Train the Robotic Trainers methodology

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Abstract: *This work reflects the importance of a methodology for robotic train the trainer's education program, through the aspects of teaching pedagogy, technology and the basic principles of robotics. To achieve this, a methodology is included that contains a sequence of educational processes and applications focused on modern training techniques. Learners are invited to attend a theoretical background of the program for two days (first weekend) with traditional training methods, and then for four weeks using e-learning techniques they study the material, interact with the teacher and submit their work for evaluation. Afterwards in the second weekend, the training is completed and the trainees are closing the program with a micro teaching example. Upon completion of the program, each trainee completes a short questionnaire from which his / her motivation to participate and his / her satisfaction from his / her participation arise. In the course of the survey, 85 trainees participated, and from the questionnaire's work, the overwhelming majority is very satisfied, which highlights this methodology and determines it to be fully operational, reliable and efficient.*

Keywords: *Robotics, Train the Trainers*

JEL Classification: *I20, I21*

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1 INTRODUCTION

In recent years, a new teaching subject, robotics, has involved in our lives. This innovative subject created the need for training in this field both in the field of robotics and in the basic pedagogical and educational principles of people who are called upon to support the role of the instructor – trainer. The robotics trainers' training is focused on learning the basic robotics pedagogy principles, acquiring skills and cultivating the three-way philosophy of knowledge, skills and attitudes associated with the added value of using robotics through online technology in education. The technocratic dimension is important as trainers need to be trained in the use of e-learning systems as well as in software systems for the creation of learning materials related to the teaching of the robotics cognitive object. At the same time it is considered necessary to train the trainers in pedagogical and didactic robotics so that they can create activities that are tailored to the needs of learners. Is required a training on issues related to basic principles of design and management of eLearning activities and processes such as classroom management, assessment, virtual classroom creation, and the modification of learning objects.

In particular, after completing the training program, trainees are able to explain the main principles of robotics, to show the robotics capabilities and technology in general, to support educational activities, to design robotic training programs by exploiting and to organizing and managing learning objects using modern e-learning techniques. In addition, they are able to use the capabilities provided by electronic classroom

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management environments, to implement asynchronous robotics training programs, to coordinate and tutoring learners attending asynchronous robotics programs and to evaluate their participation and performance to them.

2 STATE OF THE ART

As it is clear from the international literature, is considered more effective when teachers' professional development is designed based on their training needs, (Duncombe & Armour, 2004) especially when teachers are involved in the process of planning, building and implementing their training ((National Foundation for the Improvement of Education, 1996). Kapsalis and Papastamatis (2000) define five stages of planning a training programs. Specifically, the first stage concerns the evaluation of the existing situation, the investigation and recording of the training needs of the target group, the analysis of important data and problems. In the second stage, are defined the general educational goal and the individual objectives of the program. The selection of the contents and the layout of the program follows. The fourth stage is the design of teaching strategies and the selection of training methods and practices. At the final stage, the project is being built and implemented. Educational robotics, as a pedagogical approach, is part of classical constructivism and constructionist in particular, as developed by Papert (1991). The theory of constructivism argues that students build new concepts and ideas based on their pre-existing knowledge and through their active participation and engagement in authentic activities. Constructivism argues that people build their knowledge better when they are actively involved in the design and construction (manual and digital) of real meaningful meanings for themselves or others around them.
The methodology of designing activities to be followed in the context of educational robotics is based on the problem-based learning method since it involves activities involving the creation and proper handling of an engineering construction to fulfill a mission. For the action of students in the elaboration of a work with pre-grafted robotic constructions, according to the suggestions of Papanicolau, Frangou &Alimisis (2007), a series of separate but mutually interconnected steps are proposed:

- Importation,
- Experimentation,
- Investigation,
- Composition and Creation,
- Evaluation.

