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The Interaction in Online Learning environments

Abstract

This thesis examines the pedagogical context of interaction in online learning. The basic idea starts from the assumption that in the modern era virtual learning environments (VLE) are comprised of specially designed information environments in which learners do not simply play an active role but they are also essential factors in the configuration of virtual space with a view to its emergence in a social area that promotes cooperative learning through a variety of learning activities. These elements highlight the need for developing collaborative educational environments based on a specific pedagogical framework that have an impact on the content, organization of studies and the technological infrastructure to be used.

Keywords: interaction, online learning environments, virtual space.

1. Introduction

Interaction is a key element in every learning environment. In online learning,

interaction is particularly important as there is no physical presence and contact between participants in the learning process.

In this paper we examine interaction in online learning. We initially emphasize on the pedagogical context of interaction and then we examine it in its application to online learning. Then we refer to the typology of interaction, as it is bibliographically recorded, and the effect it may have on the achievement of the objectives set. Finally, we study the bibliography of the studies on the techniques of interaction enhancement and lay emphasis on research data on the use of Gamification in online learning.

2. Pedagogical framework

The pedagogical dimension of Virtual Learning Environments is based primarily on the theoretical model of constructivism¹ with a key feature that there is a shift from teaching to learning within an environment of collaboration and interaction². Similar considerations also come from the area of cognitive theories and theories of social interaction, the Distributed Cognition theory and the theory of activity.³

Among the principles that should govern an online learning environment based on the proposed methodology of the American Association for Distance Learning, interaction is emerging as a process of importance in the sense that it enhances collaborative learning, learning by doing, learning by reflection, case-based learning, and learning by exploring.⁴

Mason & Bacsich (1998)⁵ report that the magnitude of the success of an online learning environment depends to a large extent on encouraging and supporting the active participation and interaction of the participating members. As they come in contact, they engage in a network of relationships that combines common activities and social interaction. As a result, the community combines individuals who have something in common, interacting in a real space or through a shared identity.

1 Mikropoulos, T, Kioulanis, S, Mouzakis, X, Bellou, I, Papachristos, N, Fragaki, M, Chalikides, A. (2011). Μικρόπουλος, Τ. Κιουλάνης, Σ. Μουζάκης, Χ. Μπέλλου, Ι. Παπαχρήστος, Ν. Φραγκάκη, Μ. Χαλκίδης, Α. (2011). «Αξιοποίηση των ΤΠΕ στην εκπαίδευση». Εγκάρσια δράση, Μείζον Πρόγραμμα Επιμόρφωσης Εκπαιδευτικών, Athens, P.I.

2 Anastasiades, P. (2006). Αναστασιάδης, Π. (2006). Περιβάλλοντα Μάθησης στο Διαδίκτυο και Εκπαίδευση από Απόσταση, στο Ανοικτή και εξ Αποστάσεως Εκπαίδευση – Στοιχεία Θεωρίας και Πράξης. Athens, Propombos.

3 Engstrom Y. (1999). "Activity Theory and Individual and Social Transformation." Engestrom, Yrjφ, et al., eds. Perspectives on Activity Theory: Learning in Doing: Social, Cognitive & Computational Perspectives. New York: Cambridge UP, 1999. 19-39.

4 Anastasiades, P. (2006). Αναστασιάδης, Π. (2006). Περιβάλλοντα Μάθησης στο Διαδίκτυο και Εκπαίδευση από Απόσταση, στο Ανοικτή και εξ Αποστάσεως Εκπαίδευση – Στοιχεία Θεωρίας και Πράξης. Athens, Propombos.

5 Mason, R. & Bacsich, P. (1998). Embedding computer conferencing into University teaching. Computers in Education 30 3/4, 24 9-258

3. The Interaction in Online Learning

An important element of modern online learning environments is their transformation into collaborative environments and intensive social processes. In order for an online learning environment to be developed, a combination of interactions is required through which a common goal will be achieved. Learners in online learning are in a different learning environment, making them more independent and in this sense capable of taking initiatives, but also responsible for controlling their learning path. Under these circumstances, learning arises as a result of the interaction, activity and initiatives that are being developed.⁶

An online learning community combines individuals who have something in common and interact in a variety of ways through a common identity. In this context, an online learning environment should be built around authentic real-world problems, its members involved in joint activities and debates, exchanging information and building relationships that allow learning to the limits cooperation, reflection and interaction. To achieve these goals, the provision of an educational environment that provides participants with decision-making and initiative choices, independence and participation in the learning process, self-evaluation capacities and self-esteem⁷ is a prerequisite.

Interaction is a theoretical concept that is a complex phenomenon but also a key to all forms of learning (interpersonal, contemporary, asynchronous, mixed). Yacci (2000),⁸ states that interaction, especially in distance learning, is a critical variable that needs to be clearly defined. In this context it makes a very analytical structural approach to the concept of interaction and defines it as a closed circuit where a message starts from an entity (man, machine or something else), directs to another entity and returns to the original, thus closing the circuit. With regard to inter-network interaction, he points out that this does not end if the message does not pass the circuit from the learner to the recipient and returns to it. He notes that the benefits of interaction in teaching are both cognitive (achievement of learning goals) and emotional (emotions and value-added to learning products) on the other. Lastly, he points out that there must be mutual consistency between the messages exchanged between the sender and the recipient⁹.

From the above definition and Yacci's thoughts, four variables affect the process of interaction:

6 Anastasiades, P. (2006). Αναστασιάδης, Π. (2006). Περιβάλλοντα Μάθησης στο Διαδίκτυο και Εκπαίδευση από Απόσταση, στο Ανοικτή και εξ Αποστάσεως Εκπαίδευση – Στοιχεία Θεωρίας και Πράξης. Athens, Propombos.

7 Graves, L.N. (1992). 'Cooperative learning communities: Context for a new vision of education and society', *Journal of Education*, 174 (2), pp. 57-79

8 Yacci, M. (2000). Interactivity demystified: a structural definition for distance education and intelligent computer-based instruction. *Educational Technology*, 40 (4), 1-18.

9 Bofilios, A. (2013). Μποφιλίου, Α.. Η Αλληλεπίδραση σε on line περιβάλλοντα μάθησης. Τα φόρουμ συζήτησης: ένας χώρος συνεργασίας και μάθησης. Διπλωματική εργασία. Patra, Hellenic Open University.

- (a) the interdependence of cognitive and emotional messages;
- (b) the duration of each message;
- (c) the amount of information contained in the message; and
- (d) the delay between the sending of the message and the receipt of a reply.

It is a fact that interaction is one of the most interesting issues of counter-presentation and study over time, for every form of education and of course also for distance learning. As a process it attaches great importance to the social relations and reactions of the participants in each learning environment and in this sense it can contribute positively to the achievement of the goals set. Research data show that increased interaction in distance online learning leads to better learning outcomes, but at the same time there are important questions concerning the nature and extent of the interaction, as well as the impact which it has on the odds of the participants in an online lesson¹⁰

3.1. Typology of interaction

In terms of online learning, four types of interaction have been recorded in the international literature¹¹

- (a) learner's interaction with teaching material,
- (b) interaction between trainees,
- (c) learner - trainer interaction, and
- (d) learner's interaction with the technological environment.

In this perspective,¹² it is also mentioned the trainee's interaction with himself/herself as he/she reflects while he/she is in a learning path.

Karatzides (2013),¹³ reports that Garrison and Anderson¹⁴ in order to include modern technology developments, also used the concept of "medium", i.e. the material with which the trainee interacts. The medium may have the traditional form of printed matter or include "modern" and "asynchronous" tele-education, such as a tele-learning tool or a forum for communication. In this context, the instructor - instrument interaction highlights the importance of the medium in the process of interaction. Based on these data, Garrison and Anderson formulated a more complete model that included six forms of interaction:

10 Picciano, A. (2002). Beyond student perceptions: issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks*, 6(1), 21-40

11 Moore, M. G., & Kearsley, G. (1996). *Distance education: A systems view*. Boston, MA: Wadsworth Publishing.

12 Thurmond, V., Wambach, K., (2004). "Understanding Interaction in Distance Education, A review of the literature," *International Journal of Instructional Technology & Distance Learning*. In: http://ojni.org/8_2/interactions.htm access in 13.11.2017

13 Karatzides, N. (2013). Καρατζίδης, Ν.. Τηλεδιάσχεση & Επικοινωνία/Αλληλεπίδραση στην εξ αποστάσεως Εκπαίδευση Ενηλίκων – Μία Βιβλιογραφική Επισκόπηση, Διπλωματική Εργασία, Patra, Hellenic Open University

14 Garrison, R. D. & Anderson, T. (2003). *E-learning in the 21st Century*. New York: Routledge Falmer.

- (a) trainer and trainee interaction
- (b) trainee-trainee interaction
- (c) trainee - to - media interaction
- (d) trainer-to-medium interaction
- (e) trainer-trainer interaction
- (f) medium-to-medium interaction

By categorizing the concept of interaction, Donnelly¹⁵, distinguishes two categories of interactions: transactions interactions involving the exchange of ideas and the process of team decision-making on a subject, and the outcomes related to the intention to enter into dialogue with trainees or the trainer.

Hirumi¹⁶ quotes another classification with three different mutually interconnected levels of interaction:

- (a) the first level refers to the interactions that take place within the minds of the students. These include the cognitive functions that constitute learning, but also the metacognitive processes that help individuals regulate and monitor their learning. Interactions of this level affect the interactions of the next two levels.
- (b) at the second level there are interactions that take place between the participants and other non-human resources (interface, material, forum, sources outside the platform etc) and finally,
- (c) in the third level there are interactions between the learner and the teaching. These interactions relate to a series of events or strategies that are necessary for someone to achieve the objectives of teaching. These are a post-plan and serve to plan and organize level 2 interactions, which in turn trigger level 1 interactions.

3.2. The effect of interaction on achieving the objectives of an online course

As research data show that increased interaction in online learning improves participants' performance and contributes to learning efficacy, it is of particular interest to investigate the interaction that it might have in achieving the objectives of an online course¹⁷.

Characteristically, Shea, et al¹⁸ in a survey of 3,800 individuals, who

15 Donnelly, R. (2010). Harmonizing technology with interaction in blended problembased learning. *Computers & Education*, 54(2), 350-359. doi: 10.1016/j.compedu.2009.08.012

16 Hirumi, A., (2002). A framework for analysing, designing and sequencing planned elearning interactions. *The Quarterly Review of Distance Education*, 3(2), 141-160.

17 Koustourakis G., Panagiotakopoulos X, Lionarakis, A. (2013). Κουστουράκης, Γ., Παναγιωτακόπουλος, Χ., & Λιοναράκης, Α.. Διερεύνηση των Εμποδίων στην εφαρμογή της Ανοικτής και εξ Αποστάσεως Εκπαίδευσης και προτάσεις για την αντιμετώπισή τους στο: Λιοναράκης, Α. (Επιμ.), Πρακτικά Εισηγήσεων, 2ο Πανελλήνιο Συνέδριο για την Ανοικτή και εξ Αποστάσεως Εκπαίδευση (σελ.307-317). Athens, Propombos.

18 Shea, P., Fredericksen, E., Pickett, A., Pelz, W. & Swan, K. (2001). Measures of learning effectiveness in the SUNY Learning Network. In *Online Education: Proceedings of the 2000 Sloan Summer Workshop on Asynchronous Learning Networks*. Volume 2 in the Sloan-C series, J. Bourne and J. Moore, Editors, Needham,

participated in 264 courses through the SUNY Learning Network (SLN), concluded that the greater the percentage of the course based on discussion and interaction, the more satisfied the participants are.

Also, Hartman and Truman - Davis¹⁹ (2001) in a research on web - based teaching found statistically significant correlations (amount of interaction - $r = 0.726$, interaction quality - $r = 0.807$). This means that interaction is a critical factor for the participants' satisfaction. Similarly, Dziuban and Moskal²⁰ report very high correlations in the relationship between interaction and satisfaction of participants in an online course. Their findings are based on a data collection questionnaire on the effectiveness of teaching at the University of Central Florida for a period of three years, by students who attended courses of various types of online and undergraduate learning. The survey found statistically significant correlations between the quantity/quality of interaction and satisfaction of students in all types of courses. However, in purely online courses, interaction appears to be the most critical factor in relation to other forms of study.

While most of the research supports the interaction and the satisfaction in online lessons, some researchers point out that in order to successfully interact with participants in an online course they must be particularly adapted to the non-linear and asynchronous nature of the course²¹. This labeling is based on the view that a formal learning process tends to be linear, depicting face-to-face communication. Conversely, asynchronous tele-training follows a non-linear communication model that involves significant risks. These are risks that arise from the fact that many discussions and interactions are evolving simultaneously, with the result that trainees communicate with the trainer and with other learners according to their particular interests and opinions.

Sproull & Kiesler²² point to an additional risk: that in an asynchronous tele-education discussion, an instructor can not directly correct or clarify a comment as would be the case in a live communication. In this case, if the trainees do not have the experience and the knowledge to understand the meaning of the comments they can be led to the non-information²³.

MA: Sloan-C Press.

19 Hartman, J. L. and Truman-Davis, B. (2001). Factors related to the satisfaction of faculty teaching online courses at the University of Central Florida. In *Online Education: Proceedings of the 2000 Sloan Summer Workshop on Asynchronous Learning Networks*. Volume 2 in the Sloan-C series, J. Bourne and J. Moore, Editors, Needham, MA: Sloan-C Press.

20 Dziuban, C. and Moskal, P. (2001). Emerging research issues in distributed learning. Orlando, FL: Paper delivered at the 7th Sloan-C International Conference on Asynchronous Learning Networks, 2001.

21 Ruberg, L. F., Taylor, C.D., and Moore, D.M. (1996). Student participation and interaction on-line: A case study of two college classes: Freshman Writing and Plant Science Lab. *International Journal of Educational Telecommunications*, 2(1), 69-92.

