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METHODOLOGIES AND TECHNOLOGIES TO SUPPORT DIDACTICS FOR COMPETENCES. REALIZATION OF AN ACTIVE AND PARTICIPATORY TEACHING ACTIVITY IN A UNIVERSITY CONTEXT

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Learners, in order to acquire the competences deemed essential to meet the problems of daily life, must play a leading role that put them in a position to participate in the dialectic exchange for significant contributions to reason critically, to constantly check the practices implemented through approaches that use the methodology of educational research and new information and communication technologies (ICT).
This paper describes the design and implementation of a teaching practice competences oriented, with the aim of encouraging an active and participatory learning by learners useful to acquire competences and expertise for problem solving. The study involved the construction collaboratively and cooperatively of a digital product. Attention was focused on the following teaching methods: cooperative learning, role playing,

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brainstorming, supported and complemented synergistically by the use of e-learning environments. After describing the main methods and technologies used, the paper focuses on the phases of the experimental teaching realized and results achieved.

1 Introduction

The complexity and the continuous changing of the knowledge society require continuous retraining and upskilling in every business sector, from the perspective of learning and lifewide learning. This is also the case of teacher training whom is required to hold several disciplinary skills such as those socio-psycho-pedagogical, methodological and didactic, organizational and relational, educational research and, in particular, in the current historical moment, increasingly permeated by technology, digital competencies (Messina & De Rossi, 2015; Instefjord & Munthe, 2016). These skills, which constitute teacher's "professional equipment", are indispensable today for the realization of the desired training model. This model requires teachers the use of experimentation, verification and reflection on educational practices put in place. The aim is, therefore, to help improve the educational relationship and to give meaning not only to the learning process, but also to training process of students (De Pietro, 2013). In order to acquire the skills deemed essential to cope with problems of the daily life, the training subject must play a leading role that put him in a position to participate in the dialectic exchange for significant contributions, to reason critically, to verify constantly practices implemented through approaches that use the methodology of educational research (Trinchero, 2015) (experimental, bibliographical analysis, structuring of projects, problem solving), the teaching laboratory (Gabel, 1994), where teamwork and cooperative learning facilitate not only the achievement of the educational objectives but also the acquisition of social skills and relationships with others, and new information and communications technology (ICT) (Calvani, 2004; Maccario, 2006; Perrenoud, 2003). According to this approach, the teaching laboratory is configured either as a process of formation oriented towards the maturation of valuable skills for life, and as innovative teaching methodology that gives students an opportunity to acquire knowledge through the *learning by doing*, which is a *learn to learn*. The teaching laboratory trains subject to be able to use knowledge, competence and personal skills in study and work situations. Through using of digital technologies and, in particular, of learning environments, the laboratory activities enable to stimulate situations, everyday experiences and business-professional contexts. For this reason, in this paper it is given much space to the ICT use for the development of digital skills and educational research, both valid for the solution of problems in contexts other than those in which they learn abstract knowledge. Students, therefore,

interacting with each other and communicating with the teacher (both in the presence and online) are able to test their ideas and theories about educational problems solutions. In particular, university students get more benefits, in terms of depth of knowledge and understanding, if they are actively involved in the learning process based on research and on making (Healey, 2005). Moreover, as we demonstrated in this paper, if students are involved in *problem solving*, *role playing* and *cooperative learning* reach, even, cross and specific skills to effectively carry out their future profession.

Starting from these premises, the teaching experience here showed, has been designed and tested with students enrolled to the fourth year of the Single-cycle Degree Course in Primary Education Science (Department of Humanities - University of Calabria) and attending the integrated course "Teaching and research methodology". Activities focused on the realization collaboratively and in a co-operative way of a technological product, chosen from blogs, e-book, e-learning course. It was carried out during the second semester of the academic year 2015/2016, attended 90 students. In the specific case, and this is another innovative aspect, the network technologies have enabled the realization of activities also remotely, thanks to a networked learning environment for this purpose. The laboratory contributed, moreover, to the promotion of *active*, *participatory* and *inclusive* learning, since students, future teachers, have experienced forms of integration between disciplinary knowledge and the effective management skills of a class in an inclusive perspective. To encourage activities and promotion of an educational model oriented skills, it was necessary to focus on educational design and enhancement of methodologies using ICT, intended as *technological artifacts* in support of training processes and innovation teaching. Attention was focused on the following teaching methods: *cooperative learning*, *role playing*, *brainstorming*, supported and integrated synergistically by the use of networked learning environments (Calvani *et al.*, 2008; Baldacci, 2005; Alberici, 2002).

