

Tasks Based On Graphic Humor As A Way To Develop Mathematical Communication

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Abstract

In this paper, I present an exploratory study that seeks to understand the role that tasks based on graphic humor can play in the learning of Mathematics, particularly as far as the students' written communication is concerned. To be able to achieve this goal, the HUMAT Research Project (Humor in Mathematics Teaching) allowed us to design mathematical tasks based on graphic humor (comic strips) which were used in a 4th grade class (composed of 24 students). The current study follows a qualitative and interpretive methodological approach. Data were collected through the observation of the students' actions (audio recording of classes were used) and through the analysis of their written records. The results of this study show that mathematical tasks inspired by graphic humor can be taken seriously in Mathematics classes since they are important to promote students' enthusiasm, their mathematical thinking and mathematical writing.

Keywords: primary education, mathematical tasks, instructional humor, communication in mathematics

1. INTRODUCTION

This communication is part of the HUMAT Research Project (Humor in Mathematics Teaching) developed by the Higher School of Education of Viseu (Portugal), in partnership with the University of Minho (Portugal), the University of Granada (Spain) and the University of Mendoza (Argentina).

The HUMAT project is built upon three fundamental ideas that have been produced by current research. First, it assumes that humor plays an important role in creating a learning environment that can boost the students' motivation and encourage them to learn mathematics (Banas, Dunbar, Rodriguez & Liu, 2011; Flores & Moreno, 2011; Guitart, 2012; Guitart & Flores, 2003; Martin, 2007; NCTM, 2007, 2013). Secondly, it accepts that the understanding of humor and the learning of Mathematics are two activities that require good reasoning competences (Martin, 2007; Meyer 2015; Paulos, 2008); and thirdly, that the inquiry-based teaching of Mathematics, based on a set of activity performed by students and which stems from challenging mathematical tasks, has a high learning potential (Menezes, Oliveira & Canavarro, 2015; Ponte & Quaresma, 2016).

These ideas led us to design mathematical tasks in which the presence of humor involving mathematical concepts was a central aspect, in other words, our intention was to offer tasks that would eventually lead students to learn mathematics. The book "Humor in Mathematics teaching" (Menezes et al., 2017) was a direct consequence of that work. It is a document that presents a set of mathematical tasks based on graphic humor and that provides teachers with a range of indications and information on how to explore those tasks.

2. Humor in Mathematics teaching and learning

Humor involves the communication of multiple incongruous meanings that are amusing in some manner (Banas et al., 2011; Martin, 2007). According to Meyer (2015), “humor is the capacity to perceive actions as funny, respond to an amusing stimulus, or create something that elicits amusement” (p. 1). Humor is therefore a form of communication that abundantly uses ambiguity and polysemy, balancing cognitive and affective elements to make someone laugh (Guitart, 2012; Martin, 2007). Humor serves a variety of functions: it helps increase group cohesion and help people cope with stress (Banas et al., 2011).

How does humor works? There are many theories that explain how humor works. One of them, the incongruity theory, has a high potential for instructional humor (Banas et al., 2011; Martins, 2015). In this case, humor exists whenever the person is able to perceive and resolve the incongruity of a given situation and finds it amusing (Banas et al., 2011; Martins, 2015).

Does humor have instructional value? Or is teaching and learning a too serious process to include humor? Banas et al., (2011), after analysing over 40 years of research on the importance of humor in education, reached the conclusion that the “use of positive, nonaggressive humor has been associated with a more interesting and relaxed learning environment, more positive assessment, greater perceived motivation to learn and creates a greater sense of enjoyment of the course” (p. 137).

Martin (2007) refers that “evidence from several studies indicates that many teachers tend to use humor quite frequently in classroom settings” (p. 23). Most recently, results from a study conducted in Portugal and Spain, and which involved more than 1000 teachers, show that about 80% of Mathematics teachers from all levels of teaching regularly use humor to teach Mathematics (Flores, Menezes, Ribeiro & Viseu, 2017; Menezes, Viseu, Ribeiro & Flores, 2017). These authors also conclude that this humor is mainly verbal, connected to the teacher’s oral discourse and that it is not necessarily associated with the mathematical tasks they had planned for the class.