22 Sproull, L.S. and Kiesler, S. (1991). *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT

23 Bofilioy, A. (2013). Μποφιλίου, Α., Η Αλληλεπίδραση σε on line περιβάλλοντα μάθησης. Τα φόρουμ συζήτησης: ένας χώρος συνεργασίας και μάθησης. Διπλωματική εργασία. Patra, Hellenic Open University

At the same time, Mackay²⁴ points out that in asynchronous learning, the amount of interaction and the number of observations can easily lead to a situation which is described as “information overload”. This phenomenon appears because some comments in online discussions tend to be larger and more detailed than in the face-to-face process. However, with more information from many sources, educators need to be more cautious about the quality of the discussion, as the extraordinary wealth of information can lead to a drop in attention²⁵.

3.3. Search for techniques to increase interaction

Shackelford and Maxwell²⁶ in search of techniques that attribute to interaction promote teamwork, exchange of experience and knowledge sharing. Cohen²⁷ developed the “Complex Instruction” model, according to which interaction takes place through the assumption of different roles and the corresponding skill development by the members of a group. In this direction and with regard to the development of interaction and cooperation, the role of trainers is important. However, the relationship between trainers and trainees often appears to be competitive, as continuous communication and close monitoring of the trainers’ study steps, although aimed at supporting their studies, may ultimately reduce one from the fundamental values of distance education, that is, the creation of autonomous learners.

However, the development of social interactions should not be considered as self-evident because the e-learning environment simply allows it. For this reason Kreijns, et al (2003),²⁸ suggest the design of activities that will encourage this form of interaction alongside cognitive activities. Social interactions play a crucial role in getting to know each other, developing relationships, opinions, confidence, feeling of belonging, and ultimately developing a learning community

Nandi, et.al²⁹, recognizing the importance of interactions in the on-line forums and the quality of the debate being developed, proposes a framework for assessing the quality of dialogue based on four criteria:

24 Mackay, W.E. (1989). Diversity in the Use of Electronic Mail: A preliminary inquiry.” ACM Transactions on Office Information Systems, 6(4), 380-397

25 Bofilioy, A. (2013). Μποφίλιου, Α., Η Αλληλεπίδραση σε on line περιβάλλοντα μάθησης. Τα φόρουμ συζήτησης: ένας χώρος συνεργασίας και μάθησης. Διπλωματική εργασία. Patra, Hellenic Open University

26 Shackelford, J. & Maxwell, M. (2012). Sense of community in graduate online education: Contribution of learner to learner interaction. International Review Of Research In Open And Distance Learning, 13(4), 228-249.

27 Cohen, E. (1986). Designing groupwork Strategies for the heterogeneous classroom, Teachers College Press, Teachers College, Columbia University.

28 Kreijns, K., Kirschnen, P., & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. Computers in Human Behavior, 19, 335–353.

29 Nandi, D., Chang, S., & Balbo, S. (2009). A conceptual framework for assessing interaction quality in online discussion foroyms. Proceedings ASCILITE.

- (a) messages that highlight critical thinking,
- (b) messages that highlight new ideas,
- (c) messages suggesting additional sources; and
- (d) messages encouraging others to participate.

Holms³⁰ studied the discussions developed at a discussion forum for a teacher education program, using the SOLO classification as an analysis tool. The word SOLO originates from the original Structure of Observed Learning Outcomes and was created by Biggs and Collis³¹ to classify the quality of the learning outcome through the answers given by the individual. Through five levels, the structure of understanding is reached:

The learner

- (a) did not understand the question,
- (b) understood only one side,
- (c) understood many aspects,
- (d) combined several aspects of it, and
- (e) demonstrated a high degree of abstract thinking.

Holms's results were that 50% of the messages reached the last three levels, indicating high-level interactions. Also that open-ended issues facilitate discussion, and that the presence of the teacher is a critical factor, while there are times when the participation reaches high levels.

Salmon³² studied interactions in online teaching and learning and came up with the synthesis of a five-step model describing how interactions are developed, as well as the type of information exchanged between participants in an online learning environment.

The basic philosophy behind Salmon's model is that online learning involves much more than simply taking action in front of a computer. It is a complex process since it includes cognitive, emotional, social processes and mobilization processes. Additionally, learners alongside with the subject of instruction acquire knowledge at metacognitive level.

The five steps and the type of interaction developed by Salmon are illustrated in Table 1 below³³.

Table 1.: The Salmon Model

-
1. Access to the environment, familiarity and motivation to participate
-

30 Holmes, K. (2005). Analysis of asynchronous online discussion using the solo taxonomy.

31 Biggs, J., & Collis, K. (1982). Evaluating the quality of learning. The SOLO taxonomy Structure of the observed learning outcome. http://library.mpib-berlin.mpg.de/toc/z2007_963.pdf access in 15.11.2017

32 Salmon, G. (2000). E-moderating, Kogan Page.

33 Salmon, G. (2000). E-moderating, Kogan Page.

-
2. Socialization through interaction with the participants

 3. Exchange information on the content of the program

 4. Building knowledge through discussion, collaboration and communication

 5. Development through further application of knowledge - reflection

According to the Salmon model, in the first stage each student interacts with one or two others. After this stage, the number of people with whom one interacts increases, as the frequency of interactions augments. The nature of interactions and the type of information exchanged through messages also change from one stage to another. With the appropriate support from the teacher, according to Salmon, almost all learners can go through all stages, but the time spent staying at one stage varies according to the knowledge and skills of the learners³⁴.

In this section, a detailed reference was made to the pedagogical context of the study, with an emphasis on the concept of interaction. In this context, we examined the concept and typology of interaction, as well as the impact it has on achieving the objectives of an online course, both in “modern” and “asynchronous” tele-learning processes. Finally, we focused on the degree of interaction and on techniques to increase it, with a view to achieving better learning outcomes, with the name “Reflective Interaction through Virtual Participants” developed a model of interactive interaction through the presence of Virtual Participants (VPs) in the online learning process³⁵.

The lessons that have been implemented with this method, during the following years, are:

- 2012: “M@rkus Quests”
- 2013: “Learning by six thinking hats”
- 2016: “Building the School of the Future”
- 2017: “The Secret of Fire”

A particular feature of the VPs was that they were moving in specific theoretical contexts, which meant that they interpreted the knowledge, events, situations and reality they were experiencing on their voyage under the perspective of these frames, and on that basis they discussed issues that emerged with the other participants.

In more details:

Virtual Participant 1 (VP1): He/she does not aim at justifying his/her beliefs,

34 Salmon, G. (2000). E-moderating, Kogan Page.

35 Kioulanis, S. (2013). Κιουλάνης, Σ. Στοχαστική αλληλεπίδραση μέσω εικονικών συμμετεχόντων - Reflective Interaction through Virtual Participants (R.I.VI.Ps): Ένα αλληλεπιδραστικό μοντέλο ανοικτής και εξ αποστάσεως διαδικτυακής εκπαίδευσης και επιμόρφωσης., Ηλεκτρονικό επιστημονικό περιοδικό εκπ@ιδευτικός κύκλος, Τόμος 1, Τεύχος 2. Educational Circle, V5, 11.

assumptions and knowledge but merely to use this knowledge and with the way things usually happen. He/she acts based on his/her habits without any justification or critical examination of his/her knowledge, attitudes and beliefs / assumptions. He/she usually rejects anything new and has a kind of fear for any change. He/she often makes hasty judgments, without reflecting on the consequences and he/she is also characterized by a narrow view of things, without looking for any alternatives or original solutions. He/she promotes the non reflective learning, the non learning and the rational action and generally expresses the teacher who is interested in the everyday usual things without any further search.

Virtual Participant 2 (VP2): He/she is characterized by intense critical and reflective mood. He/she does not seem willing to accept anything uncritically and through his/her communication and interaction with the participants he/she drifts the latter in a reflective activity. Thus, he/she promotes reflection, reflective action, critical thinking and reflection in action.

Virtual Participant 3 (VP3): He/she intensely thinks of the potential risks, problems, difficulties, disadvantages and negative effects that may arise in any case. His/her way of thinking moves towards established patterns and stereotypes. Through his/her interaction with the participants of the course he/she promotes “vertical thinking” which processes already existing ideas. He/she focuses on the logical analysis of data, correlation, evaluation and finally the search for the unique and correct solution of any problem. In this context between the skills of critical thinkers he/she proposes concentration and management of the relevant information, data interpretation, evaluation of evidence, indication of the existence of logical relationships between various proposals, understanding of language use with precision and clarity, creation of documented conclusions and generalizations.

Virtual Participant 4 (VP4): He/she is extrovert, optimistic, flexible, with positive and creative way of thinking, interested in anything new, creative and alternative. He/she thinks and acts out of the conventional rules of everyday life as he/she is based on a novel way of looking at things and promotes creative and lateral thinking. His/her basic elements are the production of more ideas, solutions and answers to problems, flexibility, that is change of the strategy or the way of thinking, originality in the sense of affinity with the unusual and perfection in the expression of details and the organization of ideas in broader and more comprehensive figures.

The research was based on a gradual involvement of Virtual participants in the learning process, and the research data showed that the more active the involvement of Virtual Participants in the learning process the greater their influence on the interaction between the participants is³⁶.

36 Kioulanis, S. (2017). Gamification is not (just) a game but it is an important material for on line distance learning, *educ@tional circle*, Volume 5|Issue 2|2017

4. The Gamification technique

The term “gamification” was introduced by Pelling³⁷ and refers to the use of computer games methodology and techniques, translated into texts and activities, to improve the learning experience of users, enhance their engagement in the learning process by encouraging, motivating and enhancing the sense of purpose and intimacy in the various processes. Based on the above, transferring the philosophy of electronic games to the learning process, we use the students’ psychological predisposition to play. However, gamification is not a game. Kapp³⁸ defines gamification as a cover to add the interactivity, engagement and immersion that leads to good learning.

Michał Jakubowski(2014),³⁹ states that gamification has risen as a trend around 2010 as it started to become used worldwide in various areas from business to education. That term had been used for the first time in 2002 by Nick Pelling but it was just too early for the proper adoption of the concept. There are plenty of gamification definitions, but Jakubowski suggests using these two:

- I. Gamification is the use of game design elements in non game contexts⁴⁰
- II. Gamification is the process of game thinking and game mechanics to engage users and solve problems⁴¹.

During early hype on gamification in 2010 Lee Sheldon started his course called “Multiplayer game design”. He reconstructed classic course structure into gamified one using mostly point mechanics and some narrative elements. Passing tests and exams became fighting with monsters⁴².

Another detailed description of the uses of gamification in education was done by Karl Kapp⁴³ in his book “The Gamification of Learning and Instruction: Game based Methods and Strategies for Training and Education”. Although the content of the book is quite similar to the work of Mr. Knapp, the book contains well structured knowledge and meaningful insights that were inspiring to the author.

37 Pelling, N (2011) The (short) prehistory of gamification, Retrieved, short prehistory of gamification <http://nanodome.wordpress.com/2011/08/09/the-short-prehistory-of-gamification/> access in 18.11.2017

38 Kapp, K. (2012), *The Gamification of Learning and Instruction: Game based Methods and Strategies for Training and Education*, Pfeiffer

39 Jakubowski M (2014) Gamification in Business and education project of gamified course for university students, *Developments in Business Simulation and Experiential Learning*, volume 41 <https://journals.tdl.org/absel/index.php/absel/article/viewFile/2137/2106> access in 19.11.2017

40 Deterding, D, Khaled, & Nacke (2011), *Gamification: towards a definition*, CHI

41 Zichermann, G, Cunningham, C (2011), *Gamification by Design*

42 Sheldon, L (2010) *Course Syllabus*, <http://gamingtheclassroom.wordpress.com/syllabus/> access in 20.11.2017

43 Kapp, K. (2012), *The Gamification of Learning and Instruction: Game based Methods and Strategies for Training and Education*, Pfeiffer

5. Conclusions

Interaction is a key element of any learning process, while in asynchronous pedagogy of online learning it is important for the success of any activity, mainly due to the lack of communication between the learners involved in the learning process.

The pedagogical dimension of Virtual Learning Environments relies heavily on the theoretical model of constructivism, and the magnitude of the success of an online learning environment depends, to a large extent, on the encouragement and support of active participation and interaction of participants.

The benefits of interacting with the objectives of an online course are important in terms of achieving both cognitive and emotional learning goals.

In order to enhance the interaction in online learning, a series of techniques and models are applied.

The use of gamification techniques in the learning process has enhanced collaboration among participants in the online learning environment.

The involvement of Virtual Participants in online learning has positive results as it is seen as a key factor in the development of social interactions, the development of interpersonal relationships and a climate of confidence that foster the development of an online learning community.

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Nizami Aikaterini

From I. Yalom’s Group psycho-therapy to co-operative learning-management of emotions

Abstract

In this proposal it will be discussed whether the therapeutic factors proposed by I. Yalom in his book “*The Theory and Practice of Group Psychotherapy*” can be applied in the educational practices to develop a range of skills, such as, management of emotions to co-operative learning. It will also be examined whether these factors can be used in educational practices and whether each child can be individually infused with empathy, love, durability, reinforcement- by learning themselves- the ability to discover talents, wisdom, courage, and -at a group level- altruism, responsibility, social responsibility, tolerance, working ethics, and hope. By exploiting these therapeutic factors, the aim is to achieve co-operative learning, through approaching and understanding human capabilities, motivations and emotions.

1 Nisamis Aikaterini, From I. Yalom’s Group psycho-therapy to co-operative learning-management of emotions. Proceedings of 2nd Conference, New Pedagogue, Athens 23-25 May 2015, Editor: F. Goussios, ISBN: 978-960-99435-7-4 (e-book / pdf), pp. 1006-1014

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Key words: Management of Feelings, Co-operative learning, Therapeutic factors

1. Introduction

The management of feelings through experiencing positive feelings reinforces somatic, cognitive, psychological and social resources that an individual bears². The theory of attachment, as it emerges from care and security, provides the child with a standard basis from which s/he will be able to start exploring and enhancing his/her mental and social resources. Positive moments that an individual experiences in his/her long-term relationships shield them and contribute to the increase of closeness (Fredrickson, 1998)³. Therefore, it is the modern school's objective to allow the children to learn creatively through collaboration, in a positive atmosphere, and at the same time develop an emotional intelligence that will facilitate their development by exploring their abilities and their talents. "Positive variables" like hope, optimism, psychological durability, wisdom, interest, altruism, socialization, imitation, interpersonal relationships, and other factors that Yalom revised, will act as aids to discovering that, through increasing the self-esteem of the students and the coherence of the classroom, what will be achieved is a decrease of competitiveness, and the operation of mechanisms of cooperation among children of various nationalities, capabilities and ages.

