Εκπαίδευση, Δια Βίου Μάθηση, Έρευνα και Τεχνολογική Ανάπτυξη, Καινοτομία και Οικονομία

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The collaboration of schools with international organizations and the example of Central Greece and the IEEE Teacher in Service Program

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The collaboration of schools with international organizations and the example of Central Greece and the IEEE Teacher in Service Program

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Περίληψη

Τα πρώτα έξι χρόνια της βασικής εκπαίδευσης είναι πολύ σημαντικά για να μπουν τα θεμέλια για την μάθηση των Φυσικών Επιστημών (Science), της Τεχνολογίας (Technology), της Μηχανικής (Engineering) και των Μαθηματικών (Mathematics) (STEM) Όσο πιο σταθερά είναι αυτά τα θεμέλια, τόσο μεγαλύτερες είναι οι πιθανότητες να προτιμήσουν οι μαθητές αντίστοιχες σχολές Τριτοβάθμιας Εκπαίδευσης και καριέρες. Οι εκπαιδευτικοί πρέπει να εκπαιδευτούν ώστε να συμπεριλάβουν την εκπαίδευση STEM στη διδασκαλία τους. Ο στόχος του Institute of Electrical and Electronics Engineers IEEE Teacher in service Program TISP είναι να φέρει σε επαφή και να εξοικειώσει τους εκπαιδευτικούς με την εκπαίδευση STEM. Γι' αυτό το σκοπό οργανώνει βιωματικά εργαστήρια STEM. Ένα τέτοιο εργαστήριο διεξήχθη στη Λαμία και σε αυτό συμμετείχαν 75 εκπαιδευτικοί. Στο τέλος δόθηκε στους συμμετέχοντες ένα ερωτηματολόγιο σχετικά με τις απόψεις τους για το εργαστήριο στο οποίο συμμετείχαν. Η απάντηση των εκπαιδευτικών ήταν θετική και προέκυψαν ενδιαφέροντα συμπεράσματα.

Λέξεις κλειδιά: Εκπαίδευση STEM, Επαγγελματική Εξέλιξη Εκπαιδευτικών, Εργαστήριο STEM.

Abstract

The first six years of school education for young students are very important in order for the foundations of learning Science, Technology, Engineering and Mathematics (STEM) to be set. The stronger these foundations are, the larger are the chances that the students will pursue University-education fields and careers within these subjects. Teachers have to be trained to import STEM Education in their teaching strategies. The aim of the Institute of Electrical and Electronics Engineers IEEE Teacher in service Program TISP is to present and familiarize teachers with STEM Education and it conducts hands-on STEM workshops for this reason. One such workshop involving 75 Primary School teachers took place in Lamia, Greece. At the end of the workshop the teachers were given a questionnaire requesting their reflections on the workshop. The response of the teachers was positive and there came out some interesting conclusions.

Keywords: Science, Technology, Engineering and Mathematics (STEM) Education, Teacher Professional Development, STEM Workshop, Teacher-In-Service Program**.**

1. Introduction

In this paper the procedure of IEEE TISP Program is described. This program was presented in 75 teachers in Lamia. After completing their task, each teacher was given a questionnaire involving their overall impression of the workshop. These questionnaires were then analyzed and there came out some conclusions.

IEEE is the world's largest technical professional organization for the advancement of technology (www.ieee.org, 07/2018). Among others, IEEE offers a wide range of learning opportunities within the engineering sciences, research, and other technology areas. TISP functions essentially as a professional development workshop aimed at helping teachers bring exciting hands-on engineering STEM lessons into their classrooms. Once trained, IEEE volunteers can connect with pre-university schools in their local communities to deliver the hands-on program (http://sites.ieee.org/greece-tisp/what-is-tisp/, 07/2018).

According to (Avery & Reeve, 2016), the teaching of science, technology, engineering, and mathematics (STEM) has become a priority in Primary and Secondary education today. As the need for students to become stronger in STEM grows, so does the need for well-qualified STEM teachers who understand what is needed to develop relevant and high-quality STEM programs (Avery & Reeve, 2016). Teachers, especially the ones with many years' working experience are feeling stressed and reluctant in adopting new pedagogical methods in their teaching. Professional Development Programs in STEM Education can help them integrate new instructional approaches at their Science lessons and feel more confident about themselves when they do so (Stohlmann et al.,2012)

A study among 111 Greek Primary and Secondary school teachers showed that 76,6% of them believe that professional development programs on STEM are important (Dragogiannis, 2017). Teachers' need for continuing education in order to enhance their preparation to teach STEM is accompanied by the need to investigate the effectiveness of these continuing education offerings (Nadelson et al., 2013). In this study we investigate the effectiveness of the professional development workshop we conducted to the participating Primary Education Teachers.