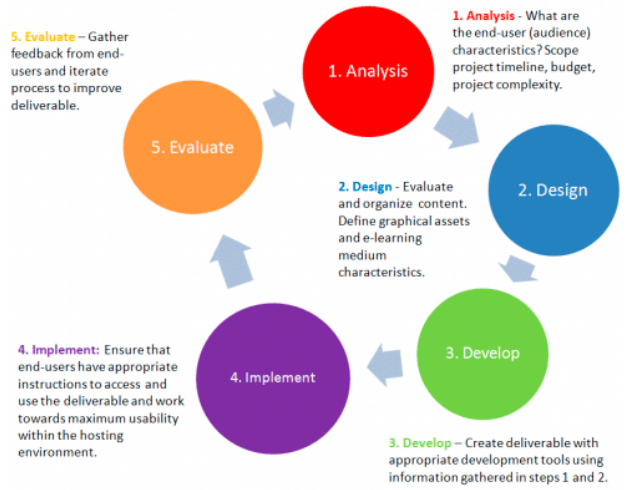
This model contributes to shaping an environment that promotes autonomous learning, mutual support for class members, free expression and creation.
Malliara, Bakamitsos, Tsitsos & Arradavi (2009) present a teaching proposal that attempts the pedagogical exploitation of educational robotics in the form of an interdisciplinary synthesis work in the context of Secondary Education. The work is part of an environmental education program on waste recycling and is aimed at students who have basic computer skills but have no prior experience in educational robotics. Students construct and plan the simulation of a recyclable waste sorter using Lego kit material. Vounatsos, Mega & Stamatidou (2009) suggest interdisciplinary robotics in secondary education. In this activity, students build Lego's building material with a catapult and schedule their movement and shots with the help of appropriate software. In the individual phases of the course, cognitive goals are covered in the subject of Technology and Informatics while at the same time skills and posts are cultivated. In order for this activity to become meaningful to the learners, as well as a playful character, basketball was chosen as its central theme and deals with the natural concepts of everyday life, such as the concepts of the shot, the range, the initial velocity, height and angle of firing.
Eleftherioti, Karatrantou & Panagiotakopoulos (2010) present a pilot effort to exploit the Lego Mindstorms NXT robotic training package in teaching programming in a cross-thematic context. The students worked together to design, construct and, above all, plan a vehicle so that it responds to light signals (lanterns) mimicking the reality. Delie (2011) in her diploma thesis proposes a new teaching approach to teaching mathematics and computer science with the help of the educational robotics system Lego Mindstorms. The application concerns the teaching of the unity of the Mathematics of the Gymnasium in the course "Cartesian Coordinate System" and the Informatics of the Gymnasium in the concept of transposition. Pedradaki & Abla (2011) have developed a series of exercises and user manuals based on the Educational Robotic Platform known as Lego Mindstorms NXT II through a cooperative and playful role-playing approach with alternating roles. Research in the context of educational robotics has given special emphasis to linking the discovery of new technologies with the development of new learning methods, in the light of new ideas of pedagogy leading to new technologies but also to the reverse. Since the late 1960s, research has turned on the development of robotic kits that kids will love (ideally they will already have a first contact with some of them) and the programming environment will be friendly and easy to understand. The goal is for students to develop the educational path on their own and to be the authors themselves, rather than just the users themselves (Martin F., 2000).

3 TRAINING METHODOLOGY

Design models and methodologies include a sequence of educational processes, a set of steps, tasks and specifications, the effective implementation of which leads to the development of a training program (Sork & Buskey, 1986). Although there are a of design models and methodologies, depending on the type of training programs, they all share common elements, referring to purpose, content, methods and evaluation, and propose specific steps that need to be followed for effective planning.
The specific methodology proposed in this research is a systematic approach to the management of educational programs and is therefore also applied to knowledge subjects of a particular technological nature. It consists of 5 phases, 1) Analysis, 2) Design, 3) Development, 4) Implementation and 5) Evaluation. In addition, it is important to provide feedback from one phase to the next so that each phase is effectively

coordinated and integrated as an individual process of learning management.

Figure 1
Basic steps of Instructional Design (Shaikh H., 2017).



