Prospective Physics Teachers Design and Develop a Normative Lesson utilizing Hands-on Applications of Digital Technologies - - Preliminary Results

Vassilios Grigoriou, Ourania Gikopoulou, Konstantia Papageorgiou & George Kalkanis
University of Athens, Pedagogical Department P.E., Science Technology and Environment Section, Science Technology and Environment Laboratory
vgrigor@primedu.uoa.gr, gikopoulou@gmail.com, nanpap06@gmail.com, kalkanis@primedu.uoa.gr
e_site: http://micro-kosmos.uoa.

Abstract. *This quantitative research studies the ability of prospective physics teacher to create educational material consistent with a specific educational methodology, adopting new technologies.*

Fifty students of the University of Athens were voluntary offered to participate in this research, developing a normative lesson. Assisting to their materialization they used PowerPoint, as a platform that can incorporate different formats of information.

First results show that students, although they were willing to integrate technology in their teaching practice, they were not able to manage the mean. They were carried away by its power and therefore the mean dominated their lesson supplanting other important factors such as methodological consistency and experiment's role.

Keywords. Educational methodology, Future science teachers**,** PowerPoint.

1. Introduction – Framework - Purpose

Research work triggered by previous studies ([4], [8]) showed that Physics Department students, who were asked to design and realize teaching, present the following common characteristics:

a) They frequently dismiss the complexity of realization of a work adopting interactivity and multimedia elements.
b) Even though they present themselves as confident with technology, they face difficulties in using tools and programming environments frequently.
c) Even though they present themselves as confident with internet use, they are not able to search information accurately (validation and form).
d) They are not able to edit files (mainly videos, picture and sound)

Findings become more discouraging when it comes to the point of educational methodology. There it is common place that students:

a) They do not understand the necessity of using any methodology.
b) They do not adopt its philosophy but use its steps mechanically.
c) They do not apply findings of previous steps to futures ones.

These aspects are very critical as researches show that prospective teachers have a special notion of content knowledge and pedagogy and thus their believes will determine their future action [6].

2. Rationale-Research Questions

Experience that has been obtained from previous research efforts ([4], [8]) has raised the question whether graduates of faculties in Greece which deal with Science, acquire the necessary accoutrements, in terms of educational methodology and use of technology as an assisting educational tool.

To put it more clearly, the research questions of this study are:

a) Are the students capable of developping educational material in Science, using PowerPoint (or analogous programs)?
b) Do they follow in this development the required educational methodology?
c) Was their training sufficient for this effort?

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3. Methods

This is a quantitative research, based on fifty students of the University of Athens who were studying physics and they were voluntary offered to participate. They were at the second year of their studies and until that time they hadn't attended any class which involved teaching methods in any way. During our class, students had preceded few lessons concerning basic principles of teaching and lessons for technology as a mean.

More analytically at the field of general didactic they dealt with methodological issues, experiment's role, teaching targets design, and use of technology in Science teaching.

At the technology workshop, they dealt with usage of digital technologies in Science teaching, such as classification of technologies based on their teaching use (mostly pairing technologies with proposed teaching methodology), standard tools show, developed with digital technologies and integrated to teaching methodology, developing teaching tools via digital technologies:

1. PowerPoint
2. Html
3. Sound, picture, video editing
4. Java applets

At last, students had attended several presentations and comments on normative lessons, designed on the basis of the proposed methodological standards, which used different technology forms. According to [1], the use of exemplary cases can increase teachers' exposure to other ideas, show existence proof of new methods under ordinary classroom conditions, and demonstration of actions in a real context.

The aforesaid educational methodology is described as scientific / educational by inquiry model. It consists of five steps: a. Triggering of interest, b. Hypotheses' formulation, c. Experimentation, d. Conclusions' draw, e. Application in similar situations/explanation with the microcosm (Fig.1).

The main criterion which would determine the answers of the research questions is a short time lesson that the students were called to make in front of the class.

We assigned them to design and realize a lesson for any field of Science, based on the proposed methodology, using as a tool the PowerPoint. They could also adopt any other technology that it could act beneficially in their effort.

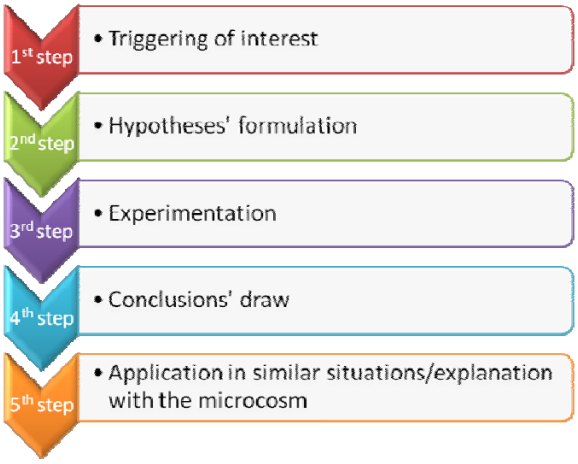

Figure 1. Educational Methodology

As a result, the fifty students brought a cd in the classroom and they taught a lesson. An oral evaluation from all the members of the classroom followed. We videotaped the lessons and we kept written records of the comments that there were made. In parallel, we analyzed the cds on the basis of methodological, elegancy and technical integrity.

The evaluation was made by two independent reviewers in a 5 steps scale (1=inadequate, 5=excellent). When there was a dissension, the disputation was solved with discussion. If that was not efficient, the final decision was made by a third reviewer.

4. Results

Students showed willing to integrate the technology in their teaching practice. They consider technology helpful for their teaching work.

