



**REAL 3D MODEL FOR PHYSICAL SCIENCES CONTRIBUTION TO THE
CREATIVE CAPACITY OF CRITICAL THOUGHT, PERSONAL PERCEPTION
AND THE EDUCATIONAL ABILITY OF THE STUDENTS**

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Abstract

The education of students in the Natural Sciences is a special one between the theory of experimentation and reconstruction and self-control for knowledge as it has passed through the process of learning and identifying the student's information through the learning process. There is an important relationship between the theory of experimentation and reconstruction and self-control for knowledge through the learning process. This paper presents and analyzes the research results of the thoughts of 180 students from a Department of Informatics and Telecommunications who participated in Physics experiments, workshops. The students practiced and trained through real 3D models that created especially for the theoretical lessons of physics in Telecommunications and Electromagnetism. The study of the results shows that the use of real three-dimensional education models in education can help to understand natural phenomena and laws in the fullest understanding of the theory of lessons which probably present a gap between the experimental process and the theoretical presentation. The real three-dimensional models in learning as learning models are deemed necessary and there is always a relative limitation in their use either from the time allocated to the program. Students would like to appear such models in the educational programs in their schools especially in the modern environment where the modern technologies may sometimes do not achieve critical thought, personal perception and or educational ability especially in the physical sciences that is a part of our daily life.

Keywords: Real 3D Models, Education, Natural Sciences

Summary

Educational material in science and in particular in Physics Science requires modern thoughts and programs that will introduce students more simply in to the theory and practice of science. There is a special relationship between the theory of experimentation and reconstruction and self-control for knowledge through the learning process. This paper presents and analyzes the research results of the thoughts of 180 students from a Department of Informatics and Telecommunications who participated in Physics experiments, workshops. They would like to introduce in the programs Real 3D Models which will help them to understand more easily the phenomena and laws of the theory. The results of the research give us the opportunity to say that in a modern technological environment where the computer technologies and virtual reality programs grow very it would be very useful to introduce practical 3D real models in the educational programs in the modern school and university.

INTRODUCTION

The education of students in the Natural Sciences is a special one between the theory of experimentation and reconstruction and self-control for knowledge as it has passed through the process of learning and identifying the student's information through the learning process.

There are many different educational models today from the national governments focused in the philosophy and the social behavior of the students especially looking forward to introduce different applications and experimental thoughts about the modern technologies and the computer science in education. This makes science and its application lessons in the modern school to become one of the most fast change environment including new ideas and thoughts about learning in different and sometimes difficult environments in a school with many demands not only in the lessons design but also for the students and trainers. This is what makes science to be one of the very sensitive fields today.

The modern educational material in the philosophy of science and in particular in Physics Science also derives from the experiment and the provisions through which the student and trainee can identify the factors of study and identification of natural law and natural phenomena (Ravanis, K. 2003). Each time the experimental design is determined by the chosen subject matter as well as by the objectives of the course. The design of an experiment and its implementation is related to the way in which the theoretical background will be approached by the instructor and the student but also by the possibility of the experimental model to become a wider orientation not only in the direct typical learning local environment but also in an enlarged environment for example national and international. In this respect, the real model that has been at any time

designed may have these goals and prospects. In any case, the model of teaching can be assessed by both students, trainers and institutions involved in the educational process. The value of the educational material consists of the results of the educational practice, concerning the building of ideas and concepts, the development of skills, the familiarity with the natural concepts and the natural law, as well as the recognition and foundation of the new knowledge (Koutselinis - Ioannidou, 1995).

It is very important to build new knowledge through experience and experimentation, thus creating greater strength and connection. The phenomenon of a lack of knowledge linking to everyday experience and practice is common, which could provide more and more evidence of the knowledge that is provided in the educational process (Cohen et al., 2011). Thus the creation of a distinct educational material is a challenge and a process of documentation and approach to the above criteria. Indeed, it is very important to achieve the goal (structuring unit around learning objectives), the use of this material by children (Krajcik et al., 2003). Thus, it is also very important for students to participate in the process through which they will acquire knowledge of phenomena and laws related to everyday reality. This will be an essential principle in their activation in actions and practices related to the relation of geometry, the nature of scientific knowledge, the natural environment and the use of simple materials as a means of creating scientific and experimental construction of educational material (Reisner et al, 2003). This makes the process through which scientific knowledge is built and can be evaluated and then applied to the educational process (Katsikas, & Kavadias G. 2002).

