TECHNO-MATHEMATICAL FLUENCY IN ONLINE MATHEMATICS COMPETITIONS: THE CASE OF MIKE

Hélia Jacinto[1] and Susana Carreira[1,2]

[1]Research Unit of the Institute of Education of the University of Lisbon; [2]Faculty of Sciences and Technology, University of Algarve

The study aims at a broad understanding of the problem solving activity with technology that youngsters are carrying out while participating in an online mathematics competition. We use a qualitative methodology and a case study approach to describe and characterize Mike's problem solving activity. In line with previous research, the preliminary results point out the mediational role of the technology used. Moreover, this case shows that it is not easy to differentiate the mathematical from the technological fluency in such activity, since Mike seems to put both of them into action simultaneously and intertwiningly. The recognition of the affordances of the tool empowers his thinking process which influences the communication of his strategy.

SUB14 – A MATHEMATICAL PROBLEM SOLVING COMPETITION

Following worldwide recommendations regarding mathematical problem solving and the use of digital technologies in the learning of mathematics, the Mathematics Department of the University of Algarve has been promoting online mathematical competitions. SUB14® addresses 12-13 years old students from the south of Portugal. The *Qualifying* stage consists of 10 problems, posted in the competition's website every two weeks. Participants must send their answer as well as a complete and detailed explanation of their reasoning process through the website or using their personal email account. The organizing committee assesses every answer and replies with a specific feedback, either praising or requiring a revision. Participants are welcome to seek the help of friends, family or teachers during this stage. The selected participants attend to the *Final* stage, held at the University of the Algarve.

Our current research is focusing on the problem solving activity that participants undertake in this competition, considering the characteristics of this beyond-school, technologically rich context. We aim at characterizing different modes of action, hoping they will provide an insight on how these participants use their mathematical and technological knowledge.

CONCEPTUAL FRAMEWORK

Our conceptual framework is grounded on a sociocultural view of mathematics and draws on the idea that: (i) mathematical literacy comprises the ability to use mathematical knowledge, namely, for solving problems; (ii) technology is a powerful mediational means of the mathematical activity (Borba & Villarreal, 2005; Werscht, 1991); and (iii) techno-mathematical fluency is expected to be a fundamental leverage to face the 21st century challenges (Hoyles, Noss, Kent, & Bakker, 2010). We also use some ideas aligned with the *theory of affordances* (Gibson, 1977), that

enlighten how students and teachers recognize the affordances of a tool, that is, its invitation to action, in order to generate meaningful mathematical knowledge.

METHODOLOGY

The research follows a case study methodology. Data collecting includes the participants' productions in answering the competition problems, in-depth interviews and observation, conducted at their homes, of their mathematical problem solving activity, in order to develop descriptive cases. In this poster we focus on the problem solving activity of one of the selected participants, Mike. We use data from three interviews regarding Mike's work during the Qualifying and the Final stages of the competition, and also of his activity during one problem solving session. All the interviews were audio and video recorded, and the researcher produced field notes following each meeting. Data were organised and analysed using an interpretative perspective and an inductive process in light of the stressed theoretical ideas.

TECHNO-MATHEMATICAL FLUENCY IN ACTION: THE CASE OF MIKE

Data shows that Mike is what one would call a "digital native": he seems to know all about technology and if he doesn't, he "googles" it. Among three problems to choose from in the final interview, Mike chose a difficult geometry problem. He solved it simply by looking at the online statement of the problem, on his computer, pointing at it and conjecturing on the proof out loud. Then he used an image editor to re-organize the picture of the statement and the spreadsheet to compose his answer, explaining his reasoning as clearly as possible. The analysis of Mike's activity shows that it isn't clear which actions are exclusive evidences of technological fluency and which ones are traces of mathematical fluency, since the thinking process and the construction of a path show that those abilities are strongly intertwined. His success seems to be related to his ability in recognizing the affordances of the tool, which empowers his thinking process and influences the communication of his strategy.

The poster will present an overview of our study using a graphical display.

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REFERENCES

Borba, M., & Villarreal, M. (2005). *Humans-with-Media and the Reorganization of Mathematical Thinking*. New York, NY: Springer.

Gibson, J. (1979). The Theory of Affordances. In R. Shaw & J. Bransford (Eds.) *Perceiving, Acting, and Knowing: Toward an ecological psychology* (pp. 67-82). Hillsdale, NJ: Erlbaum.

Hoyles, C., Noss, R., Kent, P., & Bakker, A. (2010). *Improving Mathematics at Work: The need for Techno-mathematical Literacies*. London: Routledge.

Wertsch, J. (1991). *Voices of the mind – A sociocultural approach to mediated action*. London: Harvester Wheatsheaf.