In this paper, in view of the above, it is presented the learning experience, whose intention was promoting an active and participatory learning and, at the same time, developing skills' students in research, customizing their learning autonomously, knowing how to work with peers and starting especially forms of reasoning and reflection. Ultimate goal of the research was to promote students' motivation to do, to become involved, to allow the collaborative relationship between all the actors involved in the educational process. Therefore, after describing the main methods and technologies used, paper focuses on the stages of the experimental teaching made and the results achieved. The analysis of the results focuses on the description of the sample; on a comparison of the knowledge and skills possessed by students at the beginning and at the end of the proposed activity; on the evaluation of some dimension connected to the

research (organization and methods, activities), as well as on digital products made by students.

2 Methodologies and technologies

To promote a competencies-oriented model of teaching, it was necessary to focus attention on teaching planning and enhancing of methodologies, playing on the use of ICT (Calvani *et al.*, 2009) as *technological artifacts* in support of educational processes and teaching innovation. In this paper, experience in teaching has been designed according to the following teaching methods: *cooperative learning*, *role playing*, *brainstorming*, supported and complemented synergistically by the use of online learning environments (Rivoltella & Ferrari, 2010). The latter, if properly designed from a didactic point of view, are an effective tool, because students recognize their habitat in web environments and then they improve communicative dynamics. The e-learning environments also promote the integration between formal and informal learning moments; they greatly change the variables of *time*, *space* and *memory*, influencing the processes of acquisition and process of knowledge. Structural principles of the methodologies used are described below, contextualizing them in the specific teaching situation (Varisco, 2002; Calvani *et al.*, 2011).

Cooperative learning has allowed to increase students motivation, thanks to collaborative work, sharing of tasks, allocation of responsibilities. Through this methodology, the learning process develops among "peers", the distances related to age diversity, level of competences and experiences, the motivation to study are reduced by sharing activities (De Pietro *et al*., 2015). Even the self-esteem of each student tends to increase; trust among all actors involved in teaching activities grows more and more; there is an improvement in the acceptance of "the other", therefore it's a way to promote inclusive teaching and consider the "diversity" in a constructive manner. In such a scenario, *what is the role of the teacher in education*? Teacher plays an indirect role in the teaching-learning process, as it supports the operating dynamics of the group, defines tasks and monitors their implementation, provides work rules, constantly checking the activities carried out through a *formative*, *indicative* and *regulative* assessment. The assessment is directed both to the *product*, so to the result of cooperative and collaborative activities, and to the *process*, that is the dynamics of construction of knowledge and competences (Trinchero, 2006; 2012). In our case, cooperative learning has allowed to carry out the work in a collaborative manner, following on forms of active, participatory and inclusive learning, that have led, on the one hand, to create some "digital products" (blogs, e-book, e-learning courses), and on the other hand, to enhance learning processes, more and more oriented to the development of competences.

Role playing is the other methodology used in our teaching activities, aimed to the simulation of real situations for solving problems. In this specific case, the methodology has been used on solving problems linked to the achievement of instruments and digital environments (blogs, e-books, e-learning courses mode), through immersion of students in real experiences, in other words as teachers, to illustrate the problems, to start discussions with the rest of the classroom, to get suggestions and proposed solutions. Once again, the teacher assumes the function of director and facilitator, it has defined the rules of behavior, it has created the conditions for starting a social climate, resolve any problems that emerged during the activities.

