INQUIRY-BASED ACTIVITIES USING A VARIETY OF PEDAGOGICAL TOOLS

Zacharoula Smyrnaiou, Angelique Dimitracopoulou

ABSTRACT
This study examined the impact of an inquiry-based and modeling-based instructional intervention on primary school students, using different pedagogical tools: video, real objects and a technology-based environment that supports modeling.. The study was implemented with thirty (30) students. Quantitative results demonstrated that the intervention enhanced the inquiry ability of all students. Qualitative results demonstrated that it is essential for students to practise modeling activities. It is also essential that the realisation of experiments in computer follow the realisation of real experiments, in order to activate the students reasoning in greater depth and support them pass to formal thought. The study adds to the existing literature on designing learning environments.

KEY WORDS
Inquiry Learning, Modeling, Technology-based learning environments, Video

INTRODUCTION

The literature of the science education offers important data to the science inquiry and modeling. The main characteristic of inquiry learning is that learners learn by acting as scientists. This means that learners approach problems in a scientific way using scientific methods. Because of the importance of inquiry, the content standards describing what all students need to know and be able to do include standards of science as inquiry. These inquiry standards specify the abilities students need in order to inquire the experiments and extract the knowledge that will help them understand inquiry as the way that knowledge is produced. A lot of effort has been put into how to improve students' inquiry skills (Cuevas, Lee, Hart, Deaktor, 2005). It is expected that via methods similar to the the scientific methods learners will approach the problems under study more deeply, an approach leading to a better understanding, and therefore they will learn about the nature of the scientific knowledge, including the involved processes of knowledge building.

Many researchers also agree that modeling should be the main technique of teaching sciences (Lemeignan & Weil-Barais, 1993 ; Mellar et al., 1994, etc.).For science education, it is especially important that students learn how to develop models and how to draw explanations of natural phenomena (Coleman, Brown, & Rivkin, 1997). Currently, various software tools support students' construction of models (Jackson, Stratford, Krajcik, & Soloway,1996; Dimitracopoulou & Komis, 2005). We think that inquiry and modeling should be the main highlight of science teaching. The modeling process in Sciences' teaching has been studied via the use of different pedagogical tools: usually objects from everyday life (used for the experiments) and technology-based learning environments. The results show that the advantages of different pedagogical tools can contribute to the act of learning the sciences' concepts taking into consideration the cognitive processes that are involved in modelling processs (Smyrnaiou, 2003; Smyrnaiou & Weil-Barais, 2005).

This paper cites some data concerning Greek students' responses to the application of an Inquiry Learning method. It also cites data concerning modeling and the use of different pedagogical tools (video, real objects, technology-based learning environment: MODELLINGSPACE) in inquiry-cycle and modeling-cycle learning. We present basic research (cognitive research), where students of the 6th class (11-12 years old) realise the experiments individually.

