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Using Video-Based Methods to Teach Rational Number to Prospective Primary School Teachers

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Abstract

The connections between the pedagogical approaches based in the use of video and the didactical models to teach the rational number are a source of great concern to the teachers of our Mathematics Education Department. The TPACK framework provides the appropriate domains and tools needed for the study of this topic. We present activities based in the use of the flipped classroom pedagogical model where the videos are well adjusted to the didactical models based in measure or in quotient. Our prospective primary school teachers were asked to design videos to present different contents to their future pupils or to watch some videos before taking the corresponding lessons. The main findings are related to the difficulties, pedagogical-technical and mathematical, showed by the students on their videos. On the one hand, they used to move from one type of activity to another with not enough explanation or presented too long videos. On the other hand, they presented activities different from the ones they were told. We have found that this video-based activities are related to problem solving strategies and bring out conceptual misunderstandings.

Keywords: TPACK, part-whole, rational constructs, Rational number

1. Introduction

Our prospective primary school teachers are used to work with different technological instruments in their daily life, but these instruments rarely become an essential part of their learning/teaching processes. In some areas, they have been taught about the potential of the use of video-based methods or strategies. Moreover, they look for videos in websites such as youtube, but rarely with a didactic point of view. Thus, the goal of our work is analyse pros and cons that arise when introducing different video-based methods to teach rational number problems. In particular, we use rich and poor video sequences to show didactic issues to our students.

2. Theoretical framework

In this section, we introduce the basic concepts of our framework: the TPACK shows the general domains that our prospective primary school students should cover in our course and some basic facts about the use of internet videos in mathematics.

2.2 The TPACK framework

TPACK (technological pedagogical content knowledge) is the framework that we use to study the prospective primary school teachers knowledge for technology integration as explained in Koehler & Mishra [1]. This framework builds on Lee Shulman's construct of pedagogical content knowledge (PCK) to include technology knowledge. The acronyms in Figure 1 mean:

CK: Teacher's knowledge of the mathematical content, including concepts, theories, ideas, organizational frameworks, etc.

PK: Teacher's knowledge of the processes, practices and methods involved in the teaching and learning of mathematics.

PCK: Teacher's knowledge of the possible adaptations of the mathematical content to its teaching.

TK: Teacher's knowledge that permits him/her to do different tasks using IT and to find different ways of solving a given task.

TCK: Teacher's knowledge of the mutual influences and limitations of technology and content.

TPK: Teacher's knowledge of the changes that technology generates in learning and teaching.

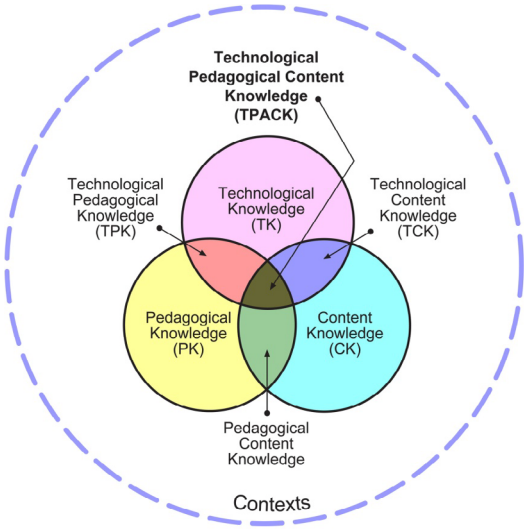

Fig. 1. TPACK diagram. Source: http://tpack.org

2.2 Video in mathematics

There are two different types of videos according to its focus [2]: Recordings of a class, including images of the teacher and digitalized writing systems. In the second group we can find interesting examples: Khan Academy (www.khanacademy.org), an international platform, mostly in English and AINTE Academia a youtube channel of a

Spanish mathematics teacher.

Some previous studies have discussed on the effectiveness of these kind of resources. Our goal in this work is to comment on the didactical approaches of them.

Following the idea explained in [3], our activities (see Figure 2) try to integrate four different types of activities, watching videos, reading documents, participating in on-line debates and writing reports. All of these activities were designed to promote a deeper understanding of the concepts based both in reflection and in mathematical communication.

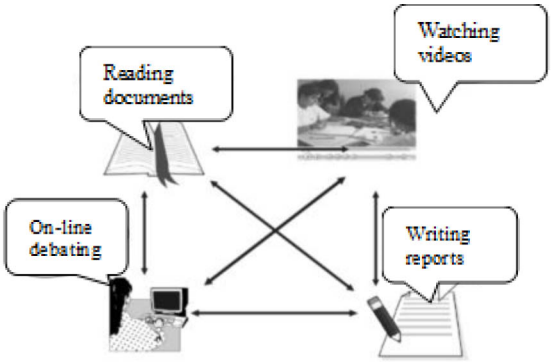

Fig. 2. Methodological structure for the use of video sequences in Mathematics

3. Results

In this section, we present some findings obtained during the experimentation phase. To show them, we describe the use of two video sequences used in our course, corresponding to different approaches: The first approach consists in the viewing of a video sequence, before or after the lesson, it works as an introduction or as a revision of the teachers' explanations. The second approach consist in the recording a video sequence by the prospective primary school teachers after attending the lesson, it promotes a deeper understanding since they have to design the appropriate explanations, activities.

