# Integrating Multiple Perspectives on Effective Learning Environments

# Abstracts

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## The role of interactions in Science learning using three educational mediums: video, technology-based learning environment and real objects

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In this paper we discuss the interactions between students and among teacher and students. It is pedagogic delusion the thought that the work of students in groups involves automatically their collaboration (Amigues, 1988). The interaction between students depends from their personality (Kempa and Ayob, 1991). Many times, their oppositions lead them to conflicts that prevent the problem's solution (Goffard and Goffard) or a student with an error representation accomplishes to convince the other (Gomatos, 1996). Dillenbourg (1999) states that students do not learn from each other merely by solving the same problem at the same time, but because they interact (e.g. by explaining something or by negotiating about several solutions).The teacher's role as tutor is very important (Dumas-Carré & Weil-Barais, 1998).

Based on the presented theoretical framework, we discuss the interactions between students and among teacher in Science teaching. Specifically, the teaching paradigm concerns Hooke's Law using springs. The physical system we study has certain advantages: it is simple enough and represents a wide spectrum of real systems in order to make it as reusable as possible. The paradigm is designed within a socio-constructivist approach, where the student takes an active role on the construction of his/her knowledge, and it exploits three different mediums: a video in order to motivate students' interest; objects from everyday life for the experiments; the software "ModellingSpace".
First, students look at a video. A spring that is neither compressed nor extended is in its equilibrium position. The length is perturbed slightly and the spring tends to come back to the equilibrium position. As long as the deformation is elastic, the force exerted by the spring will be proportional to the amount of the stretch from equilibrium. Now, a mass is hung from the spring, it is displaced from the equilibrium position and it oscillates. They describe and explain the video, expressing their first representations. Next, they carry-out the experiment using different springs. Finally, they design and virtually run the experiment using "ModellingSpace" (Dimitracopoulou et al., 1999; Komis et al., 2001) which is an open-ended learning environment that allows students to create models, work and reflect on entities (representing objects) and their properties (representing concepts),while they construct the model of the situation using the entities (concrete or abstract), the properties and their relations.

ModellingSpace is a technology based learning environment, currently in the state of prototype (Dimitracopoulou et al., 1999; Komis et al., 2001), designed to familiarize pupils with the steps of modelling. Using this learning environment, the pupils can build models of the evolution of physical, biological, systems, etc. Concretely, the

user of the learning environment determines the constitutive entities of the system in which he is interested and the descriptors of these entities. He proposes then relations between these possible descriptors to account for the evolution of the system.
The interest of this technology based learning environment is that it makes possible to pupils to handle various semiotic systems, making possible to express the entities and their relations. By comparing the transformations of the entities (represented in a figurative way by dynamic images) associated with various expressions of the relations, it is possible to apprehend the compatibility or the incompatibility of the relational expressions. It is thus possible to exploit the possible mapping between various manners of representing the relations: graphic coding with arrows of variable size (↑↑ which means the covariation of two descriptors), logical, mathematical expression, a graph, and a table of measurements. ModellingSpace (Komis et al., 1998; Politis et al., 2001) thus make possible to pupils to connect various symbolic notations of relations between variables and thus encourage various processes of translation between the various semiotic systems (language, semi-quantitative relations, etc).

We compared the models created by the students using the ModellingSpace in the tree phases. When they:

1) work individually
2) work in groups and each group was implemented separately
3) work in groups which was implemented separately and their teacher participate also to the processus.

Students attended first grade of higher-secondary school (15-16 years old). Each group consisted of three students. The developed teaching approach was implemented with 15 students in the first phase, 5 groups (or 15 students) in the second phase and 5 groups (or 15 students) and their teachers in the third phase. The duration of the implementation was 20-30 minutes for each individu while the duration of the implementation was 30 - 40 minutes for each group. The students had volunteered to participate. The implementation of the paradigm was video-recorded, while some of them were also interviewed afterwards.