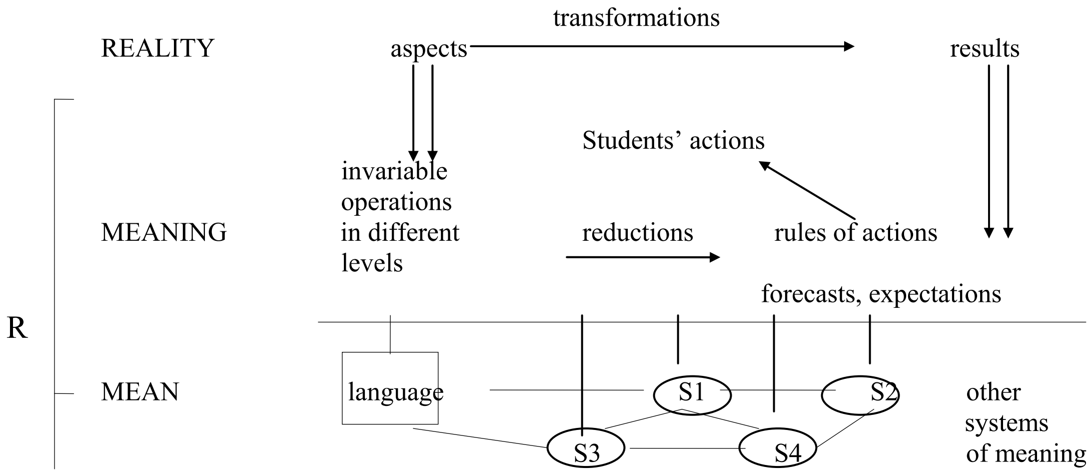
THEORETICAL FRAMEWORK

Numerous definitions of science inquiry can be found in the education literature (Flick, 2002; Barman, 2002; Settlage, 2003). The literature review shows that there is not a clear definition of science inquiry (Cuevas, Lee, Hart & Deaktor, 2005). According to the National Science Education Standards (National Research Council, 2000): Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (p. 23). Unguided inquiry is generally found to be an ineffective way of learning (D. Klahr & M. Nigam, 2004).

The educators frequently cite failures of full effective implementations of inquiry-based instruction. According to them, the explanation of this fact is the lack of sufficient empirical studies that examine the best way to teach the process of inquiry (Evans, 2003; Settlage, 2003). Research indicates that students have substantial problems with all of the inquiry processes (de Jong & van Joolingen, 1998). They have difficulty choosing the right variables to work with, they find it difficult to state testable hypotheses, and they do not necessarily draw the correct conclusions from experiments. The most difficult step for students in the inquiry process is asking appropriate questions (Royce & Holzer, 2003). They may have difficulty linking experimental data and hypotheses, because their pre-existing ideas (Chinn & Brewer, 1993). They can't translate theoretical variables from their hypothesis into manipulative and observable variables in the experiment (Lawson, 2002); they varie too many variables at one time (Keselman, 2003); they fail to make predictions; and they make mistakes when interpreting data (Lewis and al., 1993).

Modeling can play a role in the learning process when we ask students to construct models. In the "*learning by modeling*" approach students are required to construct an external model with the objective to make the model behave as similar as possible to the real system (Penner, 2001). We speak also of "*learning from models*" when students can interact with the model. Students' learning processes center around the exploration of this model by changing values of input variables and observing resulting values of output variables. In this process they experience rules from the domain or (re-) discover (aspects) these rules (de Jong, 2006). Finally, both ways of using models can be combined in what we will call "*model-based inquiry learning*". Here students receive a model that they can explore by changing input and observing output and they have to reconstruct this model, including its internal functioning, in such a way that both models will behave in the same way (Löhner, van Joolingen, Savelsbergh, & van Hout-Wolters, 2005; van Joolingen, de Jong, Lazonder, Savelsbergh, & Manlove, 2005). Whatever the approach chosen is, students cannot perform inquiry, modeling without scaffolding (Klahr & Nigam, 2004; Mayer, 2004).

Research in the field of cognitive psychology has shown that the process of translation among the various symbolic systems is essential for science learning (Vergnaud, 1987).



R=Representation

Figure 1. A general theoretical framework for the Representation of Reality (Vergnaud, 1987)

Gerard Vergnaud (1987) has proposed, in a constructivist perspective a general theoretical framework (schema) which emphasises on the relationships that the student has to construct in order to be able to understand and interpret situations, to communicate their purpose and to make predictions, inferences, etc. He emphasises the role of the student's actions and cognitive resources in the elaboration of knowledge, within a constructivist approach. He distinguishes three functioning registers: a) the register of actions on real objects (student's knowledge is dependent upon the reality: the student acts, manipulates and thus provokes changes and transformations in the world of objects); (b) the register of mental representations (presented in Vergnaud's theory by the «operational invariables», or the "constant organisation of the activity associated to classes of problems"); (c) the register of symbolic representations (maths, language, etc.).