The use of humor to teach Mathematics using mathematical tasks based on graphic humor has been highlighted by various organizations (NCTM, 2007, 2013) and authors (Flores & Moreno, 2011; Guitart, 2012; Guitart & Flores, 2003). The NCTM published two books entitled “Cartoon Corner: Humor-Based Mathematics Activities” where the authors present a set of mathematical tasks constructed from graphic humor. In Spain, Pablo Flores has been working on graphic humor for 20 years and has written two interesting books: “Humor gráfico en el aula de Matemáticas” (Graphic humor in Mathematics classroom) and “Matemáticamente competente... para réir” (Mathematically competent... to laugh). In both cases, these books do not present concrete results of the use of these tasks in the classroom. In my perspective, that kind of information would help readers understand how they work. This is the purpose of this exploratory study.

3. Communication in Mathematics teaching and learning

Communication is a key element of human activity and of the process of teaching and learning. But what does communication really mean? According to Menezes, Guerreiro, Martinho and Tomás Ferreira (2013), there are two main conceptions of communication. One of them considers “communication as transmission of information, knowledge and ideas, a process that is anchored in knowledge and in the various forms of disseminating it” (p. 46). The other conception “views communication as social interaction, in which the subjects interact with each other, searching shared meanings, and collectively constructing knowledge and forms of circulating it” (p. 46).

In this study, I chose to follow the second conception: as far as I am concerned, communication is a process of social interaction based on the activity of students directed by challenging mathematical tasks that will enable them to think, write and discuss in mathematical terms.

It is in this conception of communication, supported by inquiry-based Mathematics lessons, that the humour-based tasks will take place. That is, the tasks proposed are not only intended to create an environment that will favour the learning of Mathematics (affective function), but their main goal will be to foster the students’ mathematical thinking and enable them to learn while communicating (cognitive function).

An inquiry-based Mathematics lesson is organized around three or four phases (Canavarro, Oliveira & Menezes, 2014). Stein, Engle, Smith and Hughes (2008) propose a three-phase model (the launch phase, the explore phase, and the discuss and summarize phase). In this study, classes followed this sequence and students worked in pairs in order to produce written records that would support the collective discussion.

For most people, and for students in particular, writing is less natural than talking. However, writing is essential to human thinking and to the production of knowledge. This holds true in science and also goes for students’ learning. Several authors argue that writing must have an important place in Mathematics classes (Bicer, Capraro & Capraro, 2013; Burton & Morgan, 2000; Morgan, 2002). Integrating writing into Mathematics classrooms has many

benefits for students' mathematical learning. Morgan (2002) summarizes the main benefits/ singularities that come from promoting writing in Mathematics classes: (1) Writing produces a lasting record; (2) Writing and Mathematics are similar activities; (3) Writing develops mathematical understanding; (4) It favours positive attitudes towards Mathematics; and (5) eases the assessment of Mathematical learning process.

Some authors present strategies to promote writing in Mathematics in which students are asked to "Describe what you have done", "Explain why something works", "Create a wall journal/newspaper", "Write stories about Mathematics", "Describe images", " and "Solve problems" (Burton & Morgan, 2000; Menezes, 2011; Morgan, 2002). In this study, we use tasks based on graphic humor (images) to encourage students to think about mathematics, write about mathematics and communicate/share the results they got as they solved their mathematics tasks.

4. Methodology

4.1 Methodological options

The nature of the study led to a qualitative and interpretive approach. For this purpose, data were collected through the observation of classes (each one of those classes was approximately 90 minutes long), audio recordings of those classes and the students' records (task completion).

4.2 Participants

The students who have taken part in this study belong to a Portuguese 4th year class (primary education). The group was composed of 24 students of both sexes and their teacher. The tasks were presented to the teacher who then decided to make some changes, both in the text used to set the task and in the way it would be presented to the class.