The presentation of real educational models of learning and education in physical sciences can help the student to see the

reality and experience the essence of things around him through participation and real-life depiction (Drougas, 2006). Modeling can create important fields of learning and exploration in the natural sciences through the exploratory learning process, while at the same time enabling the student to create his own performances through his experience and character (Hestenes, 1987) help him transform, redesign and expand scientific practices and knowledge, something that can even lead him to research as he will understand the essence of natural phenomena more and more simply and procedures, which can occur every day around him, or even be represented in school textbooks during his learning process (Hart, 2008). This paper presents the effects of introduction of the real 3D models in education in to five scientific practices in education and learning of physical sciences today concerning the design and implementation of a real model and the discovery of parameters related to the physical laws and is intended to be capable students

- a) To formulate scientific questions about the model and the corresponding theoretical structure,
- b) To formulate and investigate assumptions,
- c) To document their hypotheses using the model, to devise That sort of construction with simple materials they can find and use them in their immediate environment,
- d) Formulate and describe a relevant experimental procedure and
- e) Correlating theory with actual substance.

In this way they will gain more powerful knowledge and experience.

The educational material and its design are based on the theoretical background, the law, the phenomenon of the mathematical description and the exploration of the possibilities of the school manuals in the development and provision of complete knowledge as well as the experiences of teachers during the educational process. It is

important that significant weight is given to preparing students for educational action through the planned material. Also, the student's previous knowledge of the physical phenomena and the subject to be studied is also used. According to the literature several such actions have been proposed that have been documented as effective (Reisner et al., 2003). In each case of implementing the real model as a learning material, students should be able to use the material to engage in questions related to the subject and become familiar with its use as an effective means of formulating scientifically documented views and actions that will correlated with skills and personal experiences and representations such as linguistic, numerical - mathematical, geometric. Thus they will be able to participate, evaluate, draw conclusions, create, incite, design, which is a broader exploratory learning process. This will be a modern thought and an application in the today physical sciences in the high school or in the universities.

Theoretical Problems in Learning

The objectives of creating such models and the goals set for the education of students and educators in the modern environment of the school and the university are analyzed.

It has been scientifically stated that students have developed different concepts of the physical world around them and the causes of phenomena that have been shaped mainly by their experiences and their daily involvement in the social environment (Driver et al., 1996). This knowledge is personal perceptions that often do not represent the reality of creating natural phenomena and laws in physics and may not accurately represent the true nature and meaning of a natural law in the universe which have passed to the subconscious according to their own views and experiences from personal knowledge and conclusions.

But without destroying and ignoring these empirical and cognitive perceptions of students about natural law and natural phenomena, we should look at how we will create new images and data and make use of this knowledge and experience students.

This will create a new foundation and educational standards for the production and supply of knowledge and for the creation of a real and properly documented model that will form the basis for creating an intelligent and specialized educational material. This learning material will be much more effective in helping both students and teachers to complete the scientific and educational process and the availability and discovery of knowledge through experimentation, personal creation and personal discovery (Luzon & Gonzalez, 2006).

Educational material today is not only the basis of the documented and scientific knowledge and evolutionary course of the student but also of the trainer in the process of recognizing and certifying knowledge and the basic principle for the creation of many basic processes to improve and extend the knowledge and experience in more and more expanded areas and fields where different sciences can work together to deliver a significant result (Katsikas X.&Kavadias G .2002)..

These fields of knowledge and experimentation can help the learner more effectively to understand and to know, create, compare and relate to each other more than one field of knowledge. Such as Physics and Technology, or Geometry and the Arts through personal experience, imagination and future.

In this way, the personality and personal creation of the student in the modern school are revealed, where there are many sciences and many modern facts and knowledge that require personal goals and experience (Holec, 1981).

The form, structure and type of educational material have changed very

much in recent decades, especially with the entry of information technology and virtual reality into education Virtual Reality has introduced new fields of study and knowledge but has also removed students and teachers from personal creation and the art, as well as the use of the simple materials around us and in to the school environment (Drougas, 2005). Many of those materials around us that we think are not useful can be very useful if they are used to create real 3D models that will help young students to come into contact with reality.