Furthermore, it has been proposed that the use of technology-based learning environments (e.g. simulation or modelling environments) can facilitate the connection between the three registers: aspects of reality, their conceptualisation and their symbolic representations and thus to achieve a profounder students' understanding (Smyrnaiou & Weil-Barais, 2003). . However, students' understanding was significantly better, when students carried out real experiments before using the technological environment (Smyrnaiou, 2003).

MODELLINGSPACE is a technology based learning environment (Dimitracopoulou & Komis, 2005), designed to familiarize pupils with modeling processes (Smyrnaiou & Weil-Barais, 2005). It constitutes an open, though complete, learning system, adaptable to a wide range of students (11-17 years old) and able to be used during different curriculum subjects, school classes and European countries.

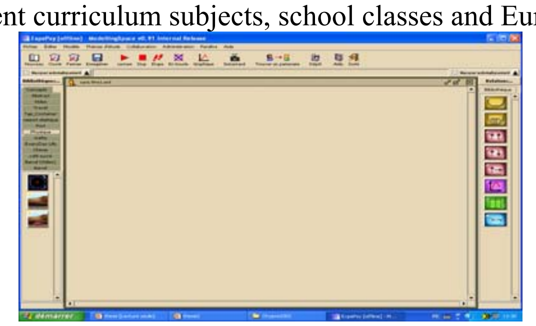


Figure 2. The interface of technology-based learning environment: MODELLINGSPACE

A student who wants to design a model must at first determine the model's entities, located at the left of the screen, and the list of relations, which are located on the right side of the screen (figure 2).

DESCRIPTION OF THE STUDY

The existing literature points to an array of issues related to science inquiry and modeling, including the difficulty in arriving at a consensus about the definition of inquiry, the question of primary school students' ability to conduct science inquiry and modeling, and the way to design technology learning environments and instructional approaches appropriate for primary school students. These issues become more interesting when students use different materials, like a technology-learning environment and a video. Within this conceptualization and implementation of the instructional intervention, the present study examined how primary school students designed an inquiry process and built a model to answer predetermined questions using different pedagogical tools.

The study examined two research questions:

- What is the impact of the instructional intervention on students' ability to conduct science inquiry and overall, modeling and to use the inquiry skills of questioning, planning, implementing, concluding, and reporting?
- What is the impact of the instructional intervention on narrowing gaps in the ability to conduct the inquiry modeling using different pedagogical tools?

Teaching paradigm

Based on the presented theoretical framework, we discuss a teaching paradigm in Sciences and specifically in the topic of acidity and alkalinity. The paradigm is designed within an inquiry-modeling-based approach, where the student thinks as a scientist. He/she takes an active role on the construction of his/her knowledge, and he/she exploits three different mediums: a video in order to gather data; objects from everyday life in order to do experiments and gather information from other sources; the technological environment "MODELLINGSPACE" in order to build models and arrive at conclusions. In MODELLINGSPACE learners have to build a model (find the objects, concepts and relations) that will help them explore answers to a phenomenon under study, or in other terms solving a specific problem.

A scaffolding schema (table 1) supporting students to design an investigation for solving a problem, through the specific three pedagogical tools was developed.