Brainstorming was used to analyze students' prior knowledge, to stimulate discussion, to create an active and participatory atmosphere, to gather ideas and opinions from students. In this case, the identification of students' perception on the concept of "educational technologies" and their use in schools has been possible thanks to brainstorming. The aim was the exploration of knowledges, ideas, suggestions, opinions, in relation to the topics proposed, in order to stimulate each student and engage the entire classroom. The principles underlying this method concern the sharing of the task, the focus on a theme, the verbal confrontation among the students, sharing the "final product". In this way, students feel valued, they are granted an active role and finally social and communication relationships are improved. The teacher even in this case assumes the role of moderator, noting and summarizing the contributions made during the discussion, classifying and analyzing them together with the students.

To improve the interaction among students, both at a quantitative level and at a qualitative level, we have used an online learning environment to enhance laboratory activities. Digital technologies in general, e-learning in a particular, let us the activating of teaching and collaboration processes beyond the face-to-face didactic, enabling integration between formal and informal learning (Castoldi, 2014).

The e-learning environment has played different functions: it has integrated class teaching with online studying resources; it has allowed the dispensing of verification tests and self-tests; it has enabled and enhanced communication between all participants in the training process. In addition, since the teaching goal was the development of digital competences, the e-learning platform has represented the place where concretely technological tools are activated and experienced for reaching elaboration and generation of new knowledge (Maragliano, 2013).

3 The teaching activities carried out: description and phases

Within the integrated course "Teaching and research methodology", consisting of two modules, "Methodology of Research in Education" and "Technologies for teaching", that is part of the Single-cycle Degree Course in Primary Education Science (Department of Humanities - University of Calabria), it has been proven an educational activity aimed at promoting active and participated learning. The aim was to improve the skills and competencies in problem solving of students and develop significant learning. At the study, which was carried out during the second semester of the academic year 2015/2016, attended 90 students enrolled to the fourth year of the above mentioned degree course. The task assigned to the students during the course was focused on: "The realization collaboratively and in a co-operative way of a technological product, chosen from blogs, e-book, e-learning course". It should be specified that the task assigned was not selected at random, but following an initial test dispensed to the students and according to the brainstorming process carried out at the beginning of the course. The activity was conducted according to the following steps.

1. Administration of the questionnaire at the beginning of activities, to measure knowledgeof the students.
2. Brainstorming for bringing out the opinions and ideas of students on educational technology.
3. Start up of activities within the e-learning environment.
4. Organization of the working groups and start-up of activities.
5. Delivery of the 'products' realised and then sharing them in the e-learning environment.
6. Administration of the final questionnaire for the evaluation of the teaching experience.

The *first phase*, analysis of prerequisites, allowed to purchase the level of digital expertise held by students and it has identified the tools / digital environments on which students have had less knowledge. It was also delivered an online questionnaire through the e-learning platform, consisting of a series of multiple choice, true / false, Likert scale. Results are presented in the following section.

In the *second phase* it was used the brainstorming method to detect students' opinions on educational technologies. To carry out this phase it has been dedicated two meetings of two hours, during which all students expressed their ideas and shared their thoughts, guided by the teacher who organized, moderated and stimulated the discussion.

These two phases have allowed us to identify and carry out some more specific educational activities within the two modules that were object of the experiment, directing some parts of educational programs towards the acquisition of knowledge / skills related to digital artifacts in which students presented significant deficiencies. This is an important factor, since the design of teaching is the result of a re-design and co-planning with the students and takes into account their real educational needs.

In the *third phase* the activities within the e-learning platform have been started. Each student interacted in the forums, studying the educational materials, participating in the tutoring sessions. Students had the opportunity to learn and deepen their knowledge on the use of blogs, e-books and e-learning design. The e-learning environment has also allowed interacting students beyond teaching hours and giving rise to forms of self-assessment and peer assessment (Limone, 2012).

Following these preparatory and study phases, working groups were set up, cooperative learning activities for the realization of the task assigned and performance of the role playing were started, the latter aimed at solving problems arising during the teaching work. Groups were formed spontaneously and independently, thanks, above all, to the interactions between students originate in the forum within the e-learning platform. Specifically, twenty working groups have been set up, each group appointed a group leader in order to organize activities and manage communications with professors of Faculty. In fact, we tried to give ample space to the students, adopting a didactic model of socio-constructivist nature, that was able to stimulate cooperative and collaborative learning, learning by doing, to promote autonomy and cognitive flexibility in the students.