Thus, in the age of new technologies and computer science, students can, through the presentation of real models in education, come into contact with reality, construct on their own, explore and have questions on the scientific thought and knowledge they have gained from the school or the institute. It is very important that they discover the knowledge themselves through experience and education. Each real model can be constructed to give information about science theory and its applications. It is an important educational part for the students and the teachers and can be included in the educational program of the school and or the institution. The theory and the experimental models defined by the school and institute program must be in accordance with the program and scientific thought.

It is also very important to create new fields of learning and research. This will help us create complete scientists with experience in knowledge and give them the way to discover it and to discover the discovery of new techniques and theories that we have not discovered until today. Modern scientists start through simple learning, through everyday life in modern school and university, they become researchers and complete scientists (Drougas, 2005). The use of simple materials to create real models in education can help students and educators acquire environmental consciousness and knowledge, reuse materials that are

unnecessary in their daily lives, and help in recycling. This paper analyzes the method by which real models can be used in education and their role in learning within and outside the school environment.

Also, great importance is given to the expected outcomes and objectives as well as the way they can be used in education as exploratory learning and how to help students understand the theory and phenomena studied in the science of science. Thus they will be able to participate, evaluate, draw conclusions, create, incite, design, which is a broader exploratory learning process (Gamari. 2017). Finally, conclusions are drawn on effective teaching and how they will be extended to various disciplines to aid in the process of education as an effective educational material.

The education of students especially in the Physical Sciences is a special one between the theory of experimentation and reconstruction and self-control for knowledge as it has passed through the process of learning and identifying the student's information through the learning process.

Finally, someone may understand the differences today in the education projects using three dimensional models.

The actual three-dimensional models in education seem to be out of place today or tend to disappear with the use of computing and the creation of many virtual experiments in the learning process (Drougas 2005). Modern curricula increasingly contain the use of information technology in education, creating a big gap in the ability of students and students to construct to create and relate everyday reality to theory and natural law or natural phenomena. In this direction, the creation of computer games in computer models and the films of the cinema that have a lot of phenomena, especially in the natural sciences, have been contributed quite a bit, as well as sometimes with great deviation from reality. These often create false impressions in the field of education and the

young population that is left to results and the consolidation of information that is often unrelated to reality. It is certain that many of the natural phenomena can be studied and displayed more easily with modern virtual reality programs through modern IT technologies simply many of the simple phenomena like those we see everyday around us in our everyday life and life can much easier to represent with truly three-dimensional models and to provide meaningful information to students and students to help them understand the real world better than the imaginary or the virtual. This can enable them to operate at a personal and creative level by assuming real responsibility for the design they will make but also to use many materials from their everyday life to assemble and present new patterns of constructions and creative learning that have been captured from their personal experience and empirical but also their scientific knowledge, highlighting all their possibilities and tendencies for self-creation (Eugenia Etkina et al., 2006).

The Department of Informatics and Telecommunications includes in its program many courses related to physics, geometry and mathematics. Most laboratory courses are done using modeling experiments in virtual reality mainly due to lack of space and time also because they help students to use new information technology in the experimental process. This use is easier today for young children with the entry of modern electronic technologies and information technology into everyday life. But this is a phenomenon that creates major changes in thinking and education, particularly in cases where design and manufacturing skills are needed by young researchers and also by scientists in a modern and demanding society of research and presentation of new data and techniques.

This study explores the use of real three-dimensional models in education as educational models of learning and education in tertiary education and by

extending their use in secondary education to a modern demanding and creative school in the new era of information and learning.

The Research

This research analyzes the reason of why the creation of a real three dimensional model can help students in modern schools and universities to discover their own scientific knowledge and to substantiate their knowledge and views that have emerged from personal experience. Real models can help the student to be trained through personal activity, discovery, reconstruction, and cultivate the ability of perception that is important in scientific knowledge and research. Results of the thoughts of 180 students from our University and the Department of Informatics and Telecommunications appear with the statistical data that have been selected with their answers in to 14 different questions.