Results show that the use of three media and the cooperation between students and among teacher and students facilitates students' understanding in a more intuitive way, particularly concerning the meaning of abstract concepts. When they work in groups, the most of the times it helps them positively and they arrive to agree ant to mesure the elongation from the correct position. Of course, the interactions between the students as well as the role that each student plays in the team are very interesting. Nevertheless, exist some teams (minimal) where a student has the role of leader or there are disagreements and they don't arrive in the correct result. When in the process participates their professor, prompts them to experiment more times and "carefully'. The teacher ask them many questions but also helps them when the students answer by a falshe response. For exemple "*do you remind anything... we have taught it in the book...* Or they say: *it exists in a frame with the spring and the dynamometer in the chapter 2... I help you*"; "*Beautifully! you have meet it in the lower secondary school and you have have given it also a name*". We conclude that when they work in groups positively and the teacher participates to the process the models are more complicated and arrive to the scientific model.

single solution step within one task was presented. The second experimental condition was related to the application flow and called 'pacing'. In order to avoid the well-known 'couch potato attitude' while watching videos and the consequentially superficial processing of the learning content, the users were actively involved in the application flow via click control at the beginning of each segment. Learning success was measured with a declarative knowledge test (multiple choice/ open questions) and a procedural knowledge test (near and far transfer tasks). The results showed that on-screen videos, particularly those with labels, substantially improved the learning outcomes compared to a standard introduction to the computer application. In addition, we assessed errors during task handling, actual task handling time, acceptance, and motivation. All these effects will be presented at the conference. We will discuss the implications of these results to current instructional theories.

*The role of interactions in Science learning using three educational mediums: video, technology-based learning environment and real objects*

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In this paper we discuss the interactions between students and among teacher and students. It is pedagogic delusion the thought that the work of students in groups involves automatically their collaboration (Amigues, 1988). The interaction between students depends among other things on their personality (Kempa and Ayob, 1991). Many times, their oppositions lead them to conflicts that prevent the problem's solution (Goffard and Goffard) or a student with an error representation accomplishes to convince the other (Gomatos, 1996). Dillenbourg (1999) states that students do not learn from each other merely by solving the same problem at the same time, but because they interact (e.g. by explaining something or by negotiating about several solutions).The teacher's role as tutor is very important (Dumas-Carre & Weil-Barais, 1998). The innovative paradigm concerns Science teaching and specifically Hooke's Law. It exploits three different mediums: a video, real objects and the technology-based learning environment ModellingSpace. First, students look at a video. A spring is in its equilibrium position (neither compressed nor extended). The length is perturbed slightly and the spring tends to come back to the equilibrium position. Then a mass is hung from the spring and it is displaced from the equilibrium position and so on. They describe and explain the video, expressing their first representations. Next, they carry-out the experiment using everyday objects. Finally, they design and virtually run the experiment using ModellingSpace which is an open-ended learning environment that allows students to create models. Results show that the use of three media and the cooperation between students and among teacher and students facilitates students' understanding in a more intuitive way, particularly concerning the meaning of abstract concepts.

*The recourse to educational games software in high school educational intervention: An exploratory study*

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This paper presents the results of a preliminary study conducted with 66 high school pupils (14 to 17 years of age) who were asked to experiment with four software games recommended by the Quebec Ministry of Education: two teacherware games and two software games for commercial purposes. Our intent was 1) to gather information on the profiles of daily utilization practices of an electronic game by high school pupils and 2) to establish a first profile of their representation with regard to the utilization of educational games environments in school contexts. The research protocol included a double procedure for data gathering. After being presented with a brief survey relevant to their sociometric profile and their daily recourse to domestic practices with electronic games, pupils tested the software for a period of 90 minutes and were interviewed on four dimensions pertaining to their perception of the game, representation of its qualities and defects, game strategies and relevance to their level of schooling. Pupils had difficulty conceiving that a games context could be of some use to support school learning. This directly questions the significance of recourse to authentic learning contexts implementing curriculums of a socioconstructivist orientation. The reseach process already begun will eventually help us measure the distance between the representations of teachers concerning their recourse to educational game software in the classroom compared to evaluation of educational software made by larger samples of primary and high school pupils. The study will provide precious indicators for practitioners with regard to the integration strategies of pedagogical informatics to be privileged to support the authentic character that teaching and learning situations should adopt.