In the *fifth phase*, each group leader uploaded, in a specific area of the e-learning platform, the tasks produced. As the products were accessible via web (blogs, e-books, e-learning course), links through which it was possible to view them were communicated. The work was accompanied by a project work made collaboratively.

Finally, in the *sixth* and *final phase* it was administered a satisfaction survey on the activities, with the same method of supply as initial one.

In the next section we are going to present the main results.

4 Results analysis

Results of the teaching experience are being presented below, processed after analysing the responses to questionnaires. The analysis focuses on the description of the sample, on the comparison of the knowledge and competences possessed by students at the beginning and at the end of the proposed activity;

on the evaluation of some dimensions related to the study (organization and methodologies, activities carried out) and on digital products made by students.

Sample Description

90 students participated in the study, of which 94.3% were female. The type of schools where students came from are shown in the graph below.

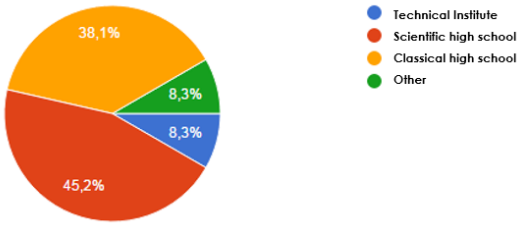

Fig. 1 - Graph – Students' schools of origin

As it can be seen, most of the students come from Scientific high schools (43%) and Classical high schools (38.1%).

Knowledge and competences possessed by students

The digital competence level stated by students is shown below. The lower value is 1 while the highest is 5.

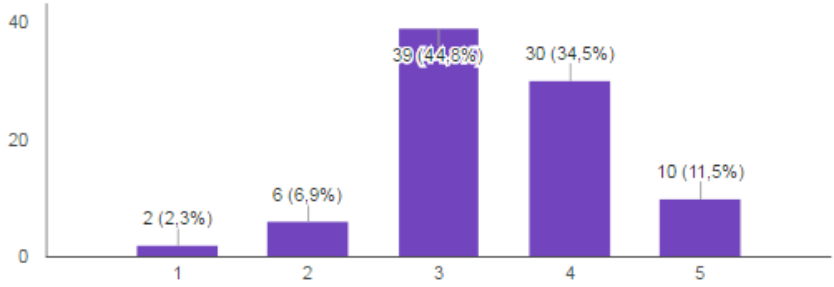

Fig. 2 - Graph – Competences possessed by students at the beginning of the study

Students stated to own a medium-high level of digital competence. That statement is confirmed by the individual answers to the questions which asked

the level of knowledge related to personal productivity tools (Word, Excel, PowerPoint or similar). Students have a medium-high level of knowledge about Web and e-mails, only about 5% says that it don't know in depth such services. In fact, over 70% of students has the European Computer Driving License (ECDL).

Students have the following knowledge about the use of Web 2.0 tools:

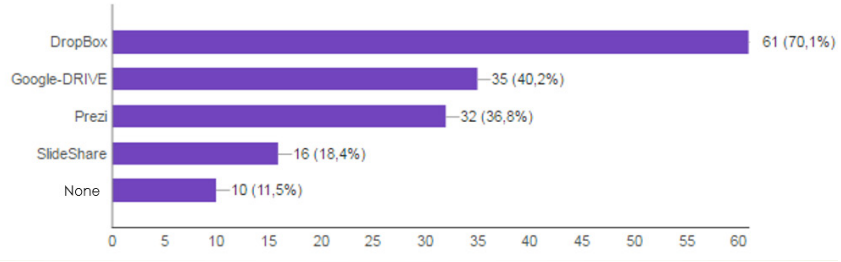

Fig. 3 - Graph – Web 2.0 knowledge

As it can be seen, students are not proficient on web 2.0 tools as they are on office automation.

Over 10% of students do not know any of the proposed tools.