2. Irvin Yalom's Group Therapeutic Factors

Instillation of Hope: Instilling and retaining hope are two factors that are relevant with every psychotherapy. Hope is not only a very important requirement for the patient to remain in a state of therapy, but it also encompasses the belief that any kind of psychotherapy itself can have a positive outcome, being an efficient on its own, like a placebo⁴.

Universality: Many people receiving treatment have an increased sense of uniqueness due to their extreme social isolation. It is almost in every case that these people experience a deep worry for their value as individuals, which is gradually decreased if they realize that, in spite of the complexity of human problems, everyone shares similarities with other people; thus, they discover common anxieties, problems and hardships. Yalom states that these people describe this as a "welcoming life" experience.

Imparting information: The explanations that the therapist provides regarding the psychological disorders allow the patients to find meaning in their

2 Fredrickson, B. L., Mancuso, R. A., Branigan, C & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, 24, pp. 237-238.

3 Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*, 2, pp. 300-319.

4 Yalom, I. (2006). *The Theory and Practice of Group Psychotherapy*. Athens: AGRA Publications

suffering and overcome their fears originating from this kind of uncertainty. It should be noted, though, that the beneficial results do not stem from the content of this advice, but from the fact that the patients exchange information, which indicates a mutual interest for mutual care.

Altruism: In this factor, Yalom explains how low the self-esteem of patients can be, and how they can feel useless. Many shrink away from the care that is offered to them, believing that they do not deserve it. Slowly and gradually they discover that they can be beneficial for each other and they create an experience for each other, which is consoling and noteworthy as it promotes their self-respect. In any case, the meaning of life is always a concept that is actualized only when we have exceeded ourselves, when we have forgotten about it and we have been absorbed by someone (or something) other than ourselves⁵.

Corrective recapitulation of the Primary Family Group: Many of the elements that define people lie deep in their childhood years, and are based on their families. The important thing in this factor is not for someone to relive these early family collisions, but to live them “correctively” through the group. This is a therapeutic processing of “pending matters” that date back to former years. It constitutes a second chance for the patient to discover and overcome older situations or relationships that included frequent collisions.

Development of socializing techniques: It is quite frequent for socializing techniques to be developed in groups of psychotherapy. This occurs because there is a huge variability between the intentions and the real impact that the patients have on others. Therefore, by being less critical and having acquired techniques for resolving collisions, they become all the abler to experience empathy and express it accurately to each other.

Imitative behavior: Imitative behavior usually plays a more significant role at the initial stages of a team, as the members identify themselves with older members and the therapists. With experiments he conducted, Bandura⁶ has proven that “imitation is an efficient therapeutic force”. Therefore, with imitative behavior, the patient has the chance to accept new behavioral schemata that s/he could absorb.

Interpersonal learning: Interpersonal learning is a wide and complex factor that consists of various opinions and versions. Sullivan⁷ claims that human beings develop the image of themselves based on how they comprehend the assessment of their behaviors by important people in their environment. Being aware that without deep, positive and mutual interpersonal relations, survival would be impossible not only for individual humans but for the entire human species as well interpersonal learning is a therapeutic factor that relies on primitive

5 Frankl, V. (1969). *The will to Meaning*. Cleveland: World Publishing

6 Bandura, A. (1963). Behavior theory and indemnificatory learning. *American Journal of Orthopsychiatry*, 33, pp. 591-601.

7 Sullivan, H. (1953). *The International Theory of Psychiatry* (New York): Norton.

memories that are recorded inside the human mind.

Group cohesiveness: The members of a cohesive group have an understanding for mutual acceptance, create a mood that is suitable to express and expose themselves, and also to a large extent realize the existence of their self-conscience and trust in themselves. The feeling of “belonging” leads the patients to understand the value of the group and feel, in turn, that their own value is being understood as well, not to mention that they are becoming accepted and receive support by the rest of the group members.

Comprehension of the self: While during interpersonal learning one learns how to manage “how others see him/her”, in “comprehension of the self” one has to go back to the past so as to resolve issues that have been created and are established, stemming from childhood experiences, or, in other words, “primitive sides of our selves that are full of fear and shame”. Only after regaining control of these “renounced sides” of ourselves can we experience fullness and a deep sense of liberty⁸.

Catharsis: Catharsis originates from the Greek verb “*kathavrô*”, meaning to release with the purpose to purge oneself, by experiencing and expressing positive or negative feelings. It is a very important factor for someone to learn how to lighten his/her mind by expressing feelings, being able to tell what is disturbing and generally to express things that burden him/her. It is associated with a combination of other factors, but mainly with group cohesiveness. Catharsis is most useful when supportive relations have been established that are based on mutual respect and compassion.

Existential factors: These factors are associated with our own existence, with dealing with human fate, our mortality, our liberty and our responsibility for the design of our own lives, our isolation, our attempts to find meaning in life. The purpose of these factors is to lead the patients to learning how to take up the responsibility for the way they live their lives, regardless of how much support they receive from others. This is a life lesson that may, on the one hand, lead to desperation, but, on the other, it may also lead to power; a power that will lead to a redefinition and confrontation of fears and anxieties, so as to give meaning in their lives, because, as Nietzsche famously said: “*he who has a why to live for can bear almost any how*”⁹.

3. Application and revision of I. Yalom’s therapeutic factors for the better operation of a classroom and the promotion of cooperative learning

If such is the case that I. Yalom’s therapeutic factors really do help in achieving

8 Yalom, I. (2006). *The Theory and Practice of Group Psychotherapy*. Athens: AGRA Publications

9 Nietzsche, F. (2008). *The Twilight of Idols*. Thessaloniki: Vaniats Publishing

the objectives of Group Psychotherapy, then could they be transferred and applied to classrooms? Could they be used by the teacher to positively reinforce groups and cooperative learning? Could they contribute to the establishment of a positive atmosphere that will create group cohesiveness, mutual respect and empathy?

Instillation of hope: Hope, a positive feeling, an optimistic physical status, a cognitive whole consisting of an individual's beliefs to produce realistic plans for the achievement of objectives and the ability to define and maintain his/her coordination and action towards these goals (Snyder, 1994)¹⁰. The reinforcement of hope can be achieved through story-telling, dramatizations, role-playing, different, more hopeful-ending versions for stories, aiming at the increase of their self-esteem, leading the children to achieve their learning goals, just like the way the hero makes it at the end of the story and completes his objectives. Through games, children learn how to support each other and reinforce their relations with each other, setting objectives and believing that, together, they can achieve them. These objectives may be personal or group-oriented. In this way, they will increase their positive feelings and confidence, their ability to adapt to new situations, and facilitate the forging of strong and stable emotional bonds.

Universality: The egocentric thought that a child of this age has resembles the sense of uniqueness that the patients in treatment have, feeling it is only themselves that have a problem. The assimilation of students in the group makes them realize that each one needs the other in order to achieve the goals that have been set each time. It is then that the student starts to realize that there are other opinions (development of active listening skills) and concludes that, to be led to success, s/he needs the contribution of the entire team. Therefore, the egocentrism gradually declines, and the student develops a mood to cooperate and help or be helped, factors that help him/her to satisfy a basic need for acceptance, affection and care. Also, the children with the least amount of bravery are relieved from the stress of failure, because they are going to altogether be led to the resolution of the problem.

Imparting information: The goal of the present study at the point here is to activate the entire group for the acquisition of knowledge, each promoting their own individual learning, while, at the same time, the learning of everybody else in the group. Imparting information helps children develop critical thinking skills, helps them to realize that there are other opinions other than theirs, which may even be more correct for achieving the common goal, to become more responsible with a feeling of respect for other people's opinions, be more cooperative and creative by adopting thinking processes that will lead them to clarifications, associations, experimentation, assumptions, corrections and, hence, be led to knowledge. Also, they can thus achieve an improvement of their oral communication and their linguistic and communicative competence.

10 Snyder, C. R. (1994). The psychology of hope: You can get there from here. New York: Free press.

Altruism: From the moment they are born, people need to feel that they are needed and useful¹¹. Kindergarten education should aim at the promotion of social exchanges by forging emotions of love, altruism, respect, the development of independence, co-operation, mutual respect, and sportsmanship and not competitiveness. The neuronal child gradually acquires the most elegant emotional tools through learning¹². Honing and exercising their emotional intelligence and the enhancement of empathy through role-playing games, imaginative games, dramatizations, fairy tales, and puppet shows allow the educators to teach children how to recognize their own and other people's emotions to describe them also to realize strategies for the management of their feelings.

Corrective recapitulation of the Primary Family Group: While for grown-ups psychotherapy can be a factor through which one can dive into his/her past and find the solutions to the problems that had been established since childhood, the case of children differs in that these are being established at that given moment. Hence, the teaching person has to act pre-emptively. As a holder of expert knowledge, s/he will have to be in a constant situation of collaborating with, educating and guiding parents, in order to prevent them from making mistakes, which lead the child to establish a mistaken self-image with low self-esteem, signs of a predisposition of resignation a lack of self-respect.

Development of socializing techniques: Following family, school constitutes a supplementary and enhancing space of interactions, where children exercise socialization. Through the development of socializing skills, they can achieve communication, self-awareness, identity, expression and management of feelings, anger and stress. We can thus confirm that the emotional operations affect the higher cognitive functions as, by increasing communication and social skills, the possibilities are increased, not only for the resolution of problems, but also for the processes involved in learning and decision making¹³.

Imitative behavior: From A. Bandura's social learning theory, we know how important the process of observation and imitation is for learning. In addition, G. Pizzolatti's discovery of the mirror neurons at the University of Parma in 2006 confirms that these are being activated when the subject acts or upon seeing someone else act¹³. This also applies to important adults like parents and teachers, as well as other members of a group, e.g. the members of a classroom exposed to observation and imitation. They are behavioral role models in a group of people that have not yet developed a dynamic personality, but instead shape their personality by observing the relationship others have with life. Children constantly "wear masks", try out, drop, adapt, change. They realize that changing

11 Yalom, I. (2006). *The Theory and Practice of Group Psychotherapy*. Athens: AGRA Publications

12 Goleman, D. (2011). *Emotional Intelligence*. Athens: Pedio Publishing

13 Dissanto, A. M. (2008). *Il ruolo delle emozioni nella relazione educativa*. Roma: Scuola IAD.

their personality leads them to a greater acceptance by others. This procedure, besides learning, has an amazing effect on the development of critical thinking and values, mainly that of self-awareness: by “discovering” what we are not, we proceed to the discovery of what we are¹¹.

Interpersonal learning: From examining both primitive and modern civilizations, it has always emerged that people lived and acted better in groups. The need for “belonging” has been a fundamental, powerful and universal motive¹¹. John Bowlby, by examining the early behavioral relationship between mother and child, reached to the conclusion that attachment behavior is not only necessary for survival, but it appears to be a nuclear, inherent and genetically defined feature¹⁴. Winnicott also mentions something similar: “What we came to call ‘infant’ does not exist. There’s only the mother-infant couple”¹⁵. The group will teach children to accept diversity, agree, disagree, learn about hierarchy, the distribution of goals for the achievement of a common purpose, the principles and objectives that are set for achievement. Our personality is in its entirety a product of our interaction with other important to us people. Our purpose is for them to learn to communicate, trust, learn to love, be honest and giving, and have stable, quality relationships.

Group cohesiveness: Safe in the security of the classroom, the child has the sense that s/he can reveal the “bad sides” of his/her character. Gradually, the group acts in a “therapeutic” way to correct this behavior, and therefore remain accepted by others. The members of this first group inside the classroom start sharing, feeling a warmth and a comfort with the sense of “belonging” and with the achievement of the common goal. Through a positive mood of acceptance, they start feeling their self-esteem being reinforced, since their opinion has value, as well. The idea that they are becoming accepted and are being supported creates the basis that will lead them to build a strong self, able to fight against hardships, keep trying and not give up. This also decreases feelings of competitiveness, but not the desire to claim; it also helps with the management of stressful situations, especially for those children who are lonely and less brave. Finally, it enhances the possibility to resolve problems under the “wing” of the classroom.

Self-awareness: The concept that children of the critical kindergarten age create in their minds about themselves will become the fundamental element of their self-image for their whole lives. The group setting at school teaches children to begin evaluating their lives, adopt a scenario about who they are and what they are worth, and help them actualize and manage their behavior. Us teachers at school need to yet again act preemptively. We will have to be mindful not to use characterizations that will entrap the child in a singular self-image, which will

14 Bowlby, I. (1980). Attachment and loss. Sadness and Depression. New York: Basic Books.

15 Winnicott, D. (1978). Thought Pediatrics to Psychoanalysis. London: Hogarth Press.

function as a *self-fulfilled prophecy* (the child will believe that s/he is nothing more than the image s/he shows). The security that groups provide in the classroom, our reasonable expectations and demands, the acceptance, the enhancement of emotions, altruism and love will help the child see life positively and develop and maintain a stable, completed and healthy perception of him/herself.

Catharsis: We all have incidents of emotional unloading in our lives, without, unfortunately, always leading to change. The ability one has to reflect on his/her emotional experience constitutes a vital ingredient for the process of change¹⁶. This is where the role of the educator comes in inside a classroom, that is, to teach children how to express their feelings and to be able to tell what it is that bothers them. In a mood of positivity, optimism and mutual trust, security and cooperation, children are able to feel liberated and acquire emotional skills that will define their futures and their development. Catharsis is a factor that can function right at that moment exclusively, when bonds among them are forged, and the group becomes cohesive.

Existential factors: As mentioned above, existential factors are associated with the role that they play in Psychotherapy, those hard, existential truths in life: our mortality, freedom and responsibility in designing our lives the way we want them to be, as well as loneliness “inside an inherent universe with no inherent meaning”¹⁶. Inside the classroom, what we need to take care of is to infuse the children with freedom, and, after they discover (with our help) their own inclinations, to take the design and responsibility of their own lives in their own hands. Schopenhauer said that “we address each other as partners in *pain*”, a quote that I. Yalom also uses in his book “The Theory and Practice of Group Psychotherapy”; it is a quote that indeed addresses the psychotherapy patients who live through adverse situations like diseases, depression etc. and bears great significance for them. Until they reach a point (although nobody wishes to be in such positions) to manage these kinds of situations and thoughts, it could be considered best to teach children “to live with each other as partners in *life*”, through the “microcosm” of an example that the class is.

