

DEVELOPING SPATIAL SENSE: A SUGGESTION OF ACTIVITIES

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This poster reports about two activities we tested with pupils in order to develop their spatial abilities. These activities are analysed within a specific framework: Berthelot-Salin's ideas about the development of spatial sense, Parzysz's "Knowing vs Seeing" and a generative structure of activities in construction (Marchand, 2006).

PROBLEMATICS

In some curricula (France, Québec), one can read that learning geometry and particularly 3D-geometry should enhance pupils' spatial sense. But the activities related to such objectives are rare or lacking. Here we present two activities we tested with students in order to develop their spatial sense and spatial knowledge.

THEORETICAL FRAMEWORK

Our research is based on

- Berthelot-Salin's ideas about the development of spatial knowledge: to recognize, to describe, to make or to transform real objects; to move, to find or to communicate the location (position) of an object; to recognize, to describe, to build, to transform a living space or a moving space.
- Parzysz's "Knowing vs Seeing": when representing a 3D-object, one has to deal with a loss of information, and to learn the rules for drawing.
- A generative structure activities elaborated around five criteria (development, space, object, task and mental image) and a key element essential to all activity (deprive of seeing or toughing and intervene on that specific phase).

FIRST ACTIVITY: "TOWERS IN A ROW"

In the first phase of this game¹, a pupil has to organize a row of 5 towers aligned in such a way that the number of visible towers is given at each end of the row.

The second phase, the same rule applies on a 3x3 grid and a 4x4 grid, with a new condition: two towers of the same height are not allowed in the same row.

This game was originally devised for kindergarten. We used it with secondary school students with learning disabilities. It proved to be quite challenging and we could witness an improvement as far as the strategies are concerned: In the end the students

¹ Adapted from Valentin D. (2005) *Découvrir le monde avec les mathématiques ; Situations pour la grande section*, Cycle 2, éditions Hatier, Paris

were able to anticipate correctly the location of a tower without any trial and error. The hidden towers were clearly identified. This activity proved to be an introduction to the drawing of plane views of a 3D-object.

Such an activity is at the same time a game but an opportunity to develop a pupil's spatial sense in Berthelot-Salin's meaning. Moreover, according to Marchand's framework, it has every characteristic of a good learning activity.

SECOND ACTIVITY: "INSIDE THE BOX"

In this kindergarten activity ("boîte à image"), pupils are invited to build a landscape inside a shoe box and to look at it by a small hole on one side of the box. Different tasks can be performed from that point on. We experimented this activity with first and second grade pupils and we chose to make them represent their scene on paper, to imagine what we would see if we made a hole on the side. We also asked them to describe their box so that others could identify it (ex.: there is a cat in front, a tree on the left...) and played "guess who?".

Choices were made according to our framework orientation and it has proven to be a rich activity to include in a sequence of activities for the development of spatial knowledge. At first, we saw kids having a hard time building their boxes so that they could see all their objects by the hole. Afterward they had a hard time with realizing the drawings (perspective, orientation, position...), and finding the significant words to describe the position of each object in the box and in relation with the others, and finally anticipating the view from another point of view. Here is an example:

CONCLUSION

This project exemplifies how we can create rich activities to develop spatial knowledge, from Kindergarten to High School students with learning disabilities. But, how can we clarify curricula to enhance this development? What would be the goals for elementary and high school in terms of spatial knowledge? And can we benefit of the spatial knowledge developed extracurricular in the mathematical class?

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