Manipulatives and semiotic tools of Game of Go as playful and creative activity to learn mathematics in early grades in France

Richard Cabassut, Antoine Fenech

Strasbourg University, France, richard.cabassut@unistra.fr, Collège international de Strasbourg

The aim of this research is to show that it is possible to develop resources to learn French primary school mathematics through the Game of Go , to use resources at school and to analyze these experimentations. Movshovitz-Hadar (2011) shoved the interest of strategy games in mathematic teaching . For Tachibana & al. (2012) the game of Go develops the cognitive functions in primary school.

For the theoretical framework, with the anthropological theory of didactics (Bosch & al. 2006) we consider that the Strasbourg Go Club (Strasgo 2019) is an institution that produces the knowledge of the ways to play the game of Go. French primary school is another institution where the mathematical syllabus is taught. We study the double transposition of the knowledge of game of Go and of the mathematical syllabus in the French primary school. We study different teaching tasks offered in classes, the way of doing these tasks and how this way of doing is justified, here from the point of view of the game of Go and from the mathematical point of view.

In the game of Go, white and black stones on a board bring manipulatives and semiotic tools to represent mathematics problems: “Mathematical comprehension begins when coordination of registers starts up. […] Mathematical thinking processes depend on a cognitive synergy of registers of representation” (Duval 2006, p.126).

For the methodology this research takes place in an IREM (Research Institute of Mathematics Teaching): “Independent from, but close to mathematics departments, these university structures welcome university mathematicians, teachers, teacher educators, didacticians and historians of mathematics who collaboratively work part-time in thematic groups, developing action-research, teacher training sessions based on their activities and producing material for teaching and teacher education” (Artigue & al. 2019 p.13). Our IREM group gathers six primary school teachers, two players from Strasbourg association of game of Go and one searcher in didactic of mathematics. We use the methodology of didactic engineering: “a phase of preliminary analysis and design, a phase of teaching experiments, and a phase of retrospective analysis” (Margolinas & al. 2015, p.901). Once per month the research group meet with the following phases: playing and learning game of Go, reporting about the experiments in the classes and sharing produced resources, reflecting on the experiments and conceiving new experiments to implement before the next meeting.

We will present **the results** through examples of learning activities and their analyze. For the game of Go knowledge, the experiments show that it is possible to learn adapted game of Go rules. From the pupils‘ point of view the experiments show that motivation, pleasure, social behaviour are developed through game of Go activities. For the mathematical knowledge many parts of the French syllabus of primary school can be taught through the use of game of Go: number, plane geometry, length and area, algorithmic, reasoning, problemsolving. The game of Go brings

interesting registers of representation and the change of registers is a good way to understand the concepts and the procedures.

References:

Artigue M. & al. (2019). The French Didactic Tradition in Mathematics. In Blum W. & al. (Eds.) *European Traditions in Didactics of Mathematics.* Springer. ICME-13 Monographs.

Bosch,M., Gascon, J. (2006). 25 years of didactic transposition. ICMI Bulletin, 58, 51–65 .

Duval, R. (2006). A cognitive analysis of problems of comprehension in a learning of mathematics. *Educational Studies in Mathematics (2006) 61: 103–13.*

Margolinas, C., Drijvers, P. (2015). Didactical engineering in France; an insider's and an outsider's view on its foundations, its practice and its impact. *ZDM Mathematics Education (*2015) 47: 893–903.

Movshovitz-Hadar, N. (2011). Bridging between mathematics and education courses: Strategy games as generators of problem solving tasks. In *O. Zaslavsky & P. Sullivan (Eds.), Constructing knowledge for teaching secondary mathematics: Tasks to enhance prospective and practicing teacher learning*, 117-140, Springer.

Strasgo (2019, March 28) An application brought to you by the Strasbourg Go Club to discover the game of Go. Retrieved from http://strasgo.gostrasbourg.fr/index_en.html .

Tachibana Y, Yoshida J, Ichinomiya M, Nouchi R, Miyauchi C, Takeuchi H. (2012) A GO intervention program for enhancing elementary school children's cognitive functions and control abilities of emotion and behavior: study protocol for a randomized controlled trial. *Trials 2012. 13:8.*