4. Conclusions

Research in neuroscience has shown that, without the information that a person gets from his/her emotions, it would be harder to make even the simplest of decisions¹⁷. Consequently, the more the educators help children to develop empathy in the classroom, the more natural it will be to experience cooperation in a mood of acceptance and positive emotions, and be able to manage negative ones more

16 Yalom, I. (2006). The Theory and Practice of Group Psychotherapy. Athens: AGRA Publications

17 Damasio, A. R. (1995). Descartes' error: Emotion, reason and the human brain. New York: Avon.

durably. Through the realization of bonds and relationships with others, the child learns of his greatness and efficiency¹⁸. As a conclusion, I would like to end this proposal by saying that I consider I. Yalom's factors of vital importance in an educational framework. It is very significant for the educator to be able to help the child through the setting of a group to get to know him/herself and others, manage his/her feelings, develop cooperative techniques, enhance his/her critical thinking skills, discover his/her talents, say his/her opinion openly, make decisions regarding his/her life. Their significance lies in the actualization of their preemptive role, since they also involve parents in the educational procedure, showing them how to avoid behaviors that could hurt the self-esteem of their child, and lead him/her to situations of self-fulfilled prophecy. The educator shows the greatness of the procedure and not the result, providing the students with the opportunity to develop self-evaluation techniques. The development of such behaviors can prepare the ground for a school that denotes happiness and security, helping the child learn and develop so as to "build" those features that will make his/her life worth living.

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¹⁸ Davis, M. & Kraus, L. (1997). *Personality and accurate empathy*.

Psychologist, 56(3), pp. 216-263.

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Greek

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The science experiment in primary education: The case of Greek textbooks

Abstract

A review on the role of experiment on science textbooks may become a fruitful tool for unfolding the teaching approaches encouraged by educational policies depending on the social, political and cultural context of each era. In order to have a critical and comparative perspective, analysis models are needed bringing forward frameworks and parameters that help researchers and educators understand the variety of aspects influencing the development and evolution of science textbooks. The review presented in this paper is focused on the role of experiment; therefore the analysis model developed to support the effectiveness of the review has been based on the various dimensions of experiment in science teaching. The EAST analysis model, developed and applied in our research, has been named from the acronym of the phrase Experiment Analysis of Science Textbooks. EAST has been used in order to study, classify and analyze Greek science textbooks from 1838 till 2008.

Keywords: textbooks, science, experiment, educational policies.

1. Introduction

A review on the role of experiment on science textbooks may become a fruitful tool for unfolding the teaching approaches encouraged by educational policies depending on the social, political and cultural context of each era. In order to have a critical and comparative perspective, analysis models are needed bringing forward frameworks and parameters that help researchers and educators understand the variety of aspects influencing the development and evolution of science textbooks, such as the KVP model: Knowledge – Values - social Practices¹. The review presented in this paper is focused on the role of experiment; therefore the analysis model developed to support the effectiveness of the review has been based on the various dimensions of experiment in science teaching. The EAST analysis model, developed and applied in our research, has been named from the acronym of the phrase Experiment Analysis of Science Textbooks². EAST has been used in order to study, classify and analyze Greek science textbooks from 1838 till 2008, providing the framework to understand the evolution of the role experiment in Greek science textbooks during a period of 170 years.

2. The didactical use of experiment

Experiments are predesigned and aim to control, validate or argue a theoretical hypothesis³. Experiments in science teaching attempt to wake students' interest and motivate science learning. At the same time, experiments in the classroom encourage citizenship skills such as active team work, methodic way of thinking, reasoning as well as attitudes and values⁴. Science and experiment in particular introduces pluralism in the classroom and offers in its contemporary version a synthesis of theories, for example objectivity, subjectivity, positivism, realism, hermeneutics, deductive and inductive reasoning etc⁵. Experiments encourage

1 Clement, P. (2008), Introduction to the special issue of SEI relating to critical analysis of school science textbooks. *Science Education International*, vol.10 (2), p.p.93-96.

2 Xanthidou, P. (2014), *Η διδακτική σημασία του πειράματος στα αναλυτικά προγράμματα και τα σχολικά εγχειρίδια φυσικής και χημείας του δημοτικού σχολείου (1838-2008)*. *PhD Thesis*. Thessaloniki: School of Primary Education. **Keywords:** overall job satisfaction, teachers, questionnaire, validity, reliability Education. Faculty of Education, Aristotle University of Thessaloniki. Xanthidou, P., & Seroglou, F. (2014), Το πείραμα στα βιβλία φυσικής και χημείας του δημοτικού σχολείου (1838 – 2008): Μια ανάλυση με το μοντέλο EAST, Στο: Κολιόπουλος, Δ. (Επιμ.) *Πρακτικά 8ου Πανελληνίου Συνεδρίου Ιστορίας, Φιλοσοφίας και Διδακτικής των Φυσικών Επιστημών*. Πάτρα, 14-16 Νοεμβρίου 2014 (p.p.277-282). Athens: Ion Publishers.

3 Meyer, H. (1987), *Unterrichts Methoden*. Bd II. Frankfurt/a.M.: Cornlesen. Kossyvakı, F. (2003), *Εναλλακτική Διδακτική*. Athens: Gutenberg.

4 Scheller, M. (1995), *Die Stellung des Menschen im Kosmos*. Bonn: Bouvier-Verlag.

5 Messner R. u.a. (1997), Ueber Aufgaben des naturwissenschaftlichen Unterrichts und Formen des Naturwissens, in *Chimica didactica*, vol.23, p.p.5-31. Kossyvakı, F. (2004), Η μορφωτική σημασία της πειραματικής διαδικασίας στο σχολείο, στο *Επιστημονική Επετηρίδα Πανεπιστήμιο Ιωαννίνων* No17 (p.p. 79-116). Ioannina: Faculty of Education School of Primary Education.

skills development and content appreciation in the context of social learning⁶, as knowledge and skills combine in action through activity learning⁷. Critical thinking, model testing, meta-reflection, knowledge restructuring and reasoning in perspective are only some of the meta-cognitive skills developed through learning with experiments in science.

Since the beginning of the 19th century, school labwork has been considered to help students observe physical phenomena and argue on them⁸. The necessity of experiment in classroom teaching is brought forward by Edgeworths in 1811 in *Essays on Practical Education* as he mentions that students feel very content from acquiring knowledge while doing experiments that meet their abilities and interests and please them not only to watch but also to participate.

School experiment is the reproduction of an experimental procedure in simplified and controlled conditions. Its design aims to validate or refute abstract representations about nature and the world around us. Students are introduced to systemic observation and data based reasoning⁹. There are many types of experiments as listed by researchers according to the estimated function and utility of experiments such as anthropological, pedagogical, psychological, didactical, methodological, cultural etc. Teachers always use experiments in the science classroom as curricula indicate, but also in order to teach science, about science and the methodologies of science.

Science teaching has to bring together the teaching of scientific knowledge, the procedures that produce and evolve scientific knowledge as well as the ways to construct it¹⁰. Science curricula have to include aspects from the history and evolution of science as well as the ways scientists work and study¹¹. Such an approach should provide students with the scientific way of thinking, a variety of scientific methodologies, experimental skills, team work spirit, reasoning and a positive attitude for science. Historical experiments could also be reconstructed through an exhibition like the one created by Peter Heering and Falk Mueller

6 Wagenschein, M. (1990), *Kinder auf dem Weg zur Physik*. Berlin: Weinheim.

7 Mueller, M., (1997), "Erziehung" in einer vom Fachwissen dominierten Schulpraxis? *Chimica didactica*, vol.1, p.p.32-62. Kossyvaki, F. (2004), Η μορφωτική σημασία της πειραματικής διαδικασίας στο σχολείο, στο *Επιστημονική Επετηρίδα Πανεπιστήμιο Ιωαννίνων* No 17, (p.p. 79-116). Ioannina: Faculty of Education School of Primary Education.

8 Edgeworth, R. I., & Edgeworth M. (1811), *Essays on practical education*. (3rd ed). London: Johnson.

Rosen, S.A. (1954), History of the Physics Laboratory in the American Public Schools. *American Journal of Physics*, vol.22, p.p.194-204. Lunetta, V., (1998), The school science laboratory: Historical perspectives and contexts for contemporary teaching. In Tobin, K., Fraser, B. (Eds.), *International Handbook of science education*, Part I (p.p.249-262). Dordrecht: Kluwer Academic Publishers.

9 Meyer, H. (1987), *Unterrichts Methoden*. Bd II. Frankfurt/a.M.: Cornlesen. Kossyvaki, F. (2004), Η μορφωτική σημασία της πειραματικής διαδικασίας στο σχολείο, στο *Επιστημονική Επετηρίδα Πανεπιστήμιο Ιωαννίνων* No 17, (p.p. 79-116). Ioannina: Faculty of Education School of Primary Education.

10 Millar, R. (1987), Towards a role of experiment in the science teaching laboratory. *Studies in Science Education*, vol.14, p.p.109-118.

11 Duschl, R.A. (1990), *Reconstructing science education*. New York: Teachers College Press.

“Exploring the World, Constructing Worlds: Experimental Cultures of Physics from the 16th to the 19th Century”¹². According to Hasok Chang three different types of historical experiments existed: Two types of them are characterized as “replication” (historical and physical replication) and the third one as “extension”¹³.

The movement of liberal education in the beginning of the 20th century also encouraged inquiry learning and suggested a utilitarian role for school labwork. In the 1960’s, USA and UK science curricula intended to involve students in inquiry science learning. Teaching with experiments, labwork and hands-on activities are part of science education research and argumentation.

Labwork activities come in a variety of forms from activities that urge students to collect data in order to verify a scientific axiom already taught to activities with an inductive nature that put students in the position to recognize mathematical forms, analogies and interrelations in the collected data, while in the school lab, students work individually, in small or bigger groups.

For more than a century, lab activities have supported basic aims in science teaching such as: understanding science concepts, developing scientific skills, encouraging problem solving techniques, offering motivation for learning and enhancing the understanding of the nature of science¹⁴.

The value of experiment has been praised by many science education researchers as a fruitful teaching method and mean, that contributes to the development of cognitive skills and scientific way of thinking. Teachers need to facilitate students’ cognitive development with structured learning experiences¹⁵, while learning through science experiments helps students built their self-esteem and freely participate in defining the aims and procedures of learning¹⁶. During an experiment, hypotheses are validated or refuted.

Each student may design experiments to check hypotheses, choose the appropriate experimental procedure and develop an insight on problem solving. Thus, the restructuring and reform of knowledge through experiment contributes to the shift from empirical to qualitative school science knowledge¹⁷.

12 Heering, P. & Mueller F. (2002), Cultures of experimental practice-An approach in a museum. *Science & Education*, vol.11, p.p.203-214.

13 Chang, H. (2011), How historical experiments can improve scientific knowledge and science education: The cases of boiling water and electrochemistry. *Science & Education*, vol.20, p.p.317-341.

14 Duschl, R.A. (1990), *Reconstructing science education*. New York: Teachers College Press. Lunetta, V., (1998), The school science laboratory: Historical perspectives and contexts for contemporary teaching. In Tobin, K., Fraser, B. (Eds.), *International Handbook of science education*, Part I (p.p.249-262). Dordrecht: Kluwer Academic Publishers.

15 Dewey, J. (1964), *Demokratie und Erziehung*. Braunschweig: Westermann.

16 Rogers C.R. (1963), The actualizing tendency in relation to “motives” and to consciousness. In. M.R. Jones (Ed.) *Nebraska Symposium on motivation* (p.p. 1-24). Lincoln: University of Nebraska Press. Kossyvakı, F. (2004), Η μορφωτική σημασία της πειραματικής διαδικασίας στο σχολείο, στο *Επιστημονική Επετηρίδα Πανεπιστήμιο Ιωαννίνων* No 17, (p.p. 79-116). Ioannina: Faculty of Education School of Primary Education.

17 Matsagouras, E. G. (2003), *Theory and praxis. Strategies of teaching. Vol. II*. Athens: Gutenberg. Kossyvakı, F. (2004), Η μορφωτική σημασία της πειραματικής διαδικασίας στο σχολείο, στο *Επιστημονική Επετηρίδα*

According to Hodson (Hodson, 1988; Hodson, 1990; Hodson, 1992)¹⁸ there are dimensions in science teaching: the first dimension is related to the gradual, personal construction of knowledge (learning science), the second dimension is related to the understanding of the nature and methods of science, as well as to the science-society interrelations (learning about science), while the third one is related to the scientific inquiry, the development of skills and problem solving (doing science), mainly focusing on the use of methods and procedures of science for investigating about science phenomena, problem solving as at the same time attempts to follow students' interest.

For doing science successfully three pre-requisites are mentioned:

- Possession of an appropriate conceptual background
- Ability to perform certain laboratory operations satisfactorily
- Experimental flair.

This last requirement seems to comprise at least two distinct factors:

- The ability to design “powerful” experiments that test or illustrate a theory in an elegant way.
- The ability to solve problems, to handle apparatus and to carry out labwork in an organized and skillful manner in order to fulfill the aims of the experiment.

A successful experience of doing an experiment helps students build confidence and self-esteem, arouse interest and focus attention in attending or doing experiments that follow. The confidence that derives from the successful design of an experiment has a major affect on the students attitude go on experimenting. Planning experiments includes identifying a problem, formulating a hypothesis, identifying dependent and independent variables, etc, and is largely a concept-driven activity). Designing experiments involves fitting a particular experimental design to a hypothesis¹⁹.

Often, students involvement in a science activity is supported by written guidelines. A study of students' ideas has shown that students perceive an experiment in many ways. Usually students' perception is completely different from the scientific one. While, there is a huge gap between teachers' intentions and students' involvement in doing experiments.

3. Types of experiments

Researchers have tried to categorize science experiments. For example, they

Πανεπιστήμιο Ιωαννίνων No 17, (p.p. 79-116). Ioannina: Faculty of Education School of Primary Education.