Another fact that emerges with regard to Web 2.0 tools, and particularly to the social networks (Facebook, Twitter, Linkedin), is represented by the fact that students use such environments for personal and informal purposes but also for educational ones. Here are two graphs compared on the use of social networks.

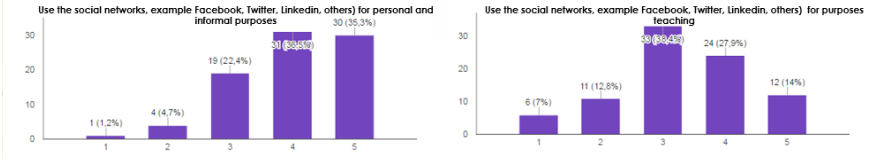

Fig. 4 - Graph – Use of social networks

As for digital skills related to the use of LIM, concept maps, e-learning environments and e-books, they have emerged the following data:

- 41.9% of the students has never used the LIM;
- 54% of the students has never used software to make concept maps;
- 70.7% of the students has never participated in a online forum, although 66.7% says to have used an e-learning platform;
- 95.3% of the students has never created an e-book.

It is clear that students know personal productivity software and Internet tools, but do not know in the same way tools and software associated with the generation of learning objects and interaction management.

Comparing these statements with the level of digital competence stated in the initial stage, it is believed that the students often get confused on the meaning of digital competence, associating it to more technical aspects related to software. On the other hand, we believe that the concept of digital concept goes much further and we should make students aware of this.

Evaluation of the main dimensions related to this teaching experience

As it regards results linked to this teaching experience, some dimensions concerning two macro indicators were noted: organization and teaching methods, laboratory activities.

The results in terms of percentage are shown below (students who responded indicating that specific value) of the assessment by students to each dimension. The students were asked to provide a rating from 1 to 5 (1 is the lowest value; 5 the highest one). The followed table "Organization and teaching methods" is sorted in decreasingly on the average value obtained between the scores of the columns 4 and 5, which represent the highest level of evaluation. This will identify the dimensions evaluated more positively.

Table 1
ORGANIZATION AND TEACHING METHODS

	low	.....			*high*	
dimension	***1***	***2***	***3***	***4***	***5***	***avg 4;5***
Interaction with student colleagues during the course	0,00%	3,37%	24,72%	57,30%	14,61%	35,96%
Interaction with teachers during the course	0,00%	2,25%	31,46%	40,45%	25,84%	33,15%
Development of new skills	0,00%	2,25%	37,08%	39,33%	21,35%	30,34%
Interest of arguments with respect to their training needs	0,00%	4,49%	35,96%	38,20%	21,35%	29,78%
Clarity topics, useful to the laboratory	0,00%	6,74%	38,20%	38,20%	16,85%	27,53%
Management of online discussion spaces	0,00%	8,99%	40,45%	33,71%	16,85%	25,28%
Ability of teachers to keep alive the attention	0,00%	13,48%	37,08%	32,58%	16,85%	24,72%
Usability of teaching materials	0,00%	7,87%	43,82%	37,08%	11,24%	24,16%
avg	0,00%	6,18%	36,10%	39,61%	18,12%	

As it can be see, on a global level it shows that the organization and teaching methods have been evaluated positively. There were no low values for any dimension; very few students (about 6%) expressed the value 2; all dimensions are rated medium to high. In particular, between the dimensions evaluated in a more than positive (column 4 and 5), those most mentioned are represented by the interaction with the students, the interaction with the teachers, the development of new competences, as a result of the activities. This is consistent with the assumptions and objectives, since according to a teaching

competences supported by ICT, it is hoped in the strengthening of levels of interaction between the actors and the development of new competences.

As shown in the table below, even the laboratory activities and their effects in other areas (eg. employment, social activities, other disciplines, etc.) were assessed positively.

