Short lecture

DESIGNING SPATIAL VISUALIZATION TASKS FOR MIDDLE SCHOOL STUDENTS WITH A 3D MODELLING SOFTWARE

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Spatial ability can be defined as the abilities of imagine the visualization of an object from different viewpoints, rotation of it and blend or integrate of the parts of the given object (McGee, 1979; Olkun, 2003; Turgut, 2007). An arbitrary person in daily life uses this ability, for instance, while walking in a street considering his/her actual position in the city or placing the wares in a room. McGee (1979) proposed two components of spatial ability: *spatial visualization* and *spatial orientation*. Spatial visualization was defined as "the ability to represent and manipulate visual objects mentally" (Turgut & Uygan, 2013, p. 292). Spatial orientation can be defined as the ability of visualize views of given objects from different viewpoints.

Spatial thinking has an important role in the teaching and learning of mathematics process. And studies showed that this ability has positive correlations with geometry and mathematics education. Besides, recently, some of mathematics questions that required the use of spatial thinking have been appeared in national exams of Turkey (Uygan & Turgut, 2012). In this respect, considering its important role in mathematics education, development (training) of spatial ability by the aid of information and communication technologies (ICT) had great attention in the reviewed literature (Kurtulus, 2013; Turgut, 2010; Turgut & Uygan, 2013; Turgut & Uygan, 2014). With similar aim, this study describes the importance of spatial thinking and thereafter, by the aid of a 3D modelling software SketchUp©, we designed some special activities in order to develop middle school students' spatial visualization skills. In the design of the activities, two sub skill of the spatial visualization; *mental rotation* and *mental integration* are considered. Two theoretical frameworks; Duval's (1998) *cognitive process of geometric reasoning* and *instrumental integration* (Assude, 2007; Verillon & Rabardel, 1995) are based. By the following instrumental integration approach, first, SketchUp's special tools (pan, rotate, protractor, orbit etc.) will be introduced (*instrumental initiation process*) and 6 activities will be given to students in a computerized environment. The tasks have been designed with 3 figures in a SketchUp interface; each is made of a square. In the task, it is asked from students how first two squares should be manipulated in order to form the third figure. One sample task is given in the Figure 1.

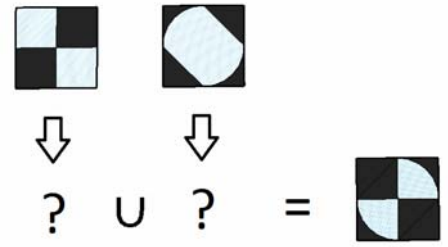

Figure 1: *Sample task*

Each task has two main steps; the first is mental rotation and the second is mental integration. These steps were inspired from Lee (2005). So students have to use protractor with a determined angle and move the squares to form the third figure. Those activities will be piloted in a computerized environment in order to investigate students reasoning process with respect to Duval's (1998) framework. The results will be presented in the conference.

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