18 Hodson, D. (1988), Experiments in science and science teaching. *Educational Philosophy and Theory*, vol.20(2), p.p.53-66. Hodson, D. (1990), A critical look at practical work in school science. *School Science Review*, vol.70, p.p. 33-40. Hodson, D. (1992), In research of a meaningful relationship: an exploration of some issues relating to integration in science and science education. *International Journal of science education*, vol.14, p.p.541-562.

19 Hodson, D. (1988), Experiments in science and science teaching. *Educational Philosophy and Theory*, vol.20(2), p. 64.

differentiate between research experiments and experiments for teaching science. Such categories focus on: experimental material, teaching methods and aims, ways of reasoning such as Baconian, Kantian, Galilean, Aristotelian²⁰. There are also ‘thought experiments’ in science teaching. An example is Galileo’s thought experiment²¹. Researchers also commend on the use of experiment in a variety of learning contexts. For example, in the context of constructivism, experiments facilitate conceptual change and science learning. Students improve their observation and data recording skills, get used to ways of measurement and learn to handle lab equipment and materials, while they have to work productively and communicate in groups²².

School science and school laboratory in primary education comes to the centre of attention after the 1970’s with the hands-on movement. In the following decades, a discussion is taking place on what actually students learn during labwork comparing minds-on to hands-on science. Researchers support that students working with materials during labwork doesn’t necessary mean that they understand the science concepts involved. Piaget’s, Dewey’s and Bruner’s works provide a philosophical foundation to this trend. In order to consider students being involved in hands-on activities, three conditions must be fulfilled²³:

- Each student or students in groups handle objects or events in the physical environment using at the same time effective teaching practices involving video, computer or museum work.
- Students use multiple intelligences in order to understand the physical environment.

20 Medawar, P.B. (1969), *Induction and Intuition in Scientific Thought*. London: Methuen. Meyer, H. (1987), *Unterrichts Methoden*. Bd II. Frankfurt/a.M.: Cornelsen. Hodson, D. (1992), In research of a meaningful relationship: an exploration of some issues relating to integration in science and science education. *International Journal of science education*, vol.14, p.p.541-562. Kossyvaki, F. (2003), *Εναλλακτική Διδακτική*. Athens: Gutenberg.

21 Matthews, M.R. (1989), Ernst Mach and thought experiments in science education. *Research in science education*, vol.18, p.p.251-257. Lattery, J.M., (2001), Thought experiments in physics education: A simple and practical example, *Science & Education*, vol.10, p.p.485-492. Seroglou, F., (2006), *Φυσικές επιστήμες για την εκπαίδευση του πολίτη*. Epikentro Publications, Thessaloniki, Greece.

22 Schutz, W., & McRobbie C. (1994), A constructivist approach to secondary school science experiments.

Research in Science Education, vol.24, p.p.295-303. Kotsis, K. (2001), Η χρήση πειραμάτων στη διδασκαλία της Φυσικής στο ελληνικό Δημοτικό Σχολείο, στο *Επιστημονική Επετηρίδα Πανεπιστήμιο Ιωαννίνων*, No14 (p.p. 219-231). Ioannina: Faculty of education School of Primary Education.

23 Hodson, D. Prophet, R. (1983), Why the science curriculum changes – evolution or social control? *School Science Review*, Sept. 83, p.p.5-18. Karanikas, G. (1993), Ο σχεδιασμός, η υλοποίηση και ο πειραματισμός με κατασκευές που κάνουν οι ίδιοι οι μαθητές μέσο για τη διδασκαλία των Φυσικών Επιστημών. *Εκπαιδευτική Κοινότητα*, vol.24, p.p.21-23. Chalkia, K. (1993), Τι είδους επιστημονικές δραστηριότητες και τι είδους «εργαστήριο» Φυσικών Επιστημών χρειάζονται τα παιδιά του Δημοτικού Σχολείου. *Παιδαγωγική Επιθεώρηση*, vol.18, p.p.31-38. Savvas, S. (1996), *Το ερευνητικά εξελισσόμενο μοντέλο στη διδασκαλία της Φυσικής με ιδιοκατασκευές και πειράματα με απλά μέσα. Πρόταση εφαρμογής για το δημοτικό σχολείο*. PhD Thesis. Athens: School of Primary Education. Faculty of Education, University of Athens. Bakali, V., & Koumaras, P. (1999), Πειράματα στο σπίτι με χρησιμοποίηση υλικών καθημερινής χρήσης. *Ανοιχτό Σχολείο*, vol.66, p.p.5-10, vol.67, p.p.5-9.

- Students are responsible for their observations and conclusions (depending on age, labwork and circumstances).

4. Presenting the EAST model: Experiment Analysis of Science Textbooks

Bringing forward the various dimensions of the role of experiment presented in science textbooks has been both challenging and demanding. Thorough comparative study of a selection of Greek science textbooks written in different time periods initially helped to point out and combine the three dimensions and their sub-categories of the EAST model (Figure 1).

4.1. The presentation of the experiment

The presentation of the experiment in the science textbook is the first dimension of the EAST model. The way an experiment is presented is crucial, reflects the perspective of the writers of the textbook, encourages the teacher towards certain teaching practices and characterizes the science language used in order to communicate with learners. The presentation of the experiment may be characterized as: theoretical, descriptive, analytical, feedback oriented, illustrated and/or explanatory.

4.1a. Theoretical presentation

In a theoretical presentation of an experiment, the narrative of the events and procedures of the experiment is purely theoretical without a structured experiment appearing. The theoretical background of the experiment in this case seems more important than the experiment itself. A verbal description prevails without visual support (total lack of images, diagrams etc.).

4.1b. Descriptive presentation

A thorough description of the experiment from the beginning till the end and its conclusion is presented. All the steps of the experimental procedure are clearly described, as well as the instruments, materials and apparatus used.

4.1c. Analytical presentation

An analytical and detailed presentation of the experiment gives step after step the experimental sequence coupled with images, picture and or diagrams. All the necessary actions follow one another helping the performer of the experiment to carry it out in a studious and focused way.

Figure 1: EAST model: Experiment Analysis of Science Textbooks

1.presentation	1a. theoretical 1b. descriptive 1c. analytical 1d. feedback oriented 1e. illustrated 1f. explanatory
2.action	2a. zero 2b. hypothetical 2c. direct 2d. homework 2e. pupil as scientist 2f. performer (teacher/pupil) 2g. number of performers (individual/ <u>groupwork</u>) 2h. materials (everyday/lab) 2i. safety rules required
3.role	3a. introductory 3b. inductive 3c. deductive 3d. proving 3e. utilitarian 3f. demonstrating 3g. historical

4.1d. Feedback oriented presentation

In this case, one or more questions play a key-role in the description of the experiment. Questions appear in order to check the understanding and appreciation of the experiment up to this point by the performer. Nevertheless, key-questions contribute to the encouragement of cognitive and meta-cognitive skills, aiming to a meaningful performance of the experiment going beyond a step by step algorithmic execution.

4.1e. Illustrated presentation

The description of the experiment is accompanied by one or more figures that support both the representation and the understanding of the experimental procedure. Illustrations offer a strong visual input, motivating the performer and offering the visual information concerning the instruments, materials and apparatus, the phases of the experiment and sometimes show children or young people carrying out the experiment. Illustrations appear in a variety of forms such as sketches, images, photographs, cartoons, clip art, diagrams, tables and figures.

4.1f. Explanatory presentation

The experimental procedure is presented followed by the necessary explanations and interpretations using the theoretical background of the experiment. The description of the experiment appears more complete as the analytical guidelines for carrying it out are supported by a thorough theoretical interpretation of the

outcome of the experiment, offering a bridge between experiment and theory.

4.2. Actions for carrying out the experiment

The way to carry out the experiment emerges from the actions encouraged and motivated by the text, the phrases and the characteristics of the verbs in the sentences. For example, the phrase “if we take” makes a hypothesis concerning the action while the phrase “let’s take” gives a direct order to actually perform the action.

4.2a. Zero action for carrying out the experiment

In this case, simple experiments are presented without any whatsoever encouragement or motivation to perform the experiment and with no explanatory illustration. The description of the experiment carries only basic information in passive voice, such as “a conductor is used”.

4.2b. Hypothetical action in carrying out the experiment

An analytical description of the experiment is coupled with a hypothetical motivation of the reader to carry out the experiment (e.g. if we use the conductor). Usually the verbs appear in first plural present tense (e.g. we take). In textbooks of the 19th and early 20th century this hypothetical action is frequently used as an indirect motivation to perform an experiment.

4.2c. Direct action in carrying out the experiment

A direct motivation for immediate action in order to perform the experiment is clearly stated by the verbal description of the experiment. Verbs appear in the first or second person in the imperative or the indicative mood, e.g. “we take”, “let’s take” or “take”, and a direct action is implied.

4.2d. Homework concerning the experiment

Experiments are asked to be performed by the pupil at home as homework and in most cases with everyday materials. In the textbooks these experiments are titled as “homework”, “exercise” or “carry out the following experiment”.

4.2e. The pupil as a scientist

Experiments put the pupil in the position of the scientist asking him to: a) make

a hypothesis, b) carry out the experiment, c) observe and keep records, d) write down a conclusion²⁴.

4.2f. Performers of the experiment

In the description of the experiment, either the teacher or the pupil(s) are asked to carry out the experiment.

4.2f1. The teacher as performer

The teacher is performing the experiments that have a demonstrative character and/or are supposed to be of high risk.

4.2f2. The pupil(s) as performer(s)

Experiments are carried out by the pupil(s) recording his/her (their) observations that are related to the evolution and outcomes of the experiment. When pupils carry out experiments their “technical” skills are encouraged such as using instruments and materials, following guidelines and instructions, becoming familiar with science terminology etc. Nevertheless, when pupils participate in lab work their interest and motivation to learn science, to carry out a task, to make objective observations and to think in a creative and comparative way is raised²⁵.

4.2g. Number of performers

In the description of the experiment individual action or group-work is indicated.

4.2g1. Individual action

Individual action contributes to development of hands skills, but also in the understanding of phenomena, when the performer of the experiment knows the goals and content of the procedure.

4.2g2. Group work

The group work in carrying out the experiment contributes to the development of the co-operation and the social skills.

24 Kokkotas, P., & Vlachos, J. (1999), Ο ρόλος του πειράματος στην επιστήμη και στη διδασκαλία-μάθηση. *Εκπαιδευτικές προσεγγίσεις*, vol.5, p.p.13-26.

25 Kokkotas, P., & Vlachos, J. (1999), Ο ρόλος του πειράματος στην επιστήμη και στη διδασκαλία-μάθηση. *Εκπαιδευτικές προσεγγίσεις*, vol.5, p.p.13-26.

4.2h. Materials

Materials indicated to be used can be either formal laboratory materials (test tubes, electroscopes etc.) or everyday materials.

4.2h1. Everyday materials

Every day materials are preferable in the primary education science as those materials are characterized by advantages both for teachers and pupils. Everyday materials are familiar to the pupils and safe. Experiments are simple to perform (do not involve complicated apparatus) and in most cases successful. Pupils focus on the phenomena while their attention is not distracted by unfamiliar scientific instruments. The experiment is demystified and less time consuming. Experiments with everyday materials help pupils coming from lower socio-economic groups and/or with low performances in science courses to participate and succeed in science tasks. While teachers' and pupils' attitudes towards science are encouraged by experiments with everyday materials²⁶.

4.2h2. Lab materials

Laboratory instruments, materials and apparatus are used in some experiments in order pupils to get accustomed to formal laboratory work.

4.2i. Safety rules required

Safety rules appear in certain high risk experiments in order to avoid accidents. In many cases experiments with safety rules are asked to be performed by the teacher as demonstration experiments. Sometimes safety rules are required also for homework experiments with everyday materials.

4.3. The role of the experiment

The role of the experiment has to do with the position of the experiment in the text related to the theory or the conclusions. For example, in the beginning of a

²⁶ Hodson, D. Prophet, R. (1983), Why the science curriculum changes – evolution or social control? *School Science Review*, Sept. 83, p.p.5-18. Karanikas, G. (1993), Ο σχεδιασμός, η υλοποίηση και ο πειραματισμός με κατασκευές που κάνουν οι ίδιοι οι μαθητές μέσο για τη διδασκαλία των Φυσικών Επιστημών. *Εκπαιδευτική Κοινότητα*, vol.24, p.p.21-23. Chalkia, K. (1993), Τι είδους επιστημονικές δραστηριότητες και τι είδους «εργαστήριο» Φυσικών Επιστημών χρειάζονται τα παιδιά του Δημοτικού Σχολείου. *Παιδαγωγική Επιθεώρηση*, vol.18, p.p.31-38. Savvas, S. (1996), *Το ερευνητικό εξελισσόμενο μοντέλο στη διδασκαλία της Φυσικής με ιδιοκατασκευές και πειράματα με απλά μέσα. Πρόταση εφαρμογής για το δημοτικό σχολείο. PhD Thesis*. Athens: School of Primary Education. Faculty of Education, University of Athens. Bakali, V., & Koumaras, P. (1999), Πειράματα στο σπίτι με χρησιμοποίηση υλικών καθημερινής χρήσης. *Ανοιχτό Σχολείο*, vol.66, p.p.5-10, vol.67, p.p.5-9.

lesson is introductory, before conclusions and driving to them is inductive, after the theory usually deductive etc.

4.3a. Introductory

Simple experiments or observations from everyday life are placed usually before the theory presented.

4.3b. Inductive

This type of experiment is used to prove the theory, driving to the conclusions. From these experiments results the appropriate theory in the text. Inductive experiments encourage inductive ways of thinking fulfilling a big range of teaching aims such as cognitive, social, emotional etc.²⁷. Inductivists consider that a series of data may lead to a science law or principle followed by a generalization. Therefore, valid scientific knowledge is based on experience, while an active discrimination between theory and scientific facts based on observation and experiment exists. Inductive methodology is more preferable for primary education and is always present in science textbooks for the primary school²⁸.

4.3c. Deductive

This kind of experiment appears as implementation of theory that has already been presented previously in the text. Deductive experiments present detailed reasoning and explanations (intend to prove or demonstrate an experimental proof). A historical review shows that lab work mostly aim to the verification of theory previously taught in the theoretical courses²⁹, while the procedure and the expected results of the experiments are included in science textbooks³⁰.