Table 1. Inquiry-modeling framework and Scaffolding questions

SCAFFOLDING QUESTIONS	INQUIRY-MODELLING PHASES
Observing the phenomenon in the video What is the problem? What do I think will happen?	Questioning
Which resources are available? How to tackle the assignment?	Planning
Design experiments with real objects Prepare the experiment Which real objects will you use? Which measures will you take? Which variables will you vary? And which ones will remain constant? Formulate a research question which variables you are going to explore: which variable will be varied in the experiments: which variables will be held constant: Conduct experiments and analyse results Draw conclusions	Implementing
Experiments with technology based learning environment (MODELLINGSPACE) Make and test a model of acidity and alcanility Which are the entities we need to choose from the entities libraries? Which are the properties we need to choose for each entity? Indicate the appropriate relationship ("table" or semi-quantitative, or quantitative) between the properties that are needed for creating the model. Create and test the model Run the model. Graphs from the model, Solve the problem using the model	Modeling
Conclusions	Concluding
Inquiry-Modeling Report presentation in the classroom Which is the final model? Can you justify it, using strong arguments (graph, table of measures, etc.) in relation with the phenomenon's description? Which were the intermediary models that you had created (you and/or your collaborators), and they were not adequate? Why they were not suitable? Formulate your own problem and ask other students to solve it.	Reporting

Research Method-Procedure

The students in their class observe the phenomenon at the video. Then each student questions him/herself on what is the problem. At first, he/she works individually and writes his/her answer on the worksheet. Students start to think which experiments they want to conduct with real objects. He/she answers to the questions. Which real objects will you use? Which measures will you take? Which variables will you vary? And which ones will remain constant? The investigation should be guided by a research question. He/she writes his/her version of this question. Students conduct the planned experiments. They plot the results of each experiment. They use different colors to differentiate between measurements. They value and explain their answer. Students will build a model that imitates or simulates the experiment they have already realised with the real objects. This means that he/she will make the representation of his/her conclusions in a symbolic form.

The target population is pupils towards the end of primary school (age 11-12). Three classes of three different primary schools were used for the study, with a a total sample number of thirty (30) students. The students were selected volunteer. Two ssessions were conducted with the same six-grade students, at the start and after two weeks. The sessions were performed by three members of the research team, each one of whom worked with one teacher. Each session lasted at about 40 min. All sessions were audiotaped and videotaped, but the quality of the elements was not very good. Finally, we have analysed mainly the written students' responses on their worksheets.

RESULTS

T-tests for the mean difference between the scores of the pre- and post-inquiry processes/activities indicate that this difference is statistically significant and, furthermore, that the scores increase after the researcher's inquiry. Consequently, this fact leads to the conclusion that the students' ability to conduct inquiry-modeling in general and to employ each of the specific skills of the inquiry-modeling framework increases after the inquiry processes. The collected data are presented in Table 2 and the paired-samples t-tests in Table 3.

Table 2. Ability to conduct science inquiry-modeling (n=28)

Skills in Inquiry	**Framework**	**Pre**	**Post**
Questioning	Problem statement Hypothesis	18 28	25 28
Implementation	Procedures Materials Recording	13 17 13	22 21 17
Modeling	Entities Properties relations	16 13 10	21 16 16
Concluding		11	17
Applying		9	12

Students' ability to formulate a problem statement (problem_pre, problem_post) improves. The mean difference between the pre-test's and the post-test's scores (problem_pre - problem_post) is -0,643 with standard deviation 0,745 and the p-value of the two-tailed t-test suggests that it is statistically significant at level a=0,01, because p-value=0,7%<10%. The fact that the difference lies below zero means that the students' scores in understanding the problem rise after the inquiry teaching. For example, during the pre-elicitation session, a student stated the problem as: ''*the change of the colour means the addition of some substances.*'' In the post-elicitation session, this student believed the problem was: ''*the change of the acid's colour or base's colour means the addition of an indicator*''.

Table 3. Paired samples test

		Paired differences			t	p-value
		Mean	Std. Deviation	Std. Error		
1	Probl_PRE - Probl_POST	-,643	,745	,199	-3,229	,007
2	Proced_PRE – Proced_POST	-,643	,842	,225	-2,857	,013
3	Mater_PRE - Mater_POST	-,286	,611	,163	-1,749	,104
4	Entit_PRE - Entit_POST	-,357	,633	,169	- 2,110	,055
5	Prop_PRE - Prop_POST	-,214	,426	,114	-1,883	,082
6	Relat_PRE - Relat_POST	-,429	,852	,228	-1,883	,082
7	Rec_PRE - Rec_POST	-,286	,726	,194	-1,472	,165
8	Concl_PRE - Concl_POST	-,429	,852	,228	-1,883	,082
9	Appl_PRE - Appl_POST	-,214	,426	,114	-1,883	,082