4.3 Analysis

In this study, my intention is to understand the potential of certain tasks to the development of students' mathematical communication, in particular the way they use their written communication competences as they solve mathematical tasks based on graphic humor. I decided to analyse the following aspects: (i) understanding of humor; (ii) use of some mathematical concepts, capacity to use specific vocabulary and notation; (iii) organization, originality and clarity of their text; (iv) completion of the given task. Regarding the first aspect, I have to verify if students had really understood the humorous situation. As for the second aspect, I have to check out if students are correctly using mathematical concepts and the correction of their vocabulary. As for the third aspect, I have to verify the organization of the students' ideas, their originality and clarity. Regarding the fourth aspect, I have to verify if the task has been correctly solved.

4.4 Mathematical tasks

The tasks were built from a certain kind of graphic humor that focuses on mathematical concepts and that can be easily found (in books and online). The tasks follow the same structure. Firstly, students are asked to complete two requests: "Describe the situation presented in the comic strip. Do you think the situation is amusing?". Next, the tasks and the requests are meant to lead students to deepen their understanding of the situation, forcing them to resort to their mathematical knowledge. Task questions invite students to write, and therefore to communicate mathematically, first through writing and then orally (they are expected to communicate their findings to the class).

Four mathematical tasks were presented in the classroom, but only the first of those tasks will be fully analyzed in this text (a full analysis would be impossible due to the size limitation of this text): (1) "When number 2 is not that big a deal..."; (2) "Right or Wrong? "; (3) "Irregular Regularity"; and (4) "Final touches!".

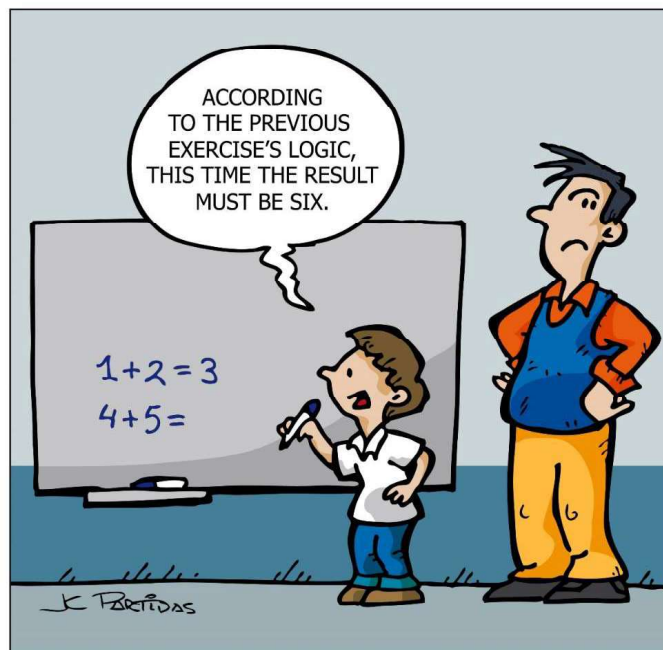
Task 1. When number 2 is not that big a deal...



1. Describe the situation presented in the comic strip. Do you think the situation is amusing?
2. Assuming that, that day, 0 was the first number taken, how many people may have already been assisted?
3. If this numbering were to continue as suggested in the panel, how many people are to be assisted until they reach number 1? And number 2?

Note: This mathematical task uses a comic strip from a blog called "Toon Hole", created by the American graphic illustrator, Ryan Kramer.

