TEACHING AND LEARNING COMPLEX NUMBERS IN THE BEGINNING OF THE UNIVERSITY CURSUS

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This contribution relates to the secondary-tertiary transition and to the new flexibility requirements (changes of frames or registers…). We especially study the teaching and learning of complex numbers, at the beginning of the university cursus. First, we present experimental teachings using the online basis of exercises WIMS [1], to work on different representations of complex numbers (Rennes, France). Secondly, we analyse students' productions working on complex numbers inside a geometrical frame (Namur, Belgium). It seems that students willingly move from a geometrical to an algebraic frame, but the choice of the most appropriate one remains a challenge.

COMPLEX NUMBERS AND TRANSITION

Different transition forms take place at the entrance of the university cursus (Gueudet 2008). There is a clear need for greater flexibility and greater autonomy for the students to change from one frame to another (Douady 2008), from one register to another (Duval 1995)… As far as complex numbers are concerned these requirements are crystal clear. A complex number can be represented under its algebraic, trigonometric or even exponential form. It also has various interpretations in the geometrical frame, where it can be associated with a point, or with a vector, or as a transformation within a plane. Different studies point out difficulties associated with these requirements of flexibility, particularly with respect to geometric representations (Panaoura et al. 2006). We consider that they require specific teaching.

Our research questions are then: which teaching devices need to be set up in order to assist students to learn complex numbers, according to the above flexibility requirements? Why choose an on-line device to help students to learn complex numbers? Which strategies are used by students to carry out a task involving complex numbers in a geometric frame? Which difficulties do the students meet in performing such a task?

To answer these questions, the poster first presents two experimental teaching approaches put in place in Rennes (France): a face to face teaching on complex numbers given at the beginning of the year, and an online course prepared by a team of IREM (Research Institute on the Teaching of Mathematics), associated with some specific exercises available on the web server WIMS[1]. WIMS can propose exercises focusing on the technical aspects, as well as exercises requiring transfer from one register to another (like « complex shot », Figure 1). The choice of this

online platform enables to meet two specificities of the work at university: acceleration of didactic time and greater availability of knowledge.
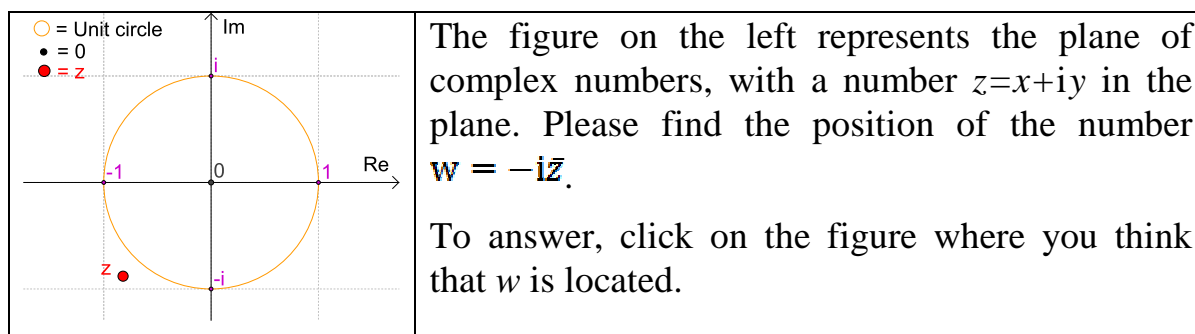

	The figure on the left represents the plane of complex numbers, with a number $z=x+iy$ in the plane. Please find the position of the number $w = -i\bar{z}$. To answer, click on the figure where you think that w is located.

Figure 1: Example of a "Complex shot" task – WIMS (Vandebrouck 2006)

Secondly, the poster presents a brief analysis of students' productions (Namur, Belgium) working on a task involving complex numbers in a geometric frame (exercise of a « complex shot » task). We have noticed that, for example, even if the geometrical frame is sufficient to solve the problem (by the addition of vectors for example), many students convert the problem under algebraic form, which requires more calculations and sometimes approximations. The poster presents extracts of several students' copies. It seems that students willingly move from a geometrical to an algebraic frame, but the choice of the most appropriate one remains a challenge.

NOTES

1. WWW Interactive Multipurpose Server, http://wims.unice.fr/wims/en_home.html

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