Even after probing questions, some students still could not state the problem in the story, particularly during pre-inquiry processes. Because of the fact that students had to understand the question in order to continue with the inquiry-modeling task, the researchers helped them pose a question or, in some cases, provided them with the question. Once all students had understood the question, either by themselves or with the researchers' help, all could formulate one hypothesis relevant to the question. Thus, all students received a positive score during both pre- and post-inquiry processes/post-tests/post-tasks.

Students' ability to develop procedures for solving the problem improved significantly. The mean difference between the pre- and the post-test (proced_pre –proced_post) is -0,643 with standard deviation 0,842 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=1,3%<10%. For example, the pre-inquiry response of a student demonstrates hardly understanding of the problem. When asked by the researcher the question: "*Do you think you could set up an experiment to get the answer? What would you do?*" the student's response was simply: "*a substance is humid, solid*". The post-inquiry response reveals consideration of the need to control variables that could confound the results, as well as an understanding of the exact information the experiment should provide. The student said: "*we could put lemon and seven-up*". Then, the student poured the same amount of lemon and seven-up in the containers. In response to the researcher's query "*Why are you putting the same amount in container?*" the student responded: "*Because it must be the same amount in order to react*". His response indicates a consideration of controling the confounding variables (i.e., the same substances- acids, the same amount of acids) step-by-step planning, and an understanding of how her plan would result in answer to the problem.

After developing procedures, students were asked to make a list of materials needed to carry out their investigation. Containers, acids (lemon, seven-up), bases (detergent for dish-washing), indicator (the red cabbage) and measure cups were placed on a table in front of the students at both pre- and post-inquiry sessions. Though, the change in students' ability to describe how they would use those materials in order to conduct their investigation was not statistically significant. The mean difference between the pre- and the post-test (materials_pre – materials_post) is -0,286 with standard deviation 0,611 and the p-value of the two-tailed test suggests it is not statistically significant at level a=0,01, because p-value=10,4%>10%. For example, in the pre-inquiry session, a student responded with an explanation lacking in detail when asked to describe the materials he would need for his investigation and how he would use them; "*I need different substances*". By the post-inquiry session, the student could describe in detail the materials he would need and how he would use them; "The 'lemon' and the 'seven-up' are acids and with the addition of the 'red cabbage' indicator, their colour become pink/red. The acid's colour does not change with the addition of an increased quantity of the indicator". This response also indicates the control of the confounding variables, i.e. substances (acids, indicator), amount of substances.

After listing materials and procedures, students were asked how they would represent the results of their investigation using the technology-based learning environment of MODELLINGSPACE. The result in students' ability to adequately build a model improved significantly. Firstly, the mean difference between the pre- and the post-test (Entities_pre – Entities_post) is -0,357 with standard deviation 0,633 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=5,5%<10%. Secondly, the mean difference between the pre- and the post-test (Properties_pre – Properties_post) is -0,214 with standard deviation 0,426 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=8,2%<10%. Finally, the mean difference between the pre- and the post-test (Relations_pre – Relations_post) is -0,429 with standard deviation 0,852 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=8,2%<10%. For example, in the pre-inquiry session, a student builds a model influenced by phenomenological descriptions. He names the entities reported in the objects (for example lemon) or in the attributes of objects as the colour (for example red/pink). On the contrary, by the post-inquiry session, the student can use the scientific concepts (for example acid, base). Another example is a student who in the pre-elicitation session uses a false semi-quantitative relation, whereas the same student in the post- inquiry session uses the suitable semi-quantitave relation that is in accordance with the linguistic expression that he had used in his conclusion.