Task 2. Irregular regularity



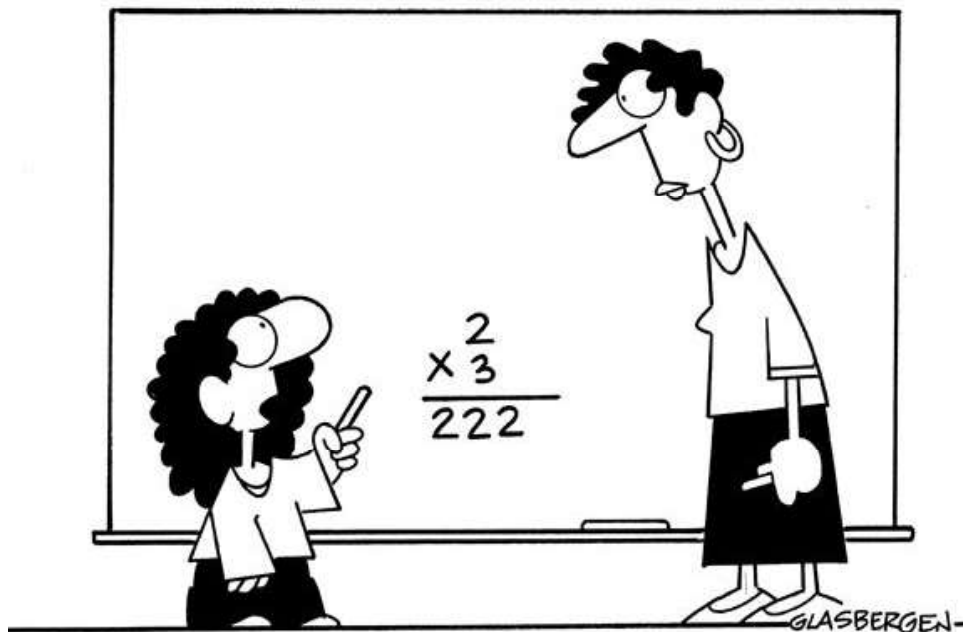
1. Describe the situation depicted in the cartoon. Do you think this is an amusing situation?

2. Why has the student replied “six”?
3. Find regularities in additions of natural numbers and justify them.

Note: This mathematical task starts with a comic strip created by Juan Carlos matches, a Venezuelan designer and the author of a blog called Rechiste.

Task 3. Right or Wrong?

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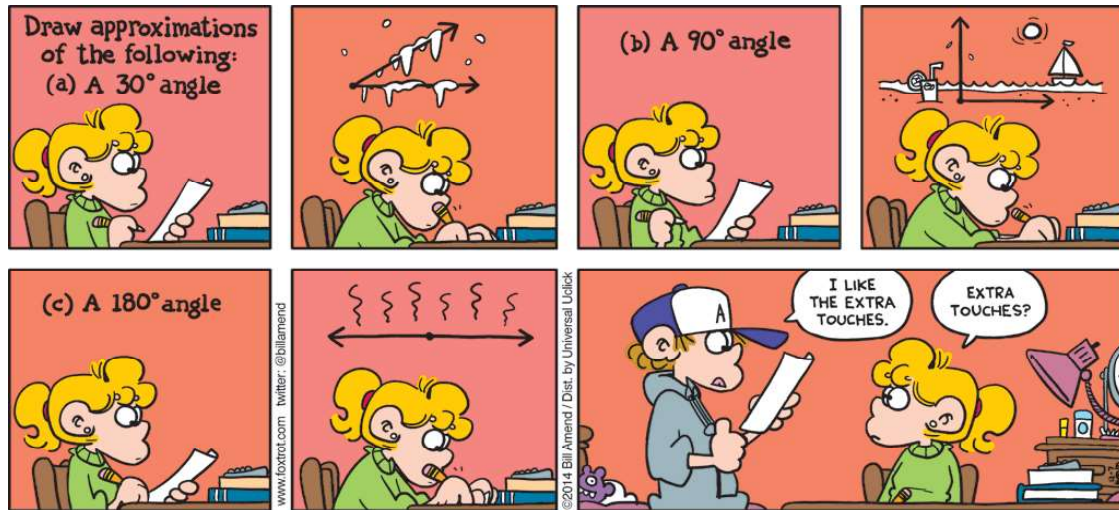


“What do you mean, it’s the wrong kind of right?”

1. Describe the situation pictured in the cartoon. Do you think it’s funny?
2. Could there be any “truth” in the situation pictured? Why?
3. How could you correct the result of the operation without deleting any of the numbers?

Note: This mathematical task uses an illustration created by Randy Glasbergen, one of America’s most popular cartoonists.

Task 4. Final touches!



1. Describe the situation depicted. What was the female character's intention? Is the situation amusing?
2. What do you think of the association Paige established between the three angles and the reality? For each of these angles, put forward other real-life examples.
3. What is the value of the angles- and what do you call them- that allow us to obtain, based on the first, the two other angles (90° e 180°)?
4. How can we get a full rotation angle from each of the three angles (using only one of them or by combining, at least, two of them)?
5. Degree Celsius is not the only conventional unit of measurement for temperature in the whole world. Carry out a research to discover what other units are used to measure that magnitude, particularly those used in the United States of America, the country where the strip was produced. Compare them.

