**606 Burgués**

# NUMERICAL PROBLEM POSING BASED ON PHOTOGRAPHS

Carme Burgues, cburgues@ub.edu

Roser Codina, rosercodina@ub.edu

We are professors at the Faculty of Teacher Training at the University of Barcelona. We work in mathematics education and training future primary teachers.

Our presentation is about the use of photography as a resource for learning math. Photography is technically and financially accessible to most people. It is important to recognize math in real life and photography allows us to do so. This makes it easy for future teachers to capture contexts in which to see and apply mathematics. So we don't use any program to modify the images. Also images may reduce the complexity of real context by focusing only on some aspects.

To see the mathematics associated to a photograph is essential in all our activities. See figure 1 for an example.

Figure 1


Bicing is the name of a bicycle sharing system in Barcelona. The city council manages and maintains the system. The bikes can be lent from, and returned to, any station in the system, making it suitable for one-way travel. The photograph shows not a thermometer but the number of bike lanes users. In addition to this obvious numbers there more sophisticated math behind this post. We can see: Numbers for counting. Numbers for measuring. Graphical scales. Shapes. Parallelism. Tessellations. Shadows. Similarities.

Goals in problem posing and problem solving:

- Real context in the problems
- Connecting math and reality (both directions)

Future teachers may learn how to design activities with images (problem posing).
Our activities are developed in 2nd and 4th courses of math education for pre-service primary school teachers (4 years program).
We demand the students to ask questions and propose problems based on an image. We saw that the time we left to think and discuss in groups was important in order to provoke interesting responses.
We will present examples found by students.

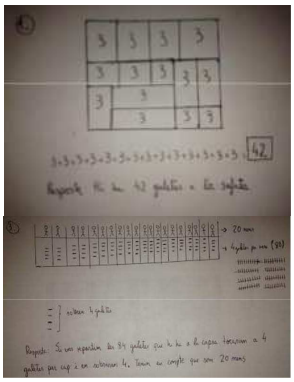
## General numerical aspects

In figure 2 you can see an image for a numerical problem.


Figure 2

They formulate questions of the following type:

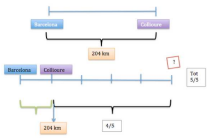
*There are 3 cookies in each hole … How many cookies are there in the tray? If you there are 2 trays, how many cookies do we have? We need to distribute the cookies for a birthday celebration. How many cookies will correspond to each one?*



Closed problem. Very simple.
Missing information in the photo with need of additional information.
The representations of the calculation are interesting.
They allow, e.g., to multiply by counting groups of 3 and to divide by making equal groups.

**Numerical aspects in measure's contexts**
In figure 3 you can see a student proposal about measure's context.

Figure 3

*We have prepared a surprise trip for our mom. We start in Barcelona and when we pass Colliure (France) we tell her that there is still 4/5 of the trip to arrive to the final destination. Where do we want to go? From the arrival point we want to continue to Berlin. We know it will take 3 hours including two short stops of 15 minutes. Which will be the required speed of the car?*

The photo contains all information about distances. Closed problem. Representations facilitate solving. It implies fractions.

**Numerical aspects in a geometric context**
In figure 4 you can see a student proposal about a geometrical problem.

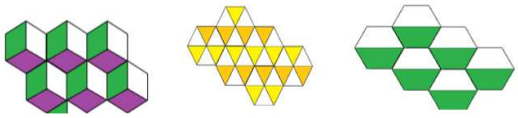
Figure 4

*We know that the distance between the vertices of the base of the bookcase is 52 cm and the height in the central part (from the base to the vertex of the interior triangle) is 22 cm.*
*Which must be book's heights so all book fit well?*
Closed problem.
Very personal context.
The configuration is in the photograph, student adds measures.

**Geometrical problems**
In figure 5 you can see a student's geometric proposal.

Figure 5

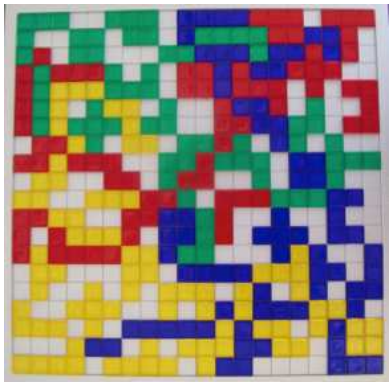
*Draw a beehive like the one made by the bees using another geometrical shape that you know and having the same shape seen in the image. When you end you must paint the drawing.*
Open problem.
Informative photo.
They identify: plane and space, how to fill figures.



Representations using different polygons like hexagons, equilateral triangles, isosceles trapezoids, symmetries, rotations, …

**Proposals of problems for Primary School pupils**

In figure 6 we can see a student proposal for pupils.



*Design another game board so form is preserved as well as the proportion of space available for each player, but for a two persons game. (5th grade)*

Game's context, appropriate to the ages. Open and complex, with possible extensions. It's a research. It combines numbers and geometry. Photo is essential.

Mathematics being recognized: Computations of lengths, proportionality, approximate calculus, square roots, and trial and error method.

Figure 6

**What we've learnt from this experience**

- Students make the photos. This implies a reflection process and a preliminary design based upon mathematical ideas.
- Photographs show contexts familiar to students. This will facilitate teachers to find familiar contexts for their future pupils.
- It is not easy for students to identify in the images the math ideas associated to them.
- Student design series of exercises instead of problems. There is a lack of experience in problem posing.
- Students confuse drawings with photos. Internet's support induces the confusion.
- Students involve themselves with enthusiasm in the activities with photographs. They mention they did not make such activities before and they think they will be interesting in their future role as teachers.

Photography wants to be in your classroom.
You can give it an opportunity.

Presentation will be available at:

https://ub.academia.edu/CARMENBURGUES or

https://barcelona.academia.edu/RoserCodina