4.3d. Proving

This experiment is used to prove the theory that has already been presented

27 Schmidkunz, H. (1986). Problemlösung im Unterricht, dargestellt am Beispiel der Naturwissenschaften. In Twellmann, W.(Hrsg.). *Handbuch Schule und Unterricht, Band 8.1.* (s. 426-437). Dusseldorf: Schwann.

28 Koulaïdis, V (2001), Εμπειρικο-επαγωγική εικόνα της επιστημονικής γνώσης. Η παράδοση της κοινής αντίληψης. Στο: Κουλαϊδής, Β. (επιμ.) *Διδακτική των Φυσικών Επιστημών*, vol. Α', (p.p. 279-294). Patras: H.O.U. Paraskevas, P. (2004), Η επαγωγική και η υποθετικο-παραγωγική επιστημονική μέθοδος στα σχολικά εγχειρίδια φυσικών επιστημών και ο ρόλος του πειράματος. *Διδασκαλία των Φυσικών Επιστημών. Έρευνα και πράξη*. vol.8-9, p.p.49-52.

29 Lock, R. (1988), A history of practical work in school science and its assessment., 1860-1986. *School Science Review*, vol.70, p.p.115-119.

30 Lazarowitz, R. & Tamir, P. (1994), Research on using laboratory instruction in science. In: Gabel, D. (Ed), *Handbook of research on science teaching and learning* (p.p. 94-128). New York: Simon & Schuster Macmillan.

previously in the text and they usually include an explanation³¹.

4.3e. Utilitarian

These experiments attempt to connect science knowledge with implementations of this knowledge in everyday life. Experiments verify the usefulness of scientific theories and explain everyday phenomena and procedures from a scientific point of view. Therefore, utilitarian experiments attempt to bridge science and society having a strong nature of science input.

4.3f. Demonstrating

The experiment is used for the demonstration of a phenomenon e.g. communicating vessels. The goal or target of this kind of experiment is the reconstruction of a phenomenon through a sequence of planned or scheduled actions or steps. In this case, the experiment is performed either by the teacher or by the pupil(s) usually in the beginning of a lesson in order to provoke pupils' interest. Demonstrating experiments motivate discussion and reasoning that push further the elaboration of the teaching content³². These experiments are considered necessary when there are either high risks for accidents (e.g. certain chemical experiments) or difficulties in handling the apparatus.

4.3g. Historical

Historical experiments are often described in science textbooks. For their presentation, sometimes a reconstruction of the historical instruments and apparatus is needed.

5. Study and analysis of science textbooks based on the EAST model: The evolution of the didactical role of experiment

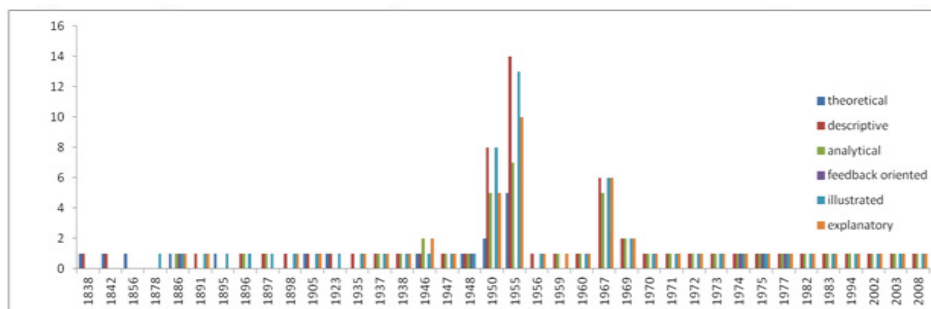
The EAST model presented above has been used to analyze physics and chemistry textbooks for Greek primary schools from 1838 until 2008, that is, since the foundation of the modern Greek state. The science textbooks study and analysis led to the classification of the experiments (included within each textbook) to several subcategories according to the EAST model. Moreover, the results of

31 Lock, R. (1988), A history of practical work in school science and its assessment., 1860-1986. *School Science Review*, vol.70, p.p.115-119. Lazarowitz, R. & Tamir, P. (1994), Research on using laboratory instruction in science. In: Gabel, D. (Ed), *Handbook of research on science teaching and learning* (p.p. 94-128). New York: Simon & Schuster Macmillan.

32 Kokkotas, P., & Vlachos, J. (1999), Ο ρόλος του πειράματος στην επιστήμη και στη διδασκαλία-μάθηση. *Εκπαιδευτικές προσεγγίσεις*, vol.5, p.p.13-26.

the analysis have been elaborated in order to lead to an overall representation using graphs and identifying the evolution of the didactical role of experiment in science textbooks.

Figure 2: The presentation of the experiment in Greek Science textbooks (Excel 97-2003)



At this point, we should note that experiments described in the analyzed textbooks may belong to more than one subcategories of the same category. An experiment, for instance, may belong to the “presentation category” and also more specifically to the subcategories “descriptive” and “illustrated”. We continue by presenting a graph for every subcategory of our classification followed by comments on the results of the analysis.

5.1. The presentation of the experiment

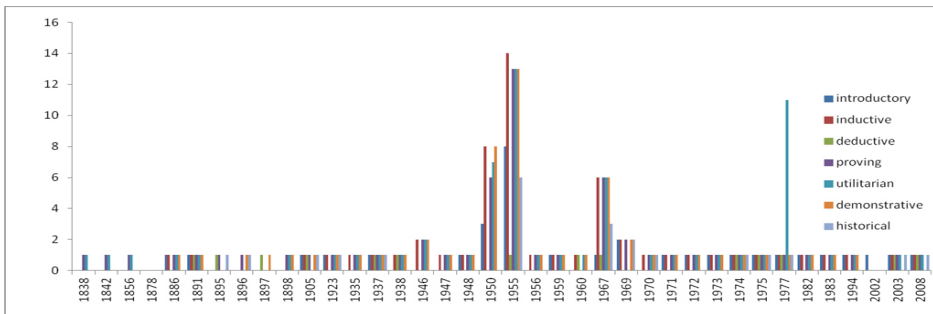
As far as the presentation category is concerned, we observe that the theoretical presentation appeared in the first (chronologically speaking) textbook in 1838 and it continued until 1955. The descriptive presentation began in 1838 and continued until the 2008 textbook which is used to this day. The analytical presentation started in 1886 and continues till the latest publication of relevant textbook. The feedback oriented presentation emerged in 1886 textbook and then in another four textbooks (1948, 1974, 1975, 1977). The illustrated presentation started in 1878 and keeps on until today. Furthermore, the explanatory presentation also started in 1886 and is still on. In 1955 we notice an important volume of publications by various houses following the free market competition and the absence of state monopoly on textbooks (Figure 2).

5.2. Actions for carrying out the experiment

Referring to the action category, the zero action subcategory can be seen from

1838 to 1955. The hypothetical action appears from 1838 to 1967. Direct action lasts from 1886 until today. Homework action experiments started in 1950 and appear until today with some gaps. The pupil as scientist action emerged in 1974 and is still on. The teacher as performer started in 1886 and continues until today. The pupil as performer emerged in 1950 and still goes on.

Figure 3: Actions for carrying out the experiment in Greek science textbooks (Excel 97-2003)

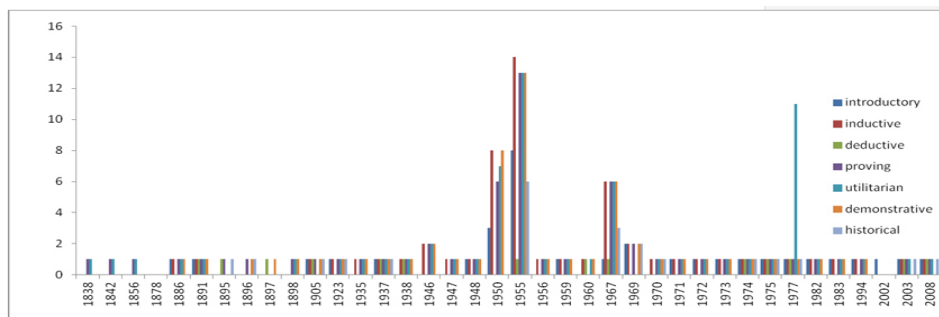


As for the “number of performers” subcategory, the individual action started in 1838. Group work introduced in 1974 is still popular and gaining space. Experiments with everyday materials set out in 1838 and continue to this day, but not in all textbooks studied. Lab work lasted from 1938 till 1994 with gaps occurring in 1975 and 1977. The safety rules were introduced in 2002 (Figure 3).

5.3. The role of the experiment

Experiments with an introductory role began in 1886 and continue up to now but with certain gaps. Experiments with an inductive role started in 1886 and continued till today, also with certain gaps. The deductive role was first introduced in 1891 and is observed to this day, but with several gaps. Experiments carrying a proving role also started in 1838 and are still on. The utilitarian role also began in 1838 together with the other approaches mentioned earlier and is used until today, but with some gaps. The demonstrative role begins in 1886 and is still observed, constituting an important element of every science textbook. The historical role started in 1895 and is observed in contemporary textbooks, but with quite a few gaps (Figure 4).

Figure 4: The role of the experiment in Greek science textbooks (Excel 97-2003)



The first textbook was published in 1838. After 1882 Greek textbooks were formed by translated parts of foreign textbooks, had a small number of pages and no illustration, and included only theoretical experiments with zero action. Kokkonis was the author of the first science textbook. Kokkonis was an important state official on education matters and was mostly engaged with educational policy, management and co-ordination³³.

During a period of state controlling interference in educational matters (1883-1895) four new textbooks were published (1886, 1891, 1894, 1895). In those years the direct performance of experiment appeared, accompanied by its inductive role, while the term “experimental science” was used for the first time.

From 1895 till 1916 only reading books were defined as the official textbooks. All the rest were called “support” textbooks and focused on implementing the knowledge taught in the classroom³⁴. A milestone in Greek textbooks was the 952/1937 state law concerning the establishment of the state textbook publishing organization.

Since 1981 a new law³⁵ came to redefine as textbooks all state textbooks for all courses used by students in primary and secondary education according to current curricula. For the first time, a series of state teachers’ guides supporting the state textbooks were published fostering teaching approaches for the classroom.

33 Tzikas, J. (1999), *Ι.Π. Κοκκόνης, ο ρόλος του στη θεμελίωση και τα πρώτα βήματα της δημοτικής εκπαίδευσης στην Ελλάδα*. Athens: Gutenberg-G.& K. Dardanos.

34 Charalambous, D. (2007), *Μεταπολεμική και μεταπολιτευτική εκπαιδευτική πολιτική: από την ασυνέχεια στη συνέχεια*, στο: Δημ. Φ. Χαραλάμπους (επιμ.): *Μεταπολίτευση και Εκπαιδευτική Πολιτική, Post-war and post-political educational policy: From discontinuity to continuity*. (p.p.69-70). Athens: Hellenic Letters.

35 State Law 1566/1985 “*Δομή και λειτουργία της πρωτοβάθμιας και δευτεροβάθμιας εκπαίδευσης*” Άρθρο 10 Σχολικά εγχειρίδια.

6. Final considerations

It has been found that initially the presentation of the experiment was theoretical and the action hypothetical. Later on, we came to experiments with analytical description, careful and precise illustration, encouraging mostly group work action, without excluding the individual student / teacher action. Moreover, experiments as homework, with safety rules and mainly with everyday materials are commonly used.

Primary school science textbooks appeared right after the foundation of the New Greek State and the beginning of primary education in Greece, although these textbooks were not detailed and without any illustrations, however they became better in content and layout gradually in time.

As far as experiments are concerned, it is important to note that even from the very first one in 1838 many experiments were included. The forms and types of experiments vary between the editions of school textbooks that followed, so in order to classify them and observe their evolution, the EAST model has been created and applied as presented in this paper.

From the initial theoretical presentation of the experiment and its hypothetical performance, to the current detailed description and illustration, group work, hands-on homework, with explicit safety rules, a long way has been covered.

The EAST model has successfully contributed for pointing out several options of the experiment in science textbooks for a long period of time. Further research could provide us with fruitful feedback concerning a) the study of science textbooks during a specific period of remarkable scientific and educational importance, and b) quantitative analysis of experiments in certain textbooks on target research sequences.

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Development of a short questionnaire to measure teacher's overall job satisfaction

Abstract

The present study describes the construction and validation in the Greek population of a short instrument for measuring the overall job satisfaction of secondary and high school teachers. Based on a literature review, a five-item, unidimensional questionnaire (TOJS) was constructed. The five items were: job satisfaction overall; satisfaction with current employment; meeting initial expectations; inclination to leave the profession; willingness to choose the same profession again. A sample of 114 secondary and high school teachers from different geographical areas of Greece replied to the questionnaire. Statistical analysis confirmed the unidimensionality of the TOJS and its very satisfactory internal consistency (Cronbach's alpha = 0.87) and other psychometric properties. Consequently, the TOJS provides a reliable, simple and easy-to-use instrument for measuring overall job satisfaction among secondary and high school teachers.

Keywords: overall job satisfaction, teachers, questionnaire, validity, reliability.

1. Introduction

Education at every level aims to develop pupils' mental and physical abilities in order for them to develop into integrated personalities and to live creatively. The teacher is the key factor in achieving these goals¹. The teacher's fundamental role in education has led to extensive research in order to highlight those elements that lead to effective education and effective schools, with the concept of job satisfaction being one of them².

Job satisfaction is associated with a number of factors such as the teacher's performance, the quality of their teaching and its impact on students (in terms of performance, behaviour and satisfaction), the teacher's commitment to the organization and the profession³, the levels of burnout⁴, and the quality of his or her life in general^{5,6,7,8,9,10,11}. In addition, many factors can influence a teacher's job satisfaction, including characteristics of the work environment and the teacher's personality^{12;13;14;15}.

1 Government Gazette (30th of September 1985). First Issue, Document Number 167, Law 1566/1985, article 1, par.1. Retrieved from http://www.pi-schools.gr/preschool_education/nomothesia/1566_85.pdf (accessed on 15/10/2017).

2 Zigarreli, M. A. (1996). An empirical test of conclusions from effective schools research. *The Journal of Educational Research*, 90(2), p.p.103-10.