Note: The comic strip that gives rise to this mathematical task belongs to the FoxTrot collection, created by Bill Amend, an American cartoonist.

5. Results

When students work in Mathematics, they usually make short records. In this case, students were asked to write longer texts to answer the first request/question "Describe the situation presented in the comic strip. Do you think the situation is amusing?". Figures 1 and 2 are images of the answers given by two pairs of students.



1. Descreva a situação apresentada na tira. Consideras a situação engraçada?

1ª imagem - Na primeira imagem vemos um senhor que foi tirar uma nova carta de condução, pois sabemos que a anterior, já não tinha validade. Como a carteira não tinha lá a cartela, ficou ter de ir à casa e a cartela, ficando depois de uma multa e ficando sem as fantasias. Então, acabou e quer tirá-la uma nova carta...

2ª imagem - Na segunda imagem a Senhora deu o número 2 ao homem e ele ficou animado.

3ª imagem - Na terceira imagem o Senhor ficou alegre, porque ele pensava que o número 2 não demorava muito a ser atendido.

4ª imagem - Na última imagem vemos que ele ficou triste, porque ainda faltam dez atendidas, fazendo ele ser atendido.

Filipa - a minha opinião é o achei isto engraçado, porque foi bem divertido as imagens 1, 2 e 3. Não tem opinião ao achista, porque o gesto, principalmente as imagens 3 e 4.

Figure 1. G4's answer to the first question.



1. Descreva a situação apresentada na tira. Consideras a situação engraçada?

Nesta situação nós vemos 4 vitórias: na 1ª o senhor afirma que quer tirar uma nova carta de condução. Na 2ª a senhora do DMV entrega-lhe uma senha com respeito número 2. O senhor demonstra-se contente por ter este número de senha, mas quando observa o número que está a ser atendido, 0,1271 decimas de milésimas fica espantado porque ainda há 1271 pessoas. Na verdade o seu número não pode-se ler de várias maneiras, como 2,0000. Nós achamos a situação engraçada e divertida.

Figure 2. G7's answer to the first question.

Students understood the situation and, after the initial surprise caused by such an unusual situation, they found it amusing:

In this situation, we see a young man who wants to get his new driving license. The DMV lady gives him the number 2. The young man is glad to have this number, but when he looks at the number of the person who is being assisted (0, 1271) he is surprised because there are still 18729 persons who will be assisted before him. In fact, number "2" can be read in several ways, like "2,0000", for instance. We found the situation funny and very entertaining. (G7)

In the first image, the boy was waiting for his new driving license. In the second image, we see that the clerk gave him the number 2. He thought it was a good number. In the third image, the boy was happy. In the last image, as he was heading for the queue, he realized that the person who was being assisted was number 0,1271. We found the situation funny because he thought number 2 was good, but it was not a big deal after all. (G9)

Two more questions were asked: "(2) Assuming that, that day, 0 was the first number taken, how many people may have already been assisted?"; and "(3) If this numbering were to continue as suggested in the panel, how many people are to be assisted until they reach number 1? And number 2?"

Because it is not usual to use this kind of numbers, the students experienced some difficulties for a few moments. Several pairs of students followed the same strategy as the G5 group: they established a correspondence between the sequence of numbers suggested in the images and the sequence of whole numbers (which are normally used to make counts). Thus, they concluded that because he was number 0,1271, 1271 other people would already been attended (Figure 3).

2. Admitindo que neste dia a numeração iniciou em 0 (zero), quantas pessoas podem já ter sido atendidas?

1 = 0,0001 R: já foram atendidas
 2 = 0,0002 1271 pessoas.
 3 = 0,0003
 4 = 0,0004
 5 = 0,0005
 6 = 0,0006
 7 = 0,0007
 8 = 0,0008
 9 = 0,0009...

Figure 3. G5's answer to the second question.

