Conceptual networks based on pupils' conception of time

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Abstract. The following study illustrates many of the procedures discussed in our previous one (Plakitsi, Kokkotas 1998), concerning the development of the concept of time on primary students. Our research is based on pupils' phenomenology and in all those characteristics accepted as ontological features of time. We have studied these features through pupils' conceptions of duration and succession of some physical events (including actions) and we have constructed a conceptual network. This network has been established from the qualitative data analysis. Data has been collected through individual interviews and questionnaires. Our findings about pupils' conception of time could be summarized in the following, where time seems to be: something which I have or I have not // something which I need or not // something which I can fill (with actions) // something like a state of affairs // something which refers to the end rather than to the beginning of some events (or actions). In addition, time is often identified by its flow, its units or its metric tools, by duration or succession of events and, sometimes, by a periodical phenomenon.

Description of the subject/problem. By the end of the century, a lot of research about pupils' ideas in various science concepts were done, so that anyone could say that they are complete. But only a few researchers group the different data in a schema, so that we can conceptualize the fundamental categories of thought, such as object, cause, space and time. Continuing a previous study of ours, we aim to describe pupils' conceptions of time, studying their perceptions about some events (changes in general), including actions and everyday life events. Specifically, we have tried to find out how pupils o 7, 10 and 12 years old perceive the concept of time, through their estimations of duration and succession of physical events. In this study we made another innovation by constructing a systemic network (Bliss, Monk and Ogborn, 1983), based on pupils' conceptions of time. In spite of the complexity of temporal knowledge, research in various aspects of its development can play an important role in our understanding of the process of cognitive development (Friedman, 1982). Besides, we are expecting that this network could be a dynamic tool in teaching changes interrelated with physical events (physical, chemical phenomena and actions) since time is the main variant in them. This study is, also, a part of a wider research program entitled «Innovative teaching methods for learning and instructing concepts which describe / interpret living and non-living things and their phenomena». A review in literature shows, in brief, that: a) Objects and events will be understood, by how they share meaning with one another, through general categories of thought such as action, movement (change in general), object, cause, space and time, as suggested in Piaget's work on the construction of reality (Piaget, 1936, 1937 & Mariani and Ogborn, 1995). b) Piaget's general idea is that fundamental categories of thought about reality can be constructed from action and change. c) Students pick out the concept of change in terms of everyday science or in terms of common sense reasoning (Anderson, 1990, Driver, 1994, Brosnan, Hatzinikita,1995, Mariani and Ogborn, 1990, 1991).
**Design.** Our approach is more phenomenological than semantic. This is a pilot phase of the wider research programme that is mentioned above. It was designed in the winter of 1998 at University of Athens, Dept. of Primary Education, Science - Technology and Environmental Section. It was carried out in Spring of 1998, at three different schools in Athens, which differ as far as their socio - economical standards are concerned. The pupils of 7, 10, 12 years old of each school were clustered in equal groups based on their school performance. Finally, the sample consisted of 67 subjects.

**Procedure.** First, we conducted individual semi - constructed interviews to find how pupils perceive the concept of time through their estimations of duration and succession of physical events. Then, we used a questionnaire (the same for all subjects). Some of the questions in the questionnaire were the same as those in the interviews. Each subject was interviewed for about 30 minutes. The average time of completing the questionnaires was 30 minutes as well. We used tasks based on Piaget’s, Fraisse’s and Friedman’s studies about time, which we modified in order to make them appropriate for the greek mentality and language. Finally, each subject was asked to draw what he/she had in his/her mind in relation to the word «time».

**Data analysis – Findings.** From the syntheses of pupils’ ideas and the qualitative data analysis (using also content analysis of the propositions which subjects had made about time), we created an elaborated conceptual network, which can be used by researchers and teachers when they work on matters associated to time and its aspects. This network is a systemic one, according Bliss, Monk and Ogborn analysis. These aspects of time exist in pupils’ learning about changes. They may prevent students from understanding the mechanisms of change and constructing meanings compatible with the scientific ones. So, a new challenge for researchers and
teachers would be arising, as manipulating a change, one would have to consider the temporal network in relation to the conceptual network which he anticipates to be learned by pupils.

**General interest.** Our contribution fits in Learning and Teaching. The network we made, could be proposed as a dynamic tool:

a) for investigating students’ understanding of change (in physical world and in everyday life),

b) for instructional approaches, as a dynamic network - «target - obstacle» (Aristolfi & Peterfalvi, 1993, see also Hatzinikita, Koulaids, Kokkotas, Vlachos, 1997),

c) for our understanding about conceptual change in learners and teachers.

Finally, we anticipate using this network in curriculum reforms, which are in progress in our country by now, but it can also be used of other researchers and curriculum reformers, because time is one of the fundamental categories of thought and the most important variant in changes.

**References.**

