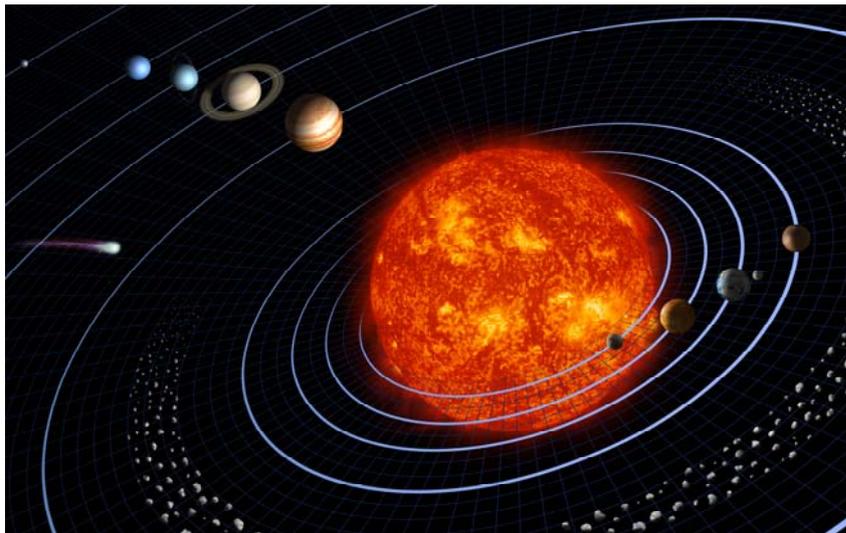


Background

General didactical background

This material is originally designed for pre-service primary teachers' (later used the term "students") science education, but it is worthwhile also to use on lower levels of education (12 – 16 years old students). Primary teachers teach the basics of solar system on grades 5 – 6, then they need to learn to explain it and use different kinds of teaching methods to make the learning environment concrete enough and understandable. In this material we present one possible way to create an authentic learning environment where participants' experiences are used as vehicles for thought and learning by using a role play as a motivating way to teach about the solar system.

According to several researchers (see Further information) understanding the solar system even on elementary level needs a radical conceptual change because in the everyday we see the earth flat and sun is rising in the morning and going down in the evening.



An artist's view of solar system, the planets are closer to each other than in reality. The picture is downloaded from http://sse.jpl.nasa.gov/multimedia/gallery/SSE_Grid.jpg

Reason for implementing a role play as a teaching method were the results of the mathematical-scientific thinking exam (2007) conducted as a part of entrance exam for pre-service teacher candidates in University of Turku, Finland. In the exam, there we used a question about the candidates' understanding about the Solar system. In the question we gave them the following task:

Draw a map, where you set the following objects in order according to the order they exist or move in reality (their size and relative distances need not to be considered, only their order): Saturn, Earth, Moon, Sun, Weather satellite, Proxima Centauri (star).

The question was supposed to be easy for the candidates but the results revealed that there were too many candidates who considered the moon centered world view, or that moon and Earth are situated on opposite sides of the Sun and that the weather satellite orbits Moon or Sun. Only 16 % of the 215 applicants scored maximum points (4 points) in this task, 38 % either did not answer at all or scored 0-1 points, 46 % gained 2 – 3 points.

It was there, we decided that something must be done, and after that we decided to try Role Play as a teaching method to teach this data to the students accepted in to the teacher program in the University and who in future are going to teach these facts to 5th and 6th grade children.

Role Play as a Teaching Method

Role-playing has been traditionally used as a teaching method to organize collaborative learning activity where students are asked to make a decision, resolve some conflict or invent a play where the roles are determined but the actions in the play are not (e.g. Gao, Noh & Koehler, 2008). Another purpose for role-playing is to stimulate reality in a classroom and provide experiences for the students (Ments, 1989; Ladousse, 1987).

In this solar system role play, the students' acquisition of knowledge is supported by providing opportunities to observe, understand and assimilate information (Maier, 2002). For effective role-playing, some adequate preparations, alignment of roles and tasks, structured feedback guidelines are required (e.g. Nestel & Tierney, 2007). In short, a role play should include the following phases: creating the context, a role play, discussion and evaluation.

To create a context for a role play, some additional materials like videos, books, or a visit to an observatory could be used. In this phase, it is essential to make a joint goal for a role play (e.g. understanding how the planets are situated and what is their relative distance around the sun, a season change or a change of day/night cycle) and to pay attention to children's prior knowledge and internal representations.

This information is essential for a teacher as well as for those students acting as observers during the role play. The observers assignment is to pay attention how the solar system is presented in the role play and whether the order of the planets are correct and whether the planets are moving along the elliptic shape of the orbit around the sun. Perhaps, the most important phase is the discussion phase, where the students should be able to discuss how the role play changed their prior understanding.

Mathematical background

Teaching the Solar system gives a natural context to also to teach dealing large numbers in mathematics, calculating the distances of the planets from Sun and compare them, for example..

The idea of teaching implementation

The idea of this teaching implementation is to provide an alternative teaching method for teaching solar system for students by focusing on for example the order and the relevant distances of the planets, change of seasons. Focusing on the students' prior knowledge and internal representation requires at least one orientation lesson where children could draw their own view of solar system. Also they could gather information from books and other materials like videos. One good way to start could be collecting students question what they do not understand and try to find ways to implement those features to the role play. In the role play that we implemented one lesson (45 minutes) were used, and the pre-service teacher students were chosen randomly for their roles (see Teaching material).

The ScienceMath-project: **The solar system – a role play**
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In the role play, the students were asked to move around the lecture hall and imitate for example how the Saturn moves the elliptic shape of the orbit around the sun the Sun. Further, a student acting in a role of Saturn had also an information label to be read to the audience but she was responsible for which information she considered meaningful for the role play. During the role play, there was a lot of information concerning the solar system available which was impossible to learn simultaneously. However, the teacher interrupted the role play time to time in order to pay attention to some important phenomenon like “Moon rotates around once in a month”. In our experiment, a plenary session was not conducted but the students were having some other home tasks about solar system to be done. But for the younger children, it would be essential to discuss how the experienced the role play and ask them to draw their world view after the role play and perhaps write some short essay what were the main points changing (or not changing) their world view.

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