To answer question 4 “If this numbering were to continue as suggested in the panel, how many people are to be assisted until they reach number 1? And number 2?”, all students used the subtraction algorithm for decimal numbers (Figure 4).

3. Se esta numeração continuar na forma que é sugerida na imagem, quantas pessoas ainda devem ser atendidas até chegar ao 1? E ao 2?

1 = 0,0001
 2 = 0,0002
 3 = 0,0003
 4 = 0,0004
 5 = 0,0005

$$\begin{array}{r} 1,0000 \\ - 0,11271 \\ \hline 0,88729 \end{array}$$

$$\begin{array}{r} 2,0000 \\ - 0,11271 \\ \hline 1,88729 \end{array}$$

R: Faltam ao 1 $0,88729$ pessoas para serem atendidas e ao 2 $1,88729$.

Figure 4. G5's answer to the third question.

As noted in the students' resolution, they chose to work with decimal numbers and they understood that they should have a whole number to represent the number of people (so, they cut out the zero).

The teacher, in order to challenge students to write, introduced a fourth question: "Explain the meaning of the title "When the number 2 is not that big a deal"." The students responded to the teacher's challenge and explained the meaning of the title. Group 1 wrote: "When the number 2 is not that big a deal means that sometimes the $2n^d$ is not very good because we can be dealing with a situation that involves tenths of a thousandth and number 2 would still be a very distant number" (Figure 5).

4. Explica o significado do título: "Quando o 2.º não é grande coisa...".

"Quando o 2º não é grande coisa... quer dizer que ser o 2º às vezes não é muito bom pois podemos estar nas décimas de milésimas e para chegar ao 2 ainda falta muito."

Figure 5. G1's answer to the fourth question.

Group 5 wrote: “This title means that number 2 or the 2nd is not always a good number because you can read the number 2 in many ways (as if it were 2,000, for instance) ... we may have to wait a long time if the numbers are represented by decimal numbers.” (Figure 6).

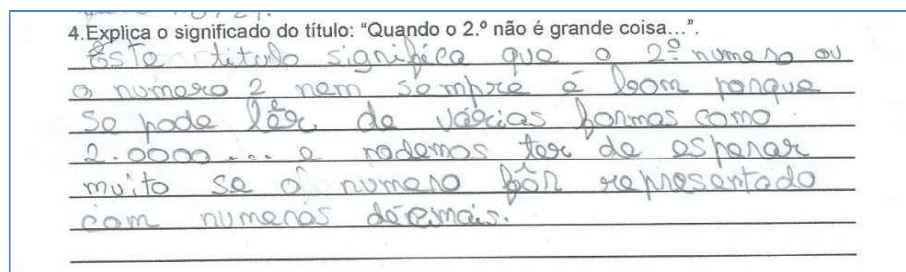


Figure 6. G5's answer to the fourth question.

All pairs of students answered all the questions of the task. The students showed enthusiasm in solving the task and wrote full texts to answer questions 1 and 4, mobilizing their mother tongue and their mathematical knowledge (giving coherent answers).

In questions 2 and 3, where a mathematic response to the questions was expected, the students used mathematical language, mathematical representations and mathematical symbols.

This written work performed by the students was important because their peers had to agree on an answer. Those written records were also important to the next phase of the class in which students had to present and discuss their findings publicly.

6. Conclusions

This exploratory study suggests that humor in the teaching and learning of Mathematics can be taken seriously. On the one hand, mathematical tasks based on graphic humor are capable of eliciting students' interest and make them think and communicate about Mathematics. This type of tasks does not only have an affective function, but they also serve an important cognitive purpose in the learning of Mathematics (Flores, Menezes, Ribeiro & Viseu, 2017; Guitart & Flores, 2003; NCTM, 2007, 2013).

On the other hand, these mathematical tasks help students broaden their writing competences, since they are asked to combine their mother tongue (their Portuguese, in this case) and the language of Mathematics (Morgan, 2001). These written records helped the students structure their thinking, allowing the creation of a continuous dialogue with their peers that enabled them to reach a common answer that would suit them both. In addition, these written records were important to support the discussion that followed (Menezes, Oliveira & Canavaro, 2015).

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