After building a model in the MODELLINGSPACE, students were asked how they would record the results of their investigation. The students' ability to adequately describe how they would record the results does not, statistically, seem to have been increased. The mean difference between the pre- and the post-test (record_pre – record_post) is -0,286 with standard deviation 0,726, but the p-value of the two-tailed test suggests this difference is not statistically significant at level a=0,01, because p-value=16,5%>10%. For example, at the start of the intervention, the researcher asked a student: "*What kind of things do you think you would want to write down?*" and the student gave an uncertain response: "*Which humid, how much lemon, which colour… because if somebody were to ask you, you could show them the notes*". By the post- inquiry session the focus of the response had changed: "*The 'lemon', the 'seven-up' are acids. When you add an acid, it has as result the change of the indicator's colour in pink/red*".

The students' ability to formulate a conclusion seems to have been improved at the post-inquiry test. The mean difference between the pre- and the post-test (formulate a conclusion_pre – formulate a conclusion_post) is -0,429 with standard deviation 0,852 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=8,2%<10%. The responses of a student represent this increase in the ability to give answers about the problem basing on the results of the investigation. In the pre-inquiry session, the student replied: "*I don't know*" in response to the question: "*What information would you look for in order to represent and explain the phenomenon in the video?*" The post-inquiry response was concise and to the point: "*The addition of acid or base has as result the change of colour of the indicator*".

Finally, students were asked to apply the investigation examining a model already built in the workspace of MODELLINGSPACE environment. The model represents the effect of the addition of an increased quantity of another indicator (different substance, different color). There was a negligible increase in students' ability to apply the results of their investigation between the pre-inquiry and the post-inquiry sessions. The mean difference between the pre- and the post-test (apply the investigation_pre – apply the investigation_post) is -0,214 with standard deviation 0,426 and the p-value of the two-tailed test suggests it is statistically significant at level a=0,01, because p-value=8,2%<10%. Though, this did not represent a statistically significant difference in terms of students' understanding of the effect of the addition of an indicator.

DISCUSSION

The results of this study demonstrate that inquiry-based and modeling-based instruction promoted effectively the involved abilities. As for the students used for this study, in their vast majority, their ability to ask appropriate questions, as a starting point for science inquiry, increased after the intervention (Royce & Holzer, 2003). Additionally, they became, in a greater depth, able to plan procedures for investigation, build models using technology-based learning environment, record results and draw conclusions. The largest gains were obtained for the skills of planning, modeling and drawing a conclusion (see Table 3). The intervention had a positive impact on students' inquiry.

We could compare the present results with previous researches results (Smyrnaiou and al., 2007) where we had studied students' descriptions and manipulations while being exposed to the three different tools: video; real objects; MODELLINGSPACE, without any teaching and scaffolding in inquiry and modeling Those results saw that the students didn't apply the inquiry process.

In addition, we have to notice that the students of our study were able to build models without have any previous extended instruction on modelling. We can explain that by the fact that "MODELLINGSPACE" (its structure, its functions) is a very good tool and help students to introduce themselves in modelling.

There are limitations to this study: one is the lack of a control -or comparison- group; another is the small sample size of 28 students who completed both pre- and post-inquiry sessions. The results of such research will provide us with further explanations for the manner in which students carry out science inquiry and modeling as well as with new ways to design effective instructional intervention in order to enhance students' ability to conduct inquiry. Finally, further research may examine the impact of various modeling technology-based learning environment to enhance students' ability to conduct inquiry and modeling.

REFERENCES

Barman, C.R., (2002). How do you define inquiry? Science and Children, 26, 8–9.

Chinn C. A., Brewer W. F., (1993). The role of anomalous data in knowledge acquisition: A theoretical framework and implications for science instruction, Review of Educational Research, 63, 1-49.