In order to investigate the results of using real 3D models in learning especially in natural sciences and students' understanding of phenomena and laws, the students' opinion was recorded using an appropriate questionnaire given and filled in with no name. The questionnaire included 14 questions that were answered by the students during the experimental courses at the Department of Computer Science and Telecommunications of the University of Ioannina. The sample consisted of 180 students from the Department of Informatics and Telecommunications who participated in Physics experiments and workshops . The questions were as shown in below **Table 1**

TABLE 1
QUESTIONNAIRE

- 1) Have you ever used real 3D models in physics Science? Yes__ No__
- 2) Have you seen in a workshop really three-dimensional models Yes__ No__

- 3) You usually use virtual models to experiment with laboratories Yes__ No__ Rarely__ Very often__
- 4) Do you know Geometry well from the classes you attended in your school Yes__ No__
- 5) Do you think that a real model helps you to understand the real form of the phenomenon Yes__ No__ Maybe__ I do not know__
- 6) You can easily build in the lab space Yes__ No__ I do not know__
- 7) Do you think that a real three-dimensional model can present the reality of the phenomenon more simply Yes__ No__ I do not know__
- 8) You have made your own construction at school Many__ No__ Some__
- 9) Would you like to really build three-dimensional models for your science Yes__ No__ I do not answer__
- 10) Would you like real-world 3D models to science laboratories Yes__ No__ I do not answer__
- 11) Do you think science is related to art Yes__ No__ I do not know__
- 12) Do you believe that a 3D real-world model would help you understand the theory of science courses Yes__ No__ Do not know__
- 13) Do you believe that a real three-dimensional model would help you in experimental research Yes__ No__ I do not know__
- 14) Do you believe that real 3D models can help teachers to introduce you more effectively and comprehensively into the theory and practice of natural laws and phenomena Yes__ No__ Do not know__

After completing the questionnaires, the students' answers were recorded statistically and the results and trends were recorded in the way in which the real three-dimensional models in the natural sciences can help to learn the natural phenomena and natural laws analyzed in relevant subjects in the section studying. The students' view of the importance of real models in learning

and understanding laws of phenomena and theoretical concepts during the course of study was explored.

RESULTS

The results recorded by the statistical analysis were very important and indicate the tendency of the students to present a new shift in the educational process and the educational standards as they have changed in the last few years on an international level.

The answers per question appear in the following **Table 2**

TABLE 2				
ANSWERS PER QUESTION				
1) Yes 18	No 162			
2) Yes 18	No 162			
3) Yes 168	No 0,	Rarely 0	Very often 12	
4) Yes 18	No 162			
5) Yes 150	No 5	Maybe 20	I do not know 5	
6) Yes 5	No 155	I do not know 20		
7) Yes 170	No 0	I do not know 10		
8) Many 0	No 155	Some 25		
9) Yes 165	No 15	No answer 0		
10) Yes 160	No 20	No answer 0		
11) Yes 160	No 10,	I do not know 10		
12) Yes 160	No 10	I do not know 10		
13) Yes 155	No 10	I do not know 15		
14) Yes 167	No 5	I do not know 8		

The statistical results from the research are shown in the following **Table 3**. The statistical data was rounded off with only two decimal places.

TABLE 3				
STATISTICAL DATA PER QUESTION (%)				
1) Yes 9.99%	No 90.01%			
2) Yes 9.99%	No 90.01%			
3) Yes 93.24%	No 0%	Rarely 0%	Very often 6.76%	
4) Yes 9.99%	No 90.01%			
5) Yes 83.25%	No 2.77%	Maybe 11.1%	I do not know 2.77%	
6) Yes 2.77%	No 86.02%	I do not know 11.1%		
7) Yes 94.35%	No 0%	I do not know 5.55%		
8) Many 0%	No 86.02%	Some 13.87%		
9) Yes 91.57%	No 8.32%	No answer 0%		
10) Yes 88.8%	No 11.1%	No answer 0%		
11) Yes 88.8%	No 5.55%	I do not know 5.55%		
12) Yes 88.8%	No 5.55%	I do not know 5.55%		
13) Yes 86.02%	No 5.55%	I do not know 8.32%		
14) Yes 92.68%	No 2.77%	I do not know 4.44%		