Table 2
LABORATORY ACTIVITIES

	low	.....			high	
dimension	1	2	3	4	5	avg 4;5
Level of motivation to study	1,12%	3,37%	42,70%	39,33%	13,48%	26,40%
Correlation with other daily activities (life, work, etc.)	0,00%	5,62%	42,70%	39,33%	12,36%	25,84%
Degree of correspondence with the theory of courses	0,00%	4,49%	47,19%	32,58%	15,73%	24,16%
Correspondence with the theory of other disciplines	1,12%	7,87%	42,70%	37,08%	11,24%	24,16%
Integration of formal/informal learning	0,00%	5,62%	47,19%	37,08%	10,11%	23,60%
Degree of correspondence with the direct placement done in schools	4,49%	16,85%	37,08%	34,83%	6,74%	20,79%
avg	1,12%	7,30%	43,26%	36,70%	11,61%	

However, it must be pointed out that compared to the previous dimensions, we recorded some slightly negative feedbacks. This is the case of the degree of correspondence with the internship at school, between what it has been done and the theory of other disciplines, of the integration between formal and informal moments favored by the activities carried out. Attention must be given to these dimensions, although overall are still positive. The dimensions that were rated more positive are: increased level of students motivation, correlation between our activities and daily routine, degree of correspondence with the theory part of the course that was object of the experimentation.

Evaluation of digital products made by students

Regarding the evaluation of digital products made by the various groups, they have been evaluated positively and have helped to improve the overall assessment process.

Specifically it has been formed 21 groups, of which 11 have chosen to create a blog; 9 to realize an e-book, only one group chose to realize an e-learning course. Other topics covered by the groups were: educational disciplines (6); fairy tales and fables (3); DSA (4); bullying (2); digital school (2); nutrition education (3); flora and fauna (1).

The highly positive evaluation of digital products made by students (blogs, e-books, e-learning courses), compared with the knowledge and skills declared by students in the initial questionnaire, very deficient, brings out an excellent level acquisition of new digital skills by students in the use of such tools.

In our case, the analysis of the results refers to the comparison between the statements in the initial stage by the students and what is actually achieved by students in real situations, according to the logic of learning by doing and the

approach oriented to the development of practical skills.

To the question, "will you use these digital tools as teaching aids in other disciplines and in future activities as a teacher?", the totality of the students responded positively. From these statements it is clear an additional level of effectiveness of implemented teaching, which allowed to make students reflect on the use of new educational technologies.

Conclusion

The experimented teaching has facilitated the acquisition of some skills such as those digital, communicative, dynamics of the group management, and has facilitated the acquisition of disciplinary contents. Simultaneously with the acquisition of these skills, activities and methods used have allowed students to create digital products and use research tools useful for the teaching practice of future teachers. Works carried out were evaluated positively by the teachers of the course and they have contributed to the global final evaluation process during the examination. With regard to the more positive aspects emerged, it should be noted, also through participant observation as a research methodology, an improvement of the interaction between students and teachers and among students themselves; a considerable interest from the activities carried out with respect to the training needs of the students; high motivation to study the disciplines; a positive correlation between educational activities and daily activities (social and business). Students have taken a strong sense of responsibility, using digital technologies as a meaning of "process technology", able to change the way of acquisition, processing and generation of new knowledge. Positive aspects have emerged in relation to the evaluation practices, oriented to a type of formative assessment, in which each student has experienced forms of self-assessment and peer evaluation, according to forms of significant and metacognitive learning. With the reference to the main critical points, there was a demand for greater connection among the activities carried out in universities and ones carried out during the internship (at schools). It requires, finally, a greater equipment of the classrooms and computer gear for laboratory use. Experimentation carried out, therefore, should be viewed as exploratory survey for the realization of future activities more orientated to a design for competencies and skills assessment, to integration between general didactics and disciplinary education and between formal and informal moments learning; the ultimate goal is to stimulate and train the students to gain flexibility and cognitive autonomy. Experimentation also is framed within the approach focused on Evidence Based Education (EBE), which is characterized by its intention of making knowledge usable in the operating field, resulting in signs and actions that make clear how to achieve an improvement of educational

action (Bonaiuti *et al.*, 2014).

ICT and particularly the networked learning environments have played a crucial role, in addition to social networking and file sharing tools used independently by students to support the training activities carried out.

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