3.1 Using a YouTube video

Many academies have recorded brief explanations as support to their classes and uploaded them to their youtube channels. Our example is a mathematics academy with more than 27.000 followers. In particular, we focus in the video "La fracción como reparto Matematicas 5º Primaria AINTE." designed to support explanations about the interpretation of the fraction as a quotient sub-construct [4] in an equal sharing context (https://.youtube.com/watch?v=M9jsNiGcQiA).

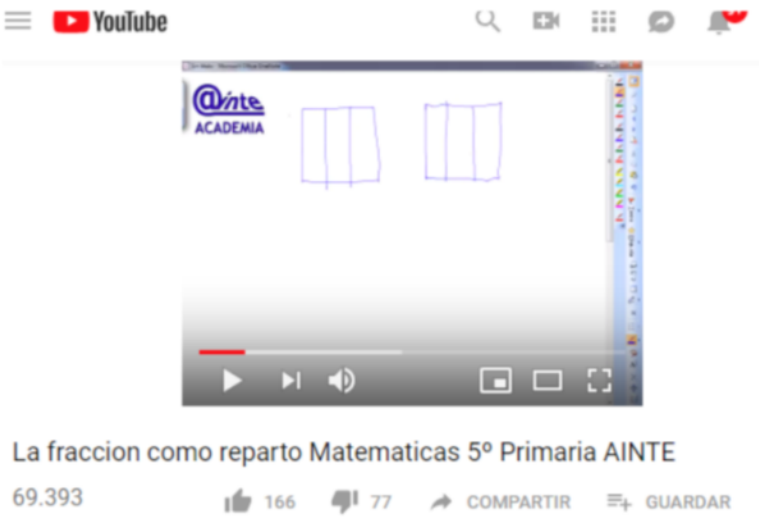

Fig. 3. fractions presented in an equal sharing context video

The author is suposed to explain to his students fractions in an equal sharing context. Students are told that two cakes are evenly distributed among three people.

He divides each cake in thirds. He asks to the students about the fraction of cake that corresponds to each of them. With this question he is isolating the numerical solution from the magnitude involved (weight or area in this case). Thus, the author is asking only for a number, not for the quantity of magnitude that corresponds to each person.

Finally, to solve the problem, the author changes the unit from «cakes» to «parts», where each part corresponds to one third of cake. To give the answer, he counts the number of «parts» and he divides it by the number of people, (see Fig 4, left) being his final answer «two parts».

Instead of this process, he should have used a one-phase technique, giving one third of each cake to each of the three persons, (see Fig. 4, right). The answer, would be given in terms of the original unit «cake» 1/3+1/3=2/3 of cake.

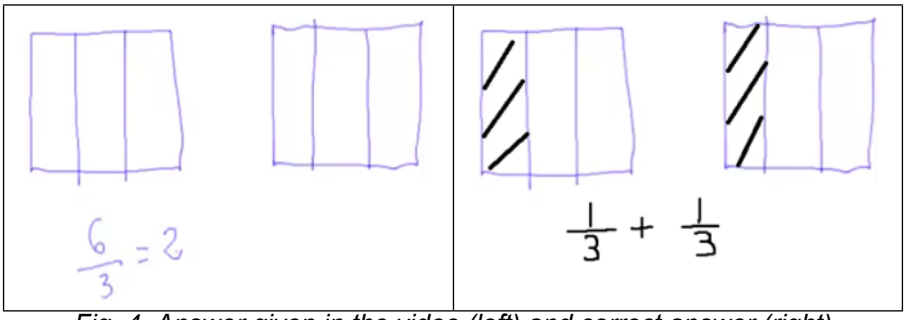

Fig. 4. Answer given in the video (left) and correct answer (right)

Afterwards, the author poses similar problems using the same technique and using the “part” as a unit. This unit corresponds in the following problem with one fifth of the cake, generating a bigger confusion since the same name corresponds in the new problem with a different unit.

Along with the viewing of this video some questions were posed by using the Edpuzzle software (https://edpuzzle.com/). See Figure 5 as an example of an intermediate question, posed right after the teacher in the video asked to their students: what fraction of cake corresponds to each person? instead of how much cake...? (Pedagogical Content Knowledge)

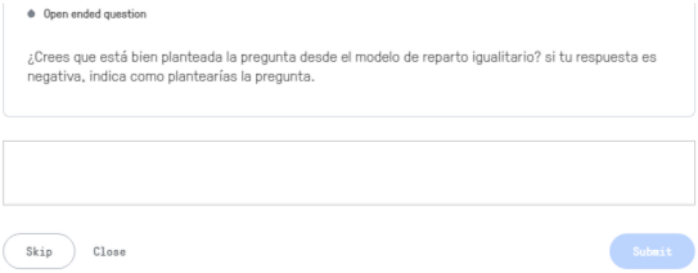

Fig. 5. Example of an open ended question (Do you think the question is well formulated according to the quotient/equal sharing sub-construct? If not, write an alternative question)

37% of our prospective primary school teachers gave correct answers.