The analysis phase of educational needs is a needs assessment that is conducted when a learning lack has been identified. Needs assessment requires systematic recognition of solutions to performance problems. It defines the direction and the outline of education based on the needs created by the lack of education. The main objective of the training need analysis is to provide the necessary information for the design of educational programs, as it can provide useful data for decisions related to the content of the program, the way of teaching, the method and the techniques. This process is an essential step in defining the objectives of a program, as well as identifying areas where should be spent more effort (Kapsalis and Papastamatis, 2000).

The design phase aims to convert relevant content into concise behavioral goals, creating the educational plan that will direct the development of all the educational tools, techniques and methods. The training requirements and the identified results during the analysis of the first phase are reflected as goals and objectives. Then, other design elements, such as teaching strategies, media choices, types of training materials, and assessment methods are considered. The development phase transforms design decisions into educational materials. In particular, taking into account the objectives, the educational approach and the media options from the design phase, it produces training materials for the trainer, course materials for the trainee and assessment tools. The implementation phase focuses on the details of education. Specialized arrangements, such as planning a training area, preparing a daily lesson, defining the training environment and even implementing the presentation, ensure that a training session is held to assess the interest of the trainees.

Finally, the purpose of the evaluation is to ensure that education, as designed and developed, achieves the initial training objectives. Then, taking into account the strengths and weaknesses of education, future re-iterations are decided and, if necessary, the design and development phase is reviewed. Besides, the evaluation ensures that training improves performance. The ISD methodology includes two types of evaluation: formative and concise. In summary, the stages of training production are: analysis, planning, development, implementation and evaluation. The advantages of the ISD approach that apply to a wide range of educational and training needs are simplicity, reliability, customization and implementation. The ISD methodology has lasted to the test of time and continues today to exert a strong influence on modern education.

4 IMPLEMENTATION OF METHODOLOGY IN ROBOTICS AREA

The charm of robotics lies in the ability of trainees to build an object (eg a car) and then steer it "smartly", taking into account environmental parameters (which are constantly changing) and processed by a program that they trainees will build through a manageable programming environment. The role of the teacher is very important, since he has to inspire, organize and direct the whole process. Unfortunately, most of the time, the teacher does not have the appropriate training, but also the appropriate support (laboratory, computers, robotics kit, course plans etc.) (Aliimis, 2009). Taking into account this lack of training, a program based on the basic ISD methodology has been designed. It consists of the five phases mentioned above, analysis, design, development, implementation and evaluation and concerns potential robotics trainers.

The aim of the project is to gain experience on the widespread use of New Technologies in the development of educational and training work in the field of educational activities related to technology and in particular robotics and exploitation accordingly. Among the specific objectives of the program is, upon completion, that each teacher involved has designed and produced a supporting teaching material for robotics teaching, tailored to the needs and dates of specific age groups. To achieve this, a hybrid training combination is used that combines traditional approach and e-learning techniques. The success of a hybrid type of education program lies, among other things, in the pedagogical and didactic followed approach. The absence of a physical presence of trainers and trainees in the same space during the presentation of a thematic module in e-learning must be taken seriously into account during the design phase of the learning material and during the course in which the course is in progress (Lampsas, 2000).

The methodology described in this paper is based on the basic principles of adult education. Specifically, an educational program has been designed that combines modern techniques with proven pedagogical methodologies. This integrated type of training, as teaching methodology, is based of the advantages of traditional education combining them with the benefits of the use of new technologies, particularly using e-learning techniques. Trainees attend a two-day seminar for the theoretical required background and then for 4 weeks they use e-learning techniques for studying through the specially designed platform the required material. Through the platform the trainees may watch the necessary lectures and interact in real time (synchronous e-learning) or in non-real time (asynchronous e-learning) with the instructor. There they also submit the assigned tasks to them. Then, there is a