2. Main Body

In the following paragraphs we present what happened at the STEM seminar, describe the STEM workshop, present the questionnaire and analyze it.

2.1. The TISP Workshop

The workshop took place during an one-day seminar on "STEM in Primary Education". It was organized by the school counselor of the 1st school district of Fthiotida and was hosted by the 11th Primary school of Lamia. It took place during a school day and the participating teachers were exempted from their school duties at that day. The teachers were general Primary school ones and the ones teaching the specialty subjects i.e. ICT, music, foreign languages and physical education. In the first part of the seminar there were given some talks and presentations about the didactics of physics in primary school, what is STEM Education and some European Programs about STEM. Then, the IEEE was presented by the Vice-President of the Greece-section and TISP by the head of the IEEE Student-branch of the University of Thessaly, Lamia. Then, the teachers were divided in 6 groups, according to the grade they were currently teaching. Each group participated in a different workshop except from the ones of 5th and 6th grade who did the same workshop.

Table 1: Conducted workshops

TISP Workshops	
Teachers currently teaching (Grade)	***Workshop***
1st	The Boat and the Beatle
2nd	The Tall Tower Challenge
3rd	Build a Big Wheel
4th	Take a flight
5th	Robot Arm
6th	Robot Arm

The workshops attended by the teachers are listed in Table 1. The specialty teachers could choose which workshop they would attend. Around 20 teachers participated in each group. They were divided in sub-groups of 4-5 teachers each. When they had completed the workshop, they were given a questionnaire about how they experienced the workshop they had attended. In the end of the

seminar, all the constructions made at the workshops were gathered in the main hall and presented by their creators. Then, a half-hour conversation and conclusions took place.

2.2. The Questionnaire

The number or the received questionnaires was 75. However, 5 of them were either not fully or inappropriately completed. Thus, they were not included in the survey. IBM SPSS was used for the analysis of the answers.

The first two questions are personal. We want to see if the answering person is a full-time teacher or a school principal. In the second question we want to see if the person is a primary teacher or a specialty teacher.

The following pie-chart (Figure 1) shows the analogy between the general education teachers and the specialties' teachers that participated at the workshops (93% general education teachers and 7% specialties' teachers).

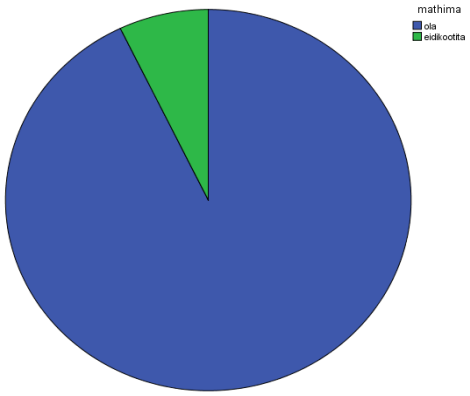

Figure 1: Analogy between General Education and Specialties' teachers

In the following pie-chart (Figure 2), the analogy of the full-time teachers as opposed to the school principals, who teach approximately 1/3 of the full-time teachers' hours and mostly non-STEM lessons (6% is the percentage of the principals as opposed to 94% of full-time teachers).

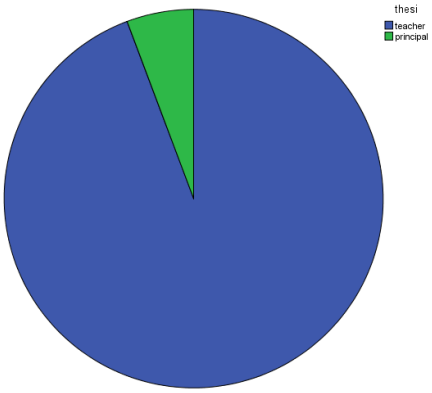

Figure 2: Pie-chart of full-time vs specialties' teachers

The first two personal questions are followed by another 5 about the teachers' reflections on this workshop.

The possible answers to these questions are the above:

1: Strongly Agree, 2: Agree, 3: Disagree, 4: Strongly Disagree

In the following figure (Fig.3) the pie chart of the question “Has the current program upgraded my technical knowledge?” is presented

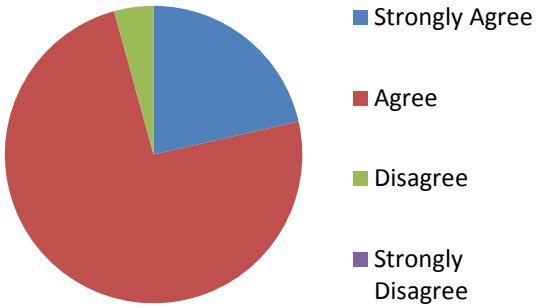

Figure 3: Upgrade of teachers' technological knowledge

13 teachers (19%) strongly agreed, 55 teachers (78%) agreed and 2 teachers (3%) disagreed.