3 Lease, H. S. (1998). Annual Review, 1993-1997: Work attitudes and outcomes. *Journal of Vocational Behaviour*, 53(2), p.p.154-183

4 Koustelios, A., & Tsigilis, N. (2005). The relationship between burnout and job satisfaction among physical education teachers: a multivariate approach. *European Physical Education Review*, 11(2), p.p. 189-203

5 Travers, C., & Cooper, C. (1996). *Teachers under pressure: Stress in the teaching profession*. London: Routledge

6 Zournatzi, E., Tsigilis, N., Koustelios, A., & Pintzopoulou, E. (2006). Job satisfaction of physical education teachers in primary and secondary education. *Dioikisi Athlitismou & Anapsychis*, 3(2), p.p.18-28

7 Somech, A., & Drach-Zahavy, A. (2000). Understanding extra-role behaviour in schools: the relationships between job satisfaction, sense of efficacy, and teachers' extra-role behaviour. *Teaching and Teacher Education*, 16, p.p.649-659.

8 Michaelowa, K., & Wittmann, E. (2002). *Teacher job satisfaction, student achievement and the cost of primary education*. HWWA Discussion Paper 188, Hamburg: Hamburg Institute of International Economics

9 Alsiewi, M. A., & Agil, S. O. (2014). Factors that influence Affective Commitment to teaching in Libya. *IOSR Journal of Business and Management*, 16(2), p.p.37-46

10 Baron, R. A. (1986). *Behaviour in Organizations*. Newton, MA: Allyn and Bacon

11 Boardman, R. M. (1985). *The relationship between life satisfaction and job satisfaction among teachers in four Midwestern states*. (Doctoral dissertation). Retrieved from <http://digitalcommons.unl.edu/dissertations/A18602923> (accessed on 10/09/2017)

12 Perie, M., Baker, D. P., & Whiterner, S. (1997). *Job satisfaction among America's teachers: effects of workplace conditions, background characteristics, and teacher compensation*. Washington, DC: National Centre for Education Statistics. Retrieved from <http://nces.ed.gov/pubs97/97471.pdf> (accessed on 25/08/2017).

13 Koustelios, D. A. (2001). Personal characteristics and job satisfaction of Greek teachers. *International Journal of Educational Management*, 15(7), p.p.354-358

14 Dinham, S., & Scott, C. (2000). Moving into the third, outer domain of teacher satisfaction. *Journal of Educational Administration*, 38(4), p.p.379-396

15 Ayan, S., & Kocacik, F. (2010). The relation between the level of job satisfaction and types of personality in high school teachers. *Australian Journal of Teacher Education*, 35(1), p.p. 27-41

2. Theoretical framework

2.1. Clarification of the definitions

Three main theoretical frameworks aiming to define job satisfaction can be identified^{16,17}: content theories, process or discrepancy theories and situational models of job satisfaction. According to content theories, job satisfaction is the extent to which the individual's needs are satisfied and their values are fulfilled; Maslow's hierarchy of needs¹⁸ and Herzberg's two-factor theory^{19,20,21} are the most characteristic examples of content theories. According to the former, needs follow a hierarchy and the lower level ones must be met first in order for the higher level needs to be satisfied. In the two-factor theory, satisfaction is the result of external factors that prevent dissatisfaction (hygiene factors) and of endogenous factors (motivators) that drive individuals to increase their performance. Discrepancy theories regard job satisfaction as the degree to which a job meets the expectations or values of the individual; they include concepts such as justice, equity, expectations, work-related rewards, and emotional orientations of individuals towards the roles they occupy^{22,23,24}. Situational models of job satisfaction combine job and personality characteristics as a way of achieving job satisfaction^{25,26}.

Job satisfaction has been measured as an overall as well as a facet-specific concept. The measurement of overall job satisfaction resembles the measurement of life satisfaction. Even though the facet approach to measuring job satisfaction can provide much more information on specific influential factors^{27,28}, it is still not as informative as an overall summary measure because

16 Thompson, D. P., McNamara, J. F., & Hoyle, J. R. (1997). Job satisfaction in educational organizations: A synthesis of research findings. *Educational Administration Quarterly*, 33(1), p.p.7-37

17 Maslow, A. (1954). *Motivation and Personality*. New York: Harper and Row

18 Maslow, A. (1954). *Motivation and Personality*. New York: Harper and Row

19 Locke, E. (1969). What is job satisfaction? *Organizational Behaviour and Human Performance*, 4, p.p. 309-36.

20 Herzberg, F., Mausner, B., & Snyderman, B. B. (1959). *The Motivation to Work (2nd ed.)*. New York: John Wiley.

21 Stello, C. M. (2011). *Herzberg's two-factor theory of job satisfaction: An integrative literature review*. Unpublished paper presented at the 2011 Student Research Conference: Exploring Opportunities in Research, Policy and Practice, University of Minnesota, Department of Organizational Leadership, Policy and Development, Minneapolis, MN. Retrieved from <http://www.cehd.umn.edu/olpd/research/studentconf/2011/stelloherzberg.pdf>, (accessed on 14/09/2017).

22 Gruneberg, M. M. (1979). *Understanding job satisfaction*. Thetford, Norfolk, Great Britain: Lowe and Brydone Printers, Ltd.

23 Adams, J. S. (1963). Towards an Understanding of Inequality. *Journal of Abnormal and Normal Social Psychology*, 67, 422-436

24 Vroom, V. H. (1982). *Work and motivation (Rev. ed.)*. Malabar, FL: Robert E. Krieger.

25 Glisson, C., & Durick, M. (1988). Predictors of job satisfaction and organizational commitment in human service organizations. *Administrative Science Quarterly*, 33(1), p.p. 61-81.

26 Quarstein, V. A., McAfee, R. B., & Glassman, M. (1992). The situational occurrences theory of job satisfaction. *Human Relations*, 45, p.p. 859-873.

27 Tsigilis, N., Koustelios, A., & Togia, A. (2004). Multivariate relationship and discriminant validity between job satisfaction and burnout. *Journal of Managerial Psychology*, 19(7), p.p. 666-675.

28 Koustelios, A., & Kousteliou, I. (2001). Job satisfaction and burn out in education. *Psychologia*, 1, p.p. 30-39.

different factors may have varying weights for different teachers²⁹.

2.2. Aim of the Research

Extensive research on job satisfaction has led to a variety of questionnaires in both the Greek and international literatures measuring overall or facet job satisfaction with good psychometric properties^{30;31;32;33;34;35}. However, these are rather lengthy questionnaires, which is not ideal if they are to be used alongside other instruments in a research study. A standardized short questionnaire measuring overall job satisfaction is lacking from the Greek bibliography, other than the single question “how satisfied you are with your job?” The aim of this study is the design of such a short questionnaire and its validation in the Greek population.

2.3. Hypotheses of the Research

The main hypothesis of the study was:

The short unidimensional TOJS questionnaire provides a valid and reliable way of measuring overall job satisfaction.

The secondary hypotheses of the study were:

- a) Overall job satisfaction differs according to teachers’ demographic characteristics, including age, gender, marital status, having children and education.
- b) Overall job satisfaction differs according to teachers’ job characteristics, including years of teaching experience and type of contract.
- c) Overall job satisfaction differs according to schools’ demographic characteristics, including school level, school type and school location.

29 Skaalvik, E. M., & Skaalvik, S. (2009). Does school context matter? Relations with teacher burnout and job satisfaction. *Teaching and Teacher Education: An International Journal of Research and Studies*, 25(3), p.p. 518-524.

30 Travers, C., & Cooper, C. (1996). *Teachers under pressure: Stress in the teaching profession*. London: Routledge.

31 Koustelios, A., & Bagiatis, K. (1997). The employee satisfaction inventory (ESI): development of a scale to measure satisfaction of Greek employees. *Educational and Psychological measurement*, 57, p.p. 469-476.

32 Ho, L. C., & Au, W.-T. (2006). Teaching Satisfaction Scale: Measuring job satisfaction of teachers. *Educational and Psychological Measurement*, 6, p.p. 172-185.

33 Gkolia, A. & Koustelios, A. (2014). Development of a questionnaire for measuring teachers’ job satisfaction (Teacher’s satisfaction inventory – (TSI)). *Episthmes Agogis*, 2-3, p.p. 195-214.

34 Lester, P. E. (1987). Development and factor analysis of the Teacher Job Satisfaction Questionnaire (TJSQ). *Educational and Psychological Measurement*, 47(1), p.p. 223-233.

35 Balzer, W. K., Kihm, J. A., Smith, C., P., Irwin, J. L., Bachiochi, P. D., . . . Parra, L. F. (1997). *User’s manual for the Job Descriptive Index (JDI; 1997 Revision) and the Job in General (JIG) Scales*. Bowling Green, OH: Bowling Green State University.

3. Methodology

3.1. Questionnaires

Demographic characteristics questionnaire

This questionnaire includes items covering the respondent's demographic characteristics (gender, age, marital status, number of children) as well as job characteristics (years of professional experience, managerial experience, type of school, working hours, training).

Teacher's Satisfaction Inventory (TSI)

The Teacher's Satisfaction Inventory (TSI) consists of 20 items measuring secondary and high school teachers' job satisfaction, forming five factors (school director, colleagues, students, working conditions, work nature)³⁶. Items are answered on a 5-point Likert scale (from 1= completely agree, to 5= completely disagree). The questionnaire, which was originally developed in Greek, is standardised and is up-to-date in that it reflects the current socioeconomic conditions of the country.

Stress Questionnaire, Section 4: your job satisfaction

The Stress Questionnaire of Travers & Cooper measures stress in teaching and includes six factors, one of which measures job satisfaction³⁷. This consists of 15 items covering working conditions, freedom at work, salary, relationships with colleagues and with the director, etc. Answers are given on 7-point Likert scales (from 1= extremely dissatisfied, to 7= extremely satisfied). The questionnaire has been translated and used in Greece³⁸.

Teacher's Overall Job Satisfaction (TOJS)

The Teacher's Overall Job Satisfaction (TOJS) questionnaire was constructed especially for the current study in order to provide a brief measure of overall

36 Gkolia, A. & Koustelios, A. (2014). Development of a questionnaire for measuring teachers' job satisfaction (Teacher's satisfaction inventory – (TSI)). *Episthmes Agogis*, 2-3, p.p. 195-214.

37 Travers, C., & Cooper, C. (1996). *Teachers under pressure: Stress in the teaching profession*. London: Routledge.

38 Petrii, S. (2007). *Survey on the impact of internal and external factors on job satisfaction of employees of private companies* (Unpublished postgraduate diploma thesis). Retrieved from: <http://pandemos.panteion.gr/index.php?op=record&type=0&q=%CE%A0%CE%B5%CF%84%CF%81%CE%AF%CE%BB%CE%B7&page=1&scope=0&lang=el&pid=iid:524>, (accessed on 13/09/2017).

job satisfaction. Initially, a review of the Greek and international literature was performed to identify existing instruments^{39;40;41;42;43;44;45}. Instruments in English were translated and independently back-translated by English language teachers. The initial instrument following the literature review consisted of 12 questions covering different concepts or the same concepts using different phraseology. The initial version of the questionnaire was piloted in a sample of ten secondary school teachers (three Greek literature teachers, two English literature teachers, two ICT teachers and three mathematicians) in order to examine its content validity. Piloting of the questionnaire led to the following five-item instrument: 1) Taking everything into account, how much do you enjoy being a teacher? 2) To what degree are you satisfied with your current job? 3) To what degree does working as a teacher meet your initial expectations? 4) If you could choose your profession again from the beginning, would you become a teacher? 5) Have you ever thought of quitting teaching? The first four questions were taken from an existing instrument for measuring overall job satisfaction⁴⁶. The first question is common to almost all the available instruments, but the fifth appears in only two of the instruments referred to above. Answers are given on 5-point Likert scales. The overall job satisfaction measure is the total score of the five items, with higher values showing greater satisfaction.

3.2. Sampling

The questionnaires were distributed to a sample of secondary and high school teachers from various regions of Greece – specifically, the prefectures of Attika,

39 Perie, M., Baker, D. P., & Whiterner, S. (1997). *Job satisfaction among America's teachers: effects of workplace conditions, background characteristics, and teacher compensation*. Washington, DC: National Centre for Education Statistics. Retrieved from <http://nces.ed.gov/pubs97/97471.pdf>, (accessed on 25/08/2017).

40 Skaalvik, E. M., & Skaalvik, S. (2009). Does school context matter? Relations with teacher burnout and job satisfaction. *Teaching and Teacher Education: An International Journal of Research and Studies*, 25(3), p.p. 518-524.

41 Menlo, A., & Poppleton, P. (1990). A five country study of the work perceptions of secondary school teachers in England, the United States, Japan, Singapore and West Germany (1986-88). *Comparative Education*, 26(2-3), p.p. 173-182.

42 Ho, L. C., & Au, W.-T. (2006). Teaching Satisfaction Scale: Measuring job satisfaction of teachers. *Educational and Psychological Measurement*, 6, p.p. 172-185.

43 Clark, A. (2005). What makes a good job? Evidence from OECD Countries. In S. Bazen, C. Lucifora, & W. Salverda (Eds.), *Job Quality and Employer Behaviour*. London: Palgrave Macmillan.

44 Ong, B. P. (1997). *Organizational climate and teachers job satisfaction in residential and non-residential school*. Master thesis. Retrieved from <http://www.geocities.ws/CollegePark/Classroom/2188/>, (accessed on 22/08/2017).

45 Survey of Health, Ageing and Retirement in Europe. (2006). Questionnaire.Wave 2.Release version: 6.0.0. SHARE-ERIC. Retrieved from http://www.share-project.org/t3/share/fileadmin/pdf_questionnaire_wave_2/country_specific_questionnaire/Greece/GR_Share_w2_Questionnaire.pdf, (accessed on 08/07/2017).

46 Menlo, A., & Poppleton, P. (1990). A five country study of the work perceptions of secondary school teachers in England, the United States, Japan, Singapore and West Germany (1986-88). *Comparative Education*, 26(2-3), p.p. 173-182.

Thessaloniki, Rodopi, Xanthi, Pieria, Dodekanisa, Chania and Viotia. Initially, the questionnaires were sent electronically to “key” teachers in each school in the sample, who then distributed the questionnaires either electronically using an online template or in a printed version. Completed printed questionnaires were returned by post to the researcher. Questionnaires were anonymous. The survey was carried out at the end of the school year (June 2016).