They managed to use PowerPoint as a tool although most of them used it for first time. They included hyperlinks functions importing multiple file formats (like video, picture, sound). The aesthetical result was very interesting fig. 2, fig.3.

On the other hand, they were not able to manage the mean. They were carried away by its power and therefore the mean dominated their lesson supplanting other important factors such as methodological consistency and experiment's role. The impression given was that they were just presenting the material they had prepared instead of feeling the teaching. "Every science teacher has his or her own beliefs about teaching

and learning which influence teaching strategies and behaviors" [5].

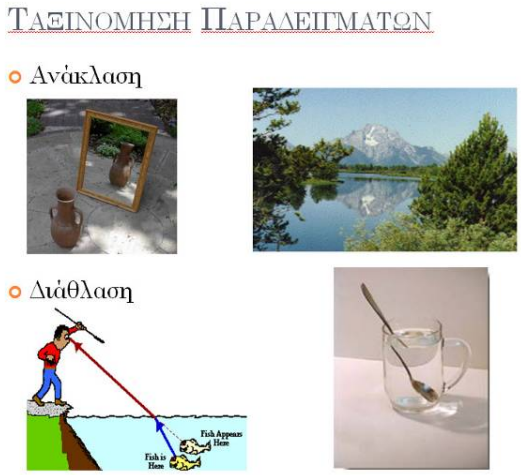

Figure 2. Examples of students' achievements

Figure 3. Examples of students' achievements

By majority, they designed properly their didactical targets, although most of the times were inconsistent with their teaching targets concerning not only teaching practice (as expected) but also teaching material.

They had fundamental methodological problems. They considered that methodological consistency is restricted exclusively at following the steps of the methodology. In practice they did not adopt the philosophy of the methodology that leads the student to discover natural principles and explain the phenomena as a young scientist. This is relevant with other studies where is mentioned that the identified concepts contained several elements which clearly did not correspond with a developed understanding of Nature of Science. The respondents displayed a naïve and unclear understanding of the scientific method and a poorly developed understanding of scientific theory [7].

5. Conclusions-Proposals

Students managed to accomplish the main goals, which were to pose didactical targets, to create educational material by using PowerPoint and to adopt an educational methodology, even though they settled mainly in technical issues. This is consistent with other researches [10] where it has been mentioned that despite continuing efforts to deliver quality training for future teachers, it has been observed that teachers show a marked difficulty in changing their instructional practice in meaningful, deep ways.

They experienced major methodological problems, focused basically in the consistency with basic principles of the educational methodology.

It should be under further research the possibility of differentiations, according to the kind of technology that students use.

Also, it should be estimated the progress in the students' performance, while they will attend a short time seminar of training, so that it could be proposed a kind of a curriculum and a timetable. We should take into account that "no innovation will be sustained unless systematic and ongoing professional development is provided to support the changes required in the pedagogy of science teachers" [9].

The results also imply that some significant changes need to be made to higher education program considering students' motivation in order to get improvement in students' motivation to learn science [2]. Similarly, one can assume that student teachers` beliefs affect both their learning and their understanding of teaching through every step of their teacher education [3].

7. References

[1] Black, P. & Atkin, J. M. (1996). Changing the subject: innovations in science, mathematics and technology education. London: Routledge.

[2] Çetin-Dindar A., Geban Ö. (2010), The Turkish adaptation of the science motivation questionnaire, Contemporary Science Education Research: Pre-Service and In Service Teacher Education, 119-127, ESERA 2009 CONFERENCE August 31st - September 4th 2009, Istanbul, Turkey.

[3] Fischler, H. (2000). Über den Einfluß von Unterrichtserfahrungen auf die Vorstellungen vom Lehren und Lernen bei Lehrerstudenten der Physik (Teil 2: Ergebnisse der Untersuchung). Zeitschrift für Didaktik der Naturwissenschaften, 6, 79-95.

[4] Grigoriou V., Kalkanis G., (2009), «Training of prospective Greek teachers in the development of simulations for the model of the ideal gas.», ESERA 2009 conference August 31st - September 4th 2009

[5] Hewson, P. W. & Kerby, H. W (1993). Conceptions in teaching science held by experienced high school science teachers. Annual Meeting of the National Association for Research in Science Teaching. Washington, USA.

[6] Markic S., Eilks I. (2010). A mixed methods approach to characterize the beliefs on science teaching and learning of freshman science student teachers from different science teaching domains, Contemporary Science Education Research: Research Teaching, 21-28, ESERA 2009 CONFERENCE August 31st - September 4th 2009, Istanbul, Turkey.

[7] Murcia, K., & Schibeci, R. (1999). Primary student teachers` conceptions of the nature of science. International Journal of Science Education, 21, 1123-1140.

[8] Oikonomidis S., Grigoriou V., Kaponikolos N., Kanavi S., Kalkanis G., (2006), «Gravitropism hands-on device», 3rd International Conference on Hands-on Science Science Education and Sustainable Development 4th - 9th September, Universidade do Minho, Braga, Portugal.

[9] Osborne, J., & Dillon, J. (2008). Science education in Europe: Critical reflections: a report to the Nuffield Foundation. London: Nuffield Foundation.

[10] Sánchez I, Manrique A., Duque M.(2009). Design and implementation of a training program in IBSE for in-service elementary school teachers, in a developing Latin American country, Contemporary Science Education Research: Pre-Service and In Service Teacher Education, 211-221, ESERA 2009 CONFERENCE August 31st - September 4th 2009, Istanbul, Turkey.