In the following figure (Figure 4) the pie chart of the question “I intend to use the concepts I have learned today in the educational process in my class the next semester” is presented.

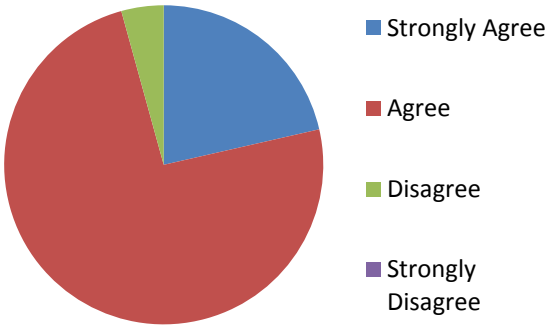

Figure 4: Use of the learned concepts

15 teachers (21%) strongly agreed, 52 teachers (75%) agreed and 3 teachers (4%) disagreed regarding their intention to use the acquired concepts in the educational process in their class the next semester.

In the following figure (Figure 5) the pie chart of the question “The practical activities presented today will increase the level of technological education of my students” is presented.

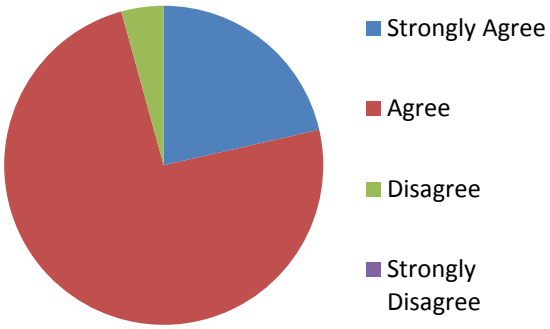

Figure 5: Increase of students' technological education

16 teachers (23%) strongly agreed, 52 teachers (74%) agreed and 2 teachers (3%) disagreed that the presented practical activities will increase the level of technological education of their students.

In the following figure (Fig. 6) the pie chart of the question "The practical activities helped me understand the topics under discussion" is presented.

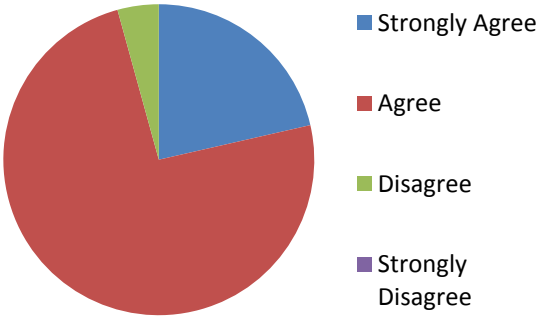

Figure 6: Understanding of the topics

15 teachers (21%) strongly agreed, 53 teachers (76%) agreed and 2 teachers (3%) disagreed that the practical activities helped them understand the discussed topics

In the following figure (Fig. 7) the pie chart of the question "The current program helped me increase my level of technological education" is presented.

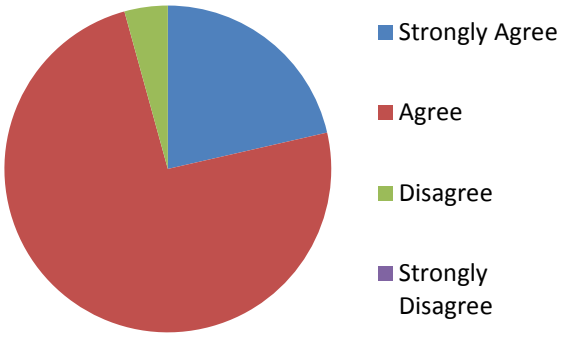

Figure 7: Increased level of teachers' technological education

15 teachers (21%) strongly agreed, 52 teachers (75%) agreed and 3 teachers (4%) disagreed that the current program helped them increase their level of technological education.

Finaly, there is a last optional question where the teachers can mention other subjects they would like to learn. This was answered only by 5 teachers. Two of them mentioned more workshops containing maths and science, one answered more workshops containing maths and science with the use of ICT, one asked for robotics and the last one requested workshops about the use of ICT in teaching music.

It is worth mentioning that all the participating school principals stated that they agreed in all the questions. The ones that stated that they disagree in some questions are primary teachers and not specialties' ones.