3.3. Statistical analysis

Descriptive analysis of the sample was performed using mean \pm SDs or median and quartiles for normally and non-normally distributed continuous variables, respectively, and percentages for the categorical variables. T-tests and one-way ANOVA were used for comparing mean values of continuous normally distributed variables across different categories. Chi-squared tests were used for comparing percentages. Reliability of the TOJS was assessed using Cronbach's alpha coefficient of internal consistency and Raykov's reliability coefficient^{47;48}. Spearman's correlation coefficient was used in order to measure concurrent and convergent validity of the TOJS. Discriminant validity of the TOJS was estimated by comparing mean scores between different categories of demographic variables. Principal components analysis using Varimax rotation was performed in order to check the unidimensionality of the TOJS. The number of factors to be extracted was based on the Kaiser criterion (eigenvalue>1), scree plot and total variance explained by the factors. Items with loadings <0.45 were excluded from the analysis. Results were considered significant for $p<0.05$ ($\alpha=5\%$) in two-tailed tests. Statistical analysis was carried out using SPSS.

4. Results

4.1. Demographic characteristics

Demographic characteristics of the sample are shown in Table 1. A total of 114 teachers replied to the questionnaire, the majority being women (67.5%), with no statistically significant differences in gender distribution between secondary and high schools ($\chi^2=0.06$, $p=0.83$). The mean age of the sample was 47 ± 8 years, with only 20% of the teachers being under 40 years old. Over 70% were married and three quarters had children. Almost one third of the sample held either a master's degree ($n=30$) or a PhD ($n=3$). The median number of years in the educational profession

47 MacDougall, M. (2011). Moving beyond the nuts and bolts of score reliability in medical education: some valuable lessons from measurement theory. *Advances and Applications in Statistical Sciences*, 6(7), p.p. 643-664.

48 Raykov, T. (1998). Coefficient alpha and composite reliability with interrelated nonhomogeneous items. *Applied Psychological Measurement*, 22(4), p.p. 375-385.

was 15 (interquartile range=11). Most of the teachers were tenured, occupied an established post in a school in an urban area, and resided near the school with no need to commute daily. More than half of the teachers in the sample were teaching in general secondary schools (56%), followed by 35% in general or vocational high schools, while the remaining teachers were appointed in special education (6%) or other specific types of schools (multicultural, religion or “second chance” secondary schools). Science teachers (mathematics, physics and chemistry) accounted for 25% of the sample, followed by Greek language and foreign language teachers (21.4% and 13.4%, respectively; not shown in table). The majority of the teachers were sampled from schools from the prefectures of Thessaloniki, Attika, Pieria and Rodopi (32.1%, 29.2%, 12.3% and 10.4%, respectively).

Table 1: Demographic characteristics of the sample (n=114)

	Mean ±SD	n	%
Age	47 ± 8		
Gender			
Male		37	32.5
Female		77	67.5
Marital status			
Single		20	17.9
Married/ In a relationship		80	71.4
Divorced/Separated		9	8.0
Widowed		3	9.7
Children (% yes)		76	76.8
Education			
Technological education/ post high school training		13	11.5
University		67	59.3
MSc/ PhD		33	29.2
Years of teaching experience	15 (11-22) [^]		
Fixed position at a school (% yes)		92	81.4
Permanent position in education (% yes)		106	93.0
Living away from permanent place of residence (% yes)		20	17.9
Commuting to work daily (% yes)		21	18.6
School level			
Secondary		71*	64.5
High school		39	35.5
School type			

General	80	72.7
Vocational	19	17.3
Special	7	6.4
Other	4	3.6
School location		
Urban centre	91	88.3
Rural/semi-urban centre	12	11.7
School prefecture		
Eastern Macedonia and Thrace	17	16.0
Central Macedonia	47	44.3
Attica	31	29.2
Central Greece/Thessaly	5	4.7
North/ South Aegean	6	5.7

^Median (Q1-Q3), *Out of the 71 secondary schools, 2 (one general and one multicultural)

4.2. Factor analysis

Mean scores of the individual TOJS questions are shown in Table 2. Question 3 (initial expectations) had the lowest mean (lowest satisfaction) and question 4 (choose teaching again) the highest. Correlations between questions varied from 0.45 to 0.74, with the lowest correlations appearing between question 5 (quitting teaching) and the remaining questions. In factor analysis, every item had communality greater than 0.50, showing that the variation of the variables was satisfactorily explained by the factor analysis. Only one factor had eigenvalue greater than 1, explaining 66% of the total variation. Item loadings on this factor were all higher than 0.70.

Table 2: Description and factor analysis of the TOJS

	Mean ±	SD	Communalities	Loading
Taking all factors into account, how much do you enjoy being a teacher?	3.90 ±	.93	0.70	0.86
To what extent are you satisfied with your current job?	3.73 ±	.93	0.74	0.85
To what extent does working as a teacher meet your initial expectations?	3.42 ±	1.11	0.72	0.85
If you could choose your profession again from the beginning, would you become a teacher?	4.12 ±	1.08	0.63	0.80
Have you ever thought of quitting teaching?	3.96 ±	.98	0.51	0.71

Reliability

Cronbach's alpha was 0.87, showing very high internal consistency of the TOJS. The Raykov coefficient was also high (0.87) confirming the reliability of the questionnaire (Table 3). Correlations of individual TOJS items with its total score varied from 0.73 ("Have you ever thought of quitting teaching?") to 0.84 ("To what extent does working as a teacher meet your initial expectations?"). Cronbach's alpha did not increase upon removing items one by one from the scales, showing that all items should remain.

Convergent and concurrent validity

Concurrent validity of the TOJS was assessed using the Stress Questionnaire of Travers & Cooper. Correlations between overall means of the Stress Questionnaire and the TOJS as well as between individual items of both questionnaires were calculated. The total scores on the two scales showed moderate correlation (Spearman's correlation coefficient $r=0.62$). Correlations between the total TOJS score and individual items of the Stress Questionnaire varied from low to moderate, from 0.14 (job security) to 0.51 (the amount of responsibility you were given). The TOJS items "If you could choose your profession again from the beginning, would you become a teacher?" and "Have you ever thought of quitting teaching?" had the lowest correlations with the items of the Stress Questionnaire.

Convergent validity of the TOJS was assessed using the TSI questionnaire. Correlations between the TOJS total score and the total and factor-specific TSI scores were moderate to low, except between the TSI factor "the job itself" and the total TOJS score which showed a satisfactory level ($r=0.70$). Correlations between the TOJS and individual TSI items were also moderate.

Table 3: Convergent and concurrent validity of the TOJS

Internal consistency (Cronbach's alpha)	0.87
Internal reliability (Raykov's reliability coefficient)	0.87
Concurrent validity (Travers & Cooper)	0.62
The physical working conditions	0.37
The freedom to choose your own method of working	0.43
Your fellow teachers	0.36
The recognition you get for good work	0.41
Your immediate boss	0.48
The amount of responsibilities you were given	0.51

Your rate of pay	0.38
The opportunity to use your abilities	0.49
Industrial relations between management and teachers in your school	0.38
Your chance of promotion	0.30
The way your school is managed	0.38
The attention paid to suggestions you make	0.46
Your hours of work	0.40
The amount of variety in your job	0.47
Job security	0.15
Convergent validity (TSI)	0.56
Immediate supervisor	0.44
Colleagues	0.34
Job itself	0.70
Students	0.37
Working conditions	0.21

Discriminant validity of the TOJS

There were no statistically significant differences between mean TOJS scores in relation to any of the demographic characteristics of the sample, with the exception of marital status and having children: married teachers and teachers with children appeared to be more satisfied compared to their colleagues (Table 4). In addition, teachers aged over 50 years had higher satisfaction levels than those aged under 40, although this difference was not statistically significant (p -value=0.08). Multiple regression analysis relating the TOJS score to all characteristics confirmed that only marital status was statistically significant..

Table 4: TOJS scores in relation to demographic characteristics

	Mean \pm SD	p- value*
Total TOJS score	19.1 \pm 4.1	
Gender		
Male	19.6 \pm 4.0	0.36
Female	18.9 \pm 4.1	
Age		
<40	17.9 \pm 4.3	0.08
40-50	18.8 \pm 3.7	
>50	20.2 \pm 4.3	
Marital status		

Single	16.9 ± 4.4	
Married/ In a relationship	20.1 ± 3.3	0.002
Divorced/Separated/Widowed	17.8 ± 5.9	
Children		
Yes	19.7 ± 3.8	
No	17.6 ± 4.1	0.03
Education		
Technological education/ post-high school training	18.8 ± 5.8	
University	19.9 ± 3.6	0.11
MSc/ PhD	18.1 ± 4.0	
Years of teaching experience		
<10	19.1 ± 3.5	
10-20	18.8 ± 4.0	0.67
20+	19.7 ± 4.8	
School level		
Secondary	19.0 ± 4.3	
High school	19.5 ± 3.8	0.59
School type		
General	19.0 ± 4.1	
Vocational	19.9 ± 3.8	0.58
Special	19.7 ± 4.5	
Established post in a school		
Yes	19.4 ± 4.0	
No	18.1 ± 4.6	0.20
Type of contract		
Permanent	19.2 ± 4.0	
Temporary	18.3 ± 5.3	0.53
Living away from permanent place of residence		
Yes	18.3 ± 3.8	
No	19.4 ± 4.1	0.26
Commuting to work daily		
Yes	18.7 ± 4.1	
No	19.2 ± 4.1	0.62
School location		
Urban centre	19.5 ± 4.0	
Rural/semi-urban centre	18.8 ± 3.5	0.57

* From independent samples t test or one-way ANOVA

5. Discussion

The aim of the current study was to design and standardise in the Greek population a short and easy-to-use questionnaire for measuring overall job satisfaction. Short questionnaires can be very useful. They have less response burden, thus helping

to improving response rates in surveys, and thus they can easily be combined with other questionnaires in research projects with a variety of research hypotheses.

This study was conducted in a sample of 114 secondary and high school teachers of Greece. The majority of the sample was female, reflecting the actual gender distribution of teachers especially in secondary education (ISCED 2 level), where only one third of the teachers are male⁴⁹. Most of the teachers had many years of teaching experience, held a permanent contract and were serving in urban areas. In other words, most of them had already finished with the initial period of continuous transfers in the Greek educational system and had returned to their usual place of residence, having been appointed to an established position in a nearby school.

The current study resulted in the creation of a five-item scale that measures overall job satisfaction. It showed good psychometric properties. Internal consistency was high, while factor analysis confirmed its one-dimensional nature. Convergent and concurrent validity were moderate. This may be due to a number of factors. Firstly, the tools used to measure validity are not normally used for the calculation of a total score. In addition, these tools measure multidimensional satisfaction with the profession, which cannot be expected to function as well as a measure of overall job satisfaction, because different teachers may weigh the factors differently⁵⁰. Multidimensional measurement of job satisfaction covers both endogenous (e.g. nature of work) and exogenous (e.g. the Principal or colleagues) factors whereas, in one-dimensional measurements, a more general and more endogenous approach is usually measured. That is reflected in our data, where the highest correlation occurred between the TOJS and “the job itself” factor of the TSI. In addition, the Stress Questionnaire of Travers & Cooper includes dimensions such as salary and opportunities for promotion that are quite stable or are not applicable to the Greek reality and are therefore not considered to affect professional satisfaction⁵¹. Finally, the majority of the sample of this study was permanent teachers, with guaranteed job security, so again the security dimension cannot be used to measure job satisfaction.

Discriminant validity of QOJS showed that married people with children are generally more satisfied with the teaching profession. These results are in accordance with the results from other studies in the Greek population^{52,53}. In addition, age is positively associated with job satisfaction, even though the

49 European Commission/EACEA/Eyridice. (2015). *The Teaching Profession in Europe: Practices, Perceptions, and Policies*. Eurydice Report. Luxembourg: Publication Office of the European Union.

50 Skaalvik, E. M., & Skaalvik, S. (2009). Does school context matter? Relations with teacher burnout and job satisfaction. *Teaching and Teacher Education: An International Journal of Research and Studies*, 25(3), p.p. 518-524.

51 Gkolia, A. & Koustelios, A. (2014). Development of a questionnaire for measuring teachers' job satisfaction (Teacher's satisfaction inventory – (TSI)). *Episthmes Agogis*, 2-3, p.p. 195-214.

52 Kantas, A. (1992), Job satisfaction of teachers in secondary education. *Nea Paideia*, p.p. 30-43.

53 Tarasiadou, A., & Platsidou, M. (2009). Job satisfaction of kindergarten teachers: individual differences and predictors. *Episthmes Agogis*, 4, p.p. 141-154.

association was at the borderline of statistical significance. The magnitude of this association, though, might be affected by the age distribution of the current sample, in which the mean age was 47 years with only 20% of the sample being less than 40 years old. The positive association between age and job satisfaction might reflect better working conditions, such as permanent contracts, serving at schools near the place of residence, and holding a permanent position in a specific school.

This research is subject to a number of limitations. It was carried out in a convenience sample (as is often the case with scale construction and testing), which consisted mainly of permanent teachers serving in urban areas with many years of teaching experience. Due to this structure of the sample, it was not possible to study the differences in levels of job satisfaction according to certain work characteristics such as the type of contract (permanent or not) or being subject to continuous transfers, factors which may well be related to dissatisfaction with the profession. A second limitation has to do with the current economic situation in Greece at the time of the study. The present research showed relatively high levels of job satisfaction, with the questions related to willingness to quit or the possibility of choosing again the teaching profession showing the highest satisfaction. Other studies have also shown similarly high job satisfaction levels^{54,55}, but the effect of the economic crisis on the level of job satisfaction is not clear. The crisis limits job opportunities which can affect job satisfaction either positively (holding a stable job)⁵⁶ or negatively (lack of motivation, inadequate resources, low life satisfaction in general)^{57,58}. In addition, it is possible for a person to remain in a current job despite dissatisfaction, due to lack of alternatives⁵⁹.

In conclusion, the TOJS revealed good psychometric properties and constitutes a particularly useful instrument for measuring overall job satisfaction in relation to other factors because of its short and easy-to-use structure. As is true of any instrument, further research covering a wider range of circumstances is desirable in order to establish its validity thoroughly.

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