learning, and enhance students and teacher communication comparing to traditional learning. Shortly, emphasize that there are alternative ways to resolve a problem. The findings which we obtained indicated that having that kind of experiments improves the students' knowledge about themselves increases their metacognitive behaviours, more of these increases their awareness.

These results are very important for educational learning but I observed that all lesson topics also on mathematics education can not appropriate for using this model (role play). Another observation is that we should allocate more time for this model than traditional teaching.

5. SUGGESTIONS

The result of this study suggests hat appropriate use models of teaching (role play) in teaching mathematics can have a positive effect on mathematics students understanding of important mathematical concepts such as Fibonacci sequence.

Student mathematics teachers should be using new models instead of traditional teaching. So the first of all should determine what works best in classrooms and choose which lesson topics are appropriate to use role play and then prepare their model for teaching.

Thus, it was suggested that role play should be used as an alternative model for teaching tools in the mathematics education system.

REFERENCES

BAKI, A. (2000). Preparing student teachers to use computers in mathematics classrooms through a long-term pre-service course in Turkey. *Journal of Information Technology for Teacher Education*, *9*(3), 343-362.

BAKI, A. (2004). Problem solving experiences of student mathematics teachers through Cabri: a case study. *Teaching Mathematics and Its Applications*, *23*(4), 172-180.

BAKI, A. (2006). *Kuramdan uygulamaya matematik eğitimi. (3. Baskı)*. Trabzon: Derya Kitabevi.

BAKI, A. & GOKCEK, T. (2007). Matematik öğretmeni adaylarının benimsedikleri öğretmen modeline ilişkin bazı ipuçları. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi,* 32(32), 22-31.

BALL, D. L. (1990). The mathematical understandings that prospective teachers bring to teacher education. *The Elementary School Journal*, *90*(4), 449-466.

ELIZALDE, M. A. (2006). *An investigation of the use and effects of instruction time in middle school mathematics classrooms*. (Doctoral dissertation). Incarnate Word University. UMI No. 3238261.

ERTEM AKBAS, E. (2018). Öğretmenlerin bakış açısıyla ilkokulla başlayan matematik korkusunun nedenlerinin ve çözüm önerilerinin incelenmesi. *International e-Journal of Educational Studies (IEJES)*, *2*(3), 12-25.

ERTEM AKBAS, E., CANCAN, M. & KILIC, E. (2019). Qualifications of an Effective Mathematics Teacher from the Perspectives of 5th to 8th Grade Secondary School Students. *Universal Journal of Educational Research*, *7*(2), 536-549.

ERTEM AKBAS, E. & KILIC, E. (2019). Evaluation of the Use of Concept Cartoon Activities in Teaching the Translation Concept from Students' Perspectives. *Journal of Education and Training Studies*, *8*(1), 1-13.

JOYCE, B., WEIL, M. & CALHOLIN, E. (2005). *Models of teaching. (6th Edition)*. Printed in the United States of America.

SCHIFTER, D. (1996). *What's happening in math class? (Vol. 1).* New York: Teachers College Press.

SMITH, W. M. (2008). *Exploring how three middle level mathematics teachers use their experiences in a professional development program*. (Doctoral dissertation). The University of Nebraska-Lincoln. UMI No. 3315316.

Appendix-1

WORKSHEET

Explain: This question gave the Fibonacci sequence its name. It was posed and answered by Leonardo of Pisa, better known as Fibonacci.

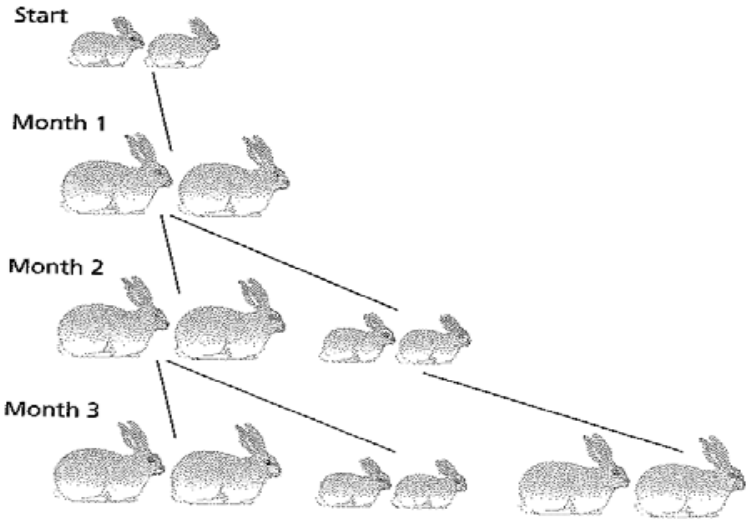
Suppose we have a pair of baby rabbits: one male and one female. Let us assume that rabbits cannot reproduce until they are one month old and that they have a one-month gestation period. Once they start reproducing, they produce a pair of bunnies each month (one of each sex). Assuming that no pair ever dies, how many pairs of rabbits will exist in a particular month?

During the first month, the bunnies grow into rabbits. After two months, they are the proud parents of a pair of bunnies. There will now be two pairs of rabbits: the original, mature pair and a new pair of bunnies. The next month, the original pair produces another pair of bunnies, but the new pair of bunnies is unable to reproduce until the following month. Thus we have:

Time in Months	Start	1	2	3	4	5	6	7
Number of Pairs	1	1	2	?	?	?	?	?

Continue to fill in this chart and search for a pattern. Here is a suggestion: Draw a family tree to keep track of the offspring.

Demonstrate:



Appendix-2

SECOND PROBLEM

Explain: Late Bloomers.

Suppose we start with one pair of baby rabbits, and again they create a new pair every month, but this time let's suppose that it takes two months before a pair of bunnies is mature enough to reproduce. Make a table for the first 10 months, indicating how many pairs there would be at the end of each month.

Do you see a pattern? Describe a general formula for generating the sequence of rabbit-pair counts.