2.3. Reliability of the Research

IBM SPSS was used in order to examine the reliability of the questionnaire used. The following table (Table 2) shows that the value of Cronbach's alpha equals to 0,871 which means that the reliability of the questionnaire is high. In other words, based on the reliability analysis that took place, the questions included in the questionnaire measure consistently the teachers' satisfaction of the participating workshop

Table 2: Reliability statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
,871	5

Then, we need to check if there are statistically significant correlations between the initial columns. For this purpose, the Bartlett test is applied

$H_0 : R = I$ (inappropriate data) against the alternative case

$H_1 : R \neq I$ (appropriate data).

The summarized results can be seen in the following table (Table 3).

Table 3: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,755
Bartlett's Test of Sphericity	Approx. Chi-Square	193,903
	df	10
	Sig.	,000

Since the p-value equals to 0.000 <0.05, we reject the zero hypothesis and we conclude at a 5% significance level that the data is suitable for applying Factor Analysis, since the zero hypothesis of no correlation between the initial questions was not accepted.

Table 4 lists the correlation coefficients among the 5 questions.

Correlation Matrix						
		tech_knowledge	usability	tech_knowl_pupils	understanding	tech_education
Correlation	tech_knowledge	1,000	,489	,338	,428	,534
	usability	,489	1,000	,745	,641	,478
	tech_knowl_pupils	,338	,745	1,000	,766	,605
	understanding	,428	,641	,766	1,000	,696
	tech_education	,534	,478	,605	,696	1,000

2.4. Discussion

Teachers feel the need for professional development, in order to meet the needs of teaching today's students. It has become clear that traditional teaching methods are not successful with 21st century students, who are exposed to technology in a great degree.

Future research can focus on the development of curricula materials and instructional models for STEM integration, connections between teacher education programs for integration and teachers' subsequent classroom teaching practices, and also ways in which teachers view STEM integration (Stohlmann et al., 2012).

The results of a follow-up questionnaire at the same teachers 1 and 2 years after the workshop would be of great value. Then we could have a general overview of the way this workshop have changed their teaching strategies and to what extent students have met the learning goals.

There is a common belief that in order for Primary School teachers to be considered successful, they have to be very familiar with science subjects and to think of themselves as valued gainers and users of knowledge. This cannot be achieved during their basic studies. Therefore, professional development is important and should be offered in various occasions.

The role of the school administrators should be taken into consideration. The designers of the STEM Professional Development programs for teachers should create opportunities and roles for school administrators to increase their familiarity with STEM Education and involve them.(Al Salami et al., 2017).

3. Conclusions

At this paper, the overall impression of 70 teachers participating in an IEEE TISP workshop was examined. According to their answers in a given questionnaire, their overall impression was very good. An overwhelming majority of them stated that this program helped them increase their level

of technological education and will increase the one of their students. The practical activities helped them understand the subjects under discussion, upgraded their technical knowledge and they will definitely use the topics that they learned during the workshop in their teaching practices.

It would be interesting if there was a follow-up with these teachers the next school year. We could examine whether they imported STEM education in their teaching strategies or not. Do they stick with the answers they gave after the workshop or have they changed their views and why. This would be a good way to improve the teachers' workshops or the way STEM Education is presented to them.

Working with the Directorate of Primary Education in the Fthiotida Prefecture, the same workshop could be offered in all Primary Education teachers that work in schools of the Prefecture. Then we could have a more general view of the impacts of this workshop.

References

Al Salami, M. K., Makela, C. J., & De Miranda, M. A. (2017). Assessing changes in teachers' attitudes toward interdisciplinary STEM teaching. *International Journal of Technology and Design Education*, *27*(1), 63–88.

Avery, Z. K., & Reeve, E. M. (2013). Developing effective STEM professional development programs. *Journal of Technology Education*, *25*(1), 55–69.

Nadelson, L. S., Callahan, J., Pyke, P., Hay, A., Dance, M., & Pfiester, J. (2013). Teacher STEM perception and preparation: Inquiry-based STEM professional development for elementary teachers. *The Journal of Educational Research*, *106*(2), 157–168.

Stohlmann, M., Moore, T. J., & Roehrig, G. H. (2012). Considerations for teaching integrated STEM education. *Journal of Pre-College Engineering Education Research*, *2*(1), 4.

The world's lergest technical professional organisation (2018). Ανακτήθηκε από https://www.ieee.org/

TISP Trainning Workshop (2018). Ανακτήθηκε από http://sites.ieee.org/greece-tisp/what-is-tisp/.

Δραγογιάννης, Κ. (2017). *Παράγοντες επιτυχίας της εκπαίδευσης STEM*. (Doctoral dissertation).