second weekend of live training where the trainees analyze the work they have done and prepare the micro-lessons required for the successful completion of the process.
As far as the Social Networking and Cooperative Learning Platform is used, it is based on Free Software / Open Software (EL / LAC) and is structured with user-centered (teacher, student) focus on personal learning styles and gives the ability to have an active role and control in the learning process. Specifically, it supports: • informal collaborative learning • Social networking with other members • adaptation to the needs of individual users and learning environments, and includes the ability to: • Public micro blogging (twitter) • Creating a personal page for each user • Personal blogs • Web bookmarking (social bookmarking) • automatically creating and publishing a video • Creating Social Networking Groups • Smart tagging system.
At the end of the second meeting is also given an evaluation questionnaire for the program where the results of the educational process and the impressions of the trainees are recorded. Two weeks after the second meeting, the trainees complete the program deliverables, which are evaluated in order to certify the successful completion of the program. The program has been applied so far to 85 trainees who completed a short evaluation questionnaire that was given to them. At the beginning of the questionnaire, a brief reference is made to the nature of the survey and to the responsible organization that supports it, as well as information confidentiality issues, as well as completion instructions. The structure of the questionnaire consists of two modules, the first of which refers to the general data of the trainees and the second on their motivation to participate in the training program and the satisfaction of participating in it.
In the questions concerning to the general data of the trainees, it was considered appropriate to ask for the gender, age and years of their total education at school, since they are decisive for the results of the research, thus defining the independent variables of the research. The questions of the second section are listed below and form part of a balanced survey of satisfaction with participation in educational programs based on bibliography.

Table 1. Questionnaire

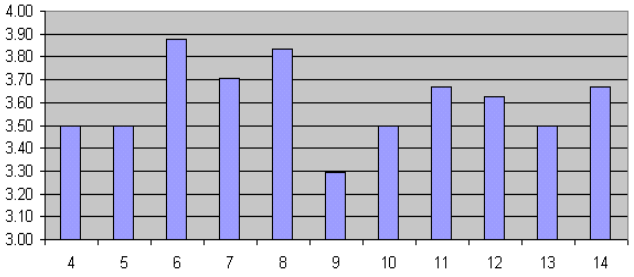
4	Were the objectives of the individual modules clear?
5	The content covered was in line with the objectives of the program?
6	The material taught was well organized?
7	Educational aids were complete and adequate?
8	The organization of the seminar was satisfactory?
9	Do you think the program for your future will be useful?
10	The program responded to your expectations?
11	The classroom was appropriate?
12	The content of pedagogical training was adequate?
13	The concepts of robotics have been adequately explained?
14	You would recommend it to a colleague or friend?

As a scoring scale, a four-scale, with four possible answers, two positive (Very much and much) and two Negative (Little and very little) were selected. It is a differentiated form of Likert's pentakon scale which is widespread in surveys that record beliefs, values, motives and other expressions of human behavior, has a modest range (not limiting three stages, neither wide nor narrow with seven or nine levels) and is considered to include steps with equal distances between them (DeVellis, 2003). The reason why there is no medium answer is to avoid the accumulation of neutral responses and thus to facilitate the distribution of responses to negative and positive answers.

5 EXPERIMENTAL RESULTS

The processing of the questionnaires shows that the overwhelming majority of participants in the program, which exceeds 90% (90.15), is pleased. Additionally, 87.5% of the respondents are satisfied with the clarity of the objectives and the correspondence of the subject matter with the objectives. The organization of the subject matter is assessed positively by 97% while the adequacy of the educational aids is evaluated in the same way from 92.75%. Regarding the organization of the seminar, 95.75% considers the organization of the seminar to be excellent, while 87.5% say that the program responded to its expectations. However, 82.25% think the program will be useful for the future, which is obviously due to external factors. Moreover, 90.75% of the respondents consider pedagogical material and 87.5% the material of robotics. Overall, a percentage exceeding 90% (91.75%) responds that it would highly recommend the program to a colleague or friend.

Figure 2
Results



6 CONCLUSION

Technology and the science of pedagogy are in constant evolution, in a continuous process and interact with each other. That is why it is imperative to adapt teachers in this context as well. The robotics training methodology suggests a hybrid form of education that includes the traditional formal form of education combined with the use of new technologies, in particular using e-learning techniques. The results of the methodology are spectacular, since, as can be seen from the sample, the overwhelming majority is absolutely satisfied with the seminar and would of course recommend it to a colleague or friend. The ISD methodology guarantees success as it enables the training to be tailored to the educational needs of the target group and, through evaluation and feedback, allows the program to be adjusted to be fully effective.

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