After considering the correctness of the question, we asked about the actual solution of the problem (Content Knowledge) with the same percentage of correct answers. Considering the errors, some students answered “2/3” without any reference to the unit or “1/3 of each cake, thus 2/3 of both cakes” changing the unit from one cake to the whole.

3.2 Recording a new video

Once the researcher explained in class the different measurement situations that guide the teaching of the measure of magnitudes in primary school, prospective primary school teachers were asked about recording a 3 minutes video with examples of one of the studied situations.

Fig. 6. Student A Calculates the measure of the area of a rectangle using an arbitrary unit.

In the analyzed videos, prospective primary school teachers used a wide range of easy-to-handle materials and they use to propose easy situations to explain different measurements situations.

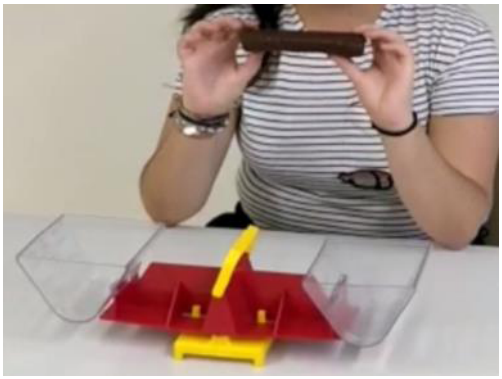

Fig. 7. Student B Constructs two modeling clay blocks that weight half of the given block

We also observed a great trend to use a traditional teaching model: before explaining the measurement situations and activities, they gave a series of theoretical explanations they were not suppose to deliver. The fact is that most of them seemed uncomfortable teaching even simple activities without these previous explanations.

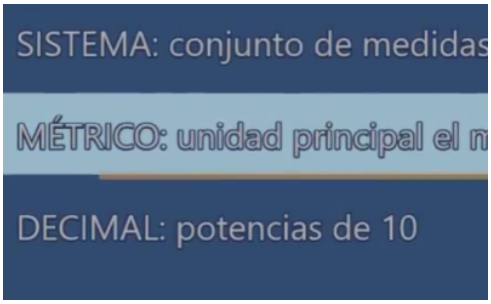

Fig. 8. Student A Previous explanations about the Metric System

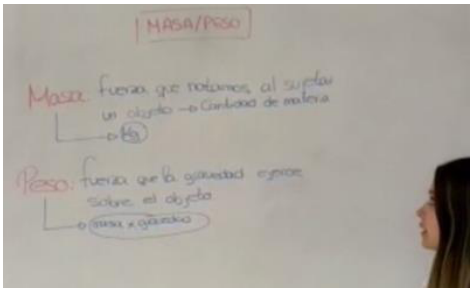

Fig. 9. Student B distinguish between mass and weight magnitudes

4. Conclusion

From a pedagogical-technological point of view (TPK): Our prospective primary school teachers found very pleasing these activities. They considered very interesting to watch and analyze the way actual teachers deliver their lessons. Specially, the possibility of watching them many times paying attention to different details. On the other hand they complain about not being possible to ask for details to the teacher in the video. Considering the Mathematical parts of the activity (CK), they indicate that teacher's explanations lead them to incorrect answers since they got convinced by them. The use of video-based activities has permitted to our prospective primary school teachers analyze their professional practices when explaining concepts related to rational numbers.

Our analysis of these activities points out to the following conclusions: watching actual teaching sequences enables our students to acquire some analysis strategies. These strategies could be used for the analysis of its own professional practice. In particular, they can realize how the part-whole sub-construct limits the use of other sub-constructs.

REFERENCES

[1] Koehler, M. J.; Mishra, P. What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education, Charlottesville, v. 9, n. 1, 2009, pp. 60-70.

[2] Pozo Montero, F., Parés Mariné, N., & Vidal Seguí, Y. Uso del vídeo (pencast) para el aprendizaje de matemáticas: la experiencia en la UPC. In *Actas de las X Jornadas Internacionales de Innovación Universitaria, 2013,* pp. 990-997.

[3] Llinares, S., Valls, J., & Roig, A. I. Aprendizaje y diseño de entornos de aprendizaje basado en videos en los programas de formación de profesores de matemáticas. *Educación matemática*, *20*(3), 2008, pp. 59-82.

[4] Charalombous C. Y. & Pitta-Pantazi D. Drawing on a theoretical model to study students' understandings of fractions. Educational Studies in Mathematics, Vol. 64, No. 3, 2007, pp. 293-316.

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