Coleman, E. B., Brown, A. L., & Rivkin, I. D., (1997). The effect of instructional explanations on learning from scientific texts, Journal of the Learning Sciences, 6(4), 347-365.

Cuevas, P., Lee, O., Hart, J., & Deaktor, R., (2005). Improving Science Inquiry with Elementary Students of Diverse Backgrounds, Journal of Research in Science Teaching, 42, 3, 337–357.

De Jong, T. (2006). Computer simulations - Technological advances in inquiry learning, Science, 312, 532-533.

De Jong T., van Joolingen W. R., (1998). Review of Educational Research, 68, 179.

Dimitracopoulou, A. & Komis, V, (2005). Design Principles for a modeling environment for learning, modeling & collaboration in sciences, in C. Constantinou, Z. Zacharia and P. Kommers (Guest Editors), International Journal of Continuing Engineering Education and Life-Long Learning (IJCEELL), Special issue on The Role of Information and Communication Technology in Science Teaching and Learning.

Evans, C., (2003). Challenges to successful science inquiry, Finding unifying themes in the multivariate nature of inquiry models, Paper presented at the annual meeting of the National Association for Research in Science Teaching, Philadelphia.

Flick, L., (2002). Inquiry as cognitive process, Paper presented at the annual meeting of the National Association for Research in Science Teaching, Philadelphia.

Jackson, S.L., Stratford, S.J., Krajcik, J., & Soloway, E., (1996). Making dynamic modeling accessible to pre-college science students, Interactive Learning Environments, 4(3), 233-257.

Keselman A., J., (2003). Res. Sci. Teach. 40, 898.

Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effects of direct instruction and discovery learning, Psychological Science, 15, 661-668.

Lawson A. E., J., (2002). Res. Sci. Teach. 39, 237.

Lemeignan, G. & Weil-Barais, A., (1993). Construire des concepts en Physique, Paris, Hachette éducation.

Lewis E. L., Stern, J. L., Linn, M. C., (Eds), (1993). Technol. 33, 45.

Löhner, S., van Joolingen, W. R., Savelsbergh, E. R., & van Hout-Wolters, B. A. H. M., (2005). Students' reasoning during modeling in an inquiry learning environment, Computers in Human Behavior, 21, 441-461.

Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? American Psychologist, 59, 14-19.

Mellar, H., Bliss, J., Boohan, R., Ogborn, J., Tompsett, (Eds), (1994), Learning with Artificial Worlds: Computer Based Modeling in the Curriculum, The Falmer Press, London.

Penner, D. E., (2001). Cognition, computers, and synthetic science: Building knowledge and meaning through modelling.,Review of Research in Education, 25, 1-37.

Royce, C. & Holzer, M., (2003). What would it be like without. .? Science Teacher, 27, 20–24.

Settlage, J., (2003). Inquiry's allure and illusion: Why it remains just beyond our reach, Paper presented at the annual meeting of the National Association for Research in Science Teaching, Philadelphia.

Smyrnaiou Z., Komis V. & Dimitracopoulou A. (in press 2007). Contribution in 12 years old students' reasoning study, when they use video, experimental objects and educational software: The case of acids and bases, Themes in Education.

Smyrnaiou, Z. & Weil-Barais, A, (2005). Évaluation cognitive d'un logiciel de modélisation auprès d'élèves de collège, Didaskalia, nº 27, pp. 133-149.

Van Joolingen, W. R., de Jong, T., Lazonder, A. W., Savelsbergh, E., & Manlove, S., (2005). Co-Lab: Research and development of an on-line learning environment for collaborative scientific discovery learning, Computers in Human Behavior, 21, 671-688.

Zacharoula Smyrnaiou
University of Peloponnisos
Tripoli
Greece
Email : smyrna@uop.gr; zacharoulasmyrnaiou@yahoo.gr

Angelique Dimitracopoulou
University of Aegean
Rhodes
Greece
Email : adimitr@rhodes.aegean.gr