Statistical results and research information

From the presentation of the statistical results of the survey to the students it seems that most of them want to have real three-dimensional models in their educational program (80%) and the remaining percentage probably due to the direction of the computer and programming in the department give more weight in IT and so would prefer virtual reality programs more easily. A very small percentage (9.99%) responds that he has used three-dimensional models in his education at school and (90.01%) has not come into contact with them at all. Only (9.99%) has seen in the laboratory experimental 3D models in the school. A large percentage (93.24%) uses virtual models in the workshops in the department and this does not allow the student to use and highlight his manufacturing capabilities and not to help imagination and exploratory learning especially in the natural sciences that are very much important. Also a large percentage (90.01%) of the class does not have a good geometry from school, so it will be difficult to understand concepts related to the coordinates of the space presented in the experimental courses and where they are usually chosen for use in the experiments virtual reality programs. Students believe that a real model can more easily help them to understand the true form of the phenomenon in a percentage of its (83.25%) and a similar percentage (11.1%) thinks it might be this helps to require more information and presentation of such models in education to convince pupils and students of the importance of these models in education. While only (2.77%) think they would not be useful in understanding the phenomena during their learning in the department. A very small percentage of the respondents said that they could do works in the laboratory area (2.77%), while (85%) believe that this is not possible and may be

due to the lack of relevant programming and possibilities given by a modern university lab today using a large amount of virtual reality screenshots.

Students believe that a real three-dimensional model can present a real phenomenon of natural sciences in a simpler way (94,35%) and this seems important to learners because they would rather want something simpler and more comprehensible to which they would like to they intervene in a real and natural way. And a percentage of the (5,55%) cannot have a view perhaps because he has not used or because he has not seen such real education models.

The school is shown by the answers they have given that did not allow them to construct and model in real form by percentage (86,02%). Perhaps this is due to the large number of courses and the lack of time in the program and the hours of the lessons each week. While only (13,87%) seem to come from schools that have created relevant construction projects.

A large percentage of them (91,57%) wants to build such models, and this is very important showing the willingness and decision of the students to self-create.

Also a fairly high percentage (88,8%) would prefer the real-world science workshops to have really three-dimensional models, while the remaining figure seems to be potentially influenced again by not having come to contact with such models and does not know their effectiveness and how they could help.

The question of whether science is related to art is answered by students, and that is very important (88,8%) that it really relates to art, and small percentages seem to diverge perhaps because of information that was not given to primary school education or by the scientific community for the relationship between science and art.

Respondents believe that a real three-dimensional model would help them to better understand their course theory by percentage (88,8%), and this is very

important because with the results it appears that using the actual 3D real models in education, learning is probably done more effective.

Finally, the students believe that the actual models would be more effective for the experimental process and would help them in a higher percentage (86,02%) and would even help the teachers themselves to be able to cope with the educational process (92,68%), a small percentage cannot have a view perhaps because of information that is not very much a part of the educational community. This highlights the new face of the modern community. This highlights the new facet of modern education where programs of continuous training of teachers and innovative methods of learning and presenting the theoretical and experimental data should be implemented.

General information from the research

The study of the results shows that the use of real three-dimensional education models in education can help to understand natural phenomena and laws in the fullest understanding of the theory of courses which probably present a gap between the experimental process and the theoretical presentation but will moreover the skills and creative tendencies of students and learners in general in an environment where knowledge is large enough and is strengthened daily by young people given data. It can also be a beginning of the learner's interaction with the theory of the lessons taught and the reality which is very important in the creation of new researchers and scientists with exploratory and design capabilities in the modern sciences of nature and engineering and technology. Thus, the real three-dimensional models in learning as learning models are deemed necessary and there is always a relative limitation in their use either from the time allocated to the program or from the pupils' education to their basic education at the school that has to

make important steps to change for an elevation of the pupil's character and his creative thinking, but also his scientific performance in the understanding and the formation of knowledge.

Proposals

The presentation of real educational models of learning and education in physical sciences can help the student to see the reality and experience the essence of things around him through participation and real-life depiction.

As shown from the research it is important to continue to work in the direction to establish new modern programs in education working with the students in to various 3D real models in the Physics theory and applications. This will be a new wave for the modern educational programs in the High schools and Universities. Students would like to appear such models in the educational programs in their schools especially in the modern environment where the modern technologies may sometimes do not achieve critical thought, personal perception and or educational ability especially in the physical sciences that is a part of our daily life. More research about establishing various such models is required to make science more simplified and more usual for the students during their education giving them a high level of education and a scientific application.

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