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Design of a board game around the notion of fractions

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Introduction

In 2014, the French ministry of education launched a strategy for teaching mathematics. It favored the use of games to “enhance student motivation and encourage them to be autonomous”¹. But games can also be used to facilitate learning itself. Pelay (2011) showed that Brousseau’s theory of didactical situations (TDS) has an intrinsic play-based dimension articulated to the didactic one and introduced the crucial concept of the didactic and play-based contract. Our PhD project continues Pelay’s work both on the theoretical aspects and implementation ones.

The didactic and play-based contract

One of the key concepts of the TDS is the *didactic contract*, the set of behaviors coming from the teacher and expected by the student and vice-versa (Brousseau, 1997). During his PhD, Pelay observed that in some cases the play-based stakes were more important than the didactic ones. He showed that it was impossible to analyze summer camps’ activities using only the concept of the didactic contract. This led him to develop the concept of *didactic and play-based contract*:

The didactic and play-based contract is defined as the set of rules and behaviors, both explicit and implicit, between an activity leader and one or several participants in a project that links explicitly or implicitly playing and learning (Pelay, 2011, p.278).¹

Pelay studied how the contract is set up and how it evolves when the rules are changed. Furthermore, he introduced the concept of didactic and play-based engineering, grounded on the methodology of didactic engineering (Artigue & Perrin-Glorian, 1991).

Back to the school context

Our research project originates on the hypothesis that the concepts developed by Pelay in the summer camp context are also relevant in the school context: the play-based dimension of the TDS might offer new perspectives to the study of teacher and student interactions when games are used in the teaching and learning of mathematics. We aim to develop a didactic and play-based engineering that will be implemented both in a laboratory setting and in classrooms, taking into account the articulation between the didactic and play-based dimensions from the start.

Methodology

In order to develop a didactic and play-based engineering to use in class, we need to take into account the transmission and reproducibility stakes. Perrin-Glorian (2011, p.68) introduced the didactic engineering of the second kind as “an engineering aiming to produce resources for teachers

¹ My translation

and study the impact of research on ordinary teaching”¹. It consists of planning for two levels of study: a first one, in a laboratory setting, to test the theoretical validity of the situations, and a second one to test the adaptability of the situations to teaching. The preliminary studies, conception and a priori analysis are common to the two levels of study, and they will differ by their experimentations, a posteriori analysis and validation. The first step to our research was the design of a board game to be the core of the didactic engineering.

Designing a game on fractions

Relying on previous research (Pelay, 2011), we hypothesized that board games are likely to favor the active engagement of students in didactic situations build around them. We chose to develop a game that could be used from grades 4 to 6, as it is at the transition between elementary and middle school in France. The notion of fraction was one of the possible topics. The epistemological study has showed different aspects to this notion. We chose to address it from the point of view of size ratio and the composition and decomposition of surfaces. We collaborated with teachers to make sure that the game would be adapted from grades 4 to 6. We ended up creating “L’atelier des potions”, a game in which the students follow recipes for “magical potions”. The game and the choices made in the design will be presented in the poster.

Perspectives

Pretests of the game have been made in a dozen of classes throughout the year and we have developed teaching activities around the game. We are now developing a didactic and play-based engineering around the game and activities.

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