Design-based research and planning of training courses: the application model of Future Education Modena

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Abstract

This paper intends to provide a general overview on e-learning concepts and new educational technologies, with a particular regard to the Design-Based Research and its application on training courses design.

The Design-Based Research shows its potential as a methodology suitable for both research and design of learning environments enhanced by technologies. As it is a very flexible research model, its planning and execution is different according to specific cases.

Online training is developing more and more; there are many training centers that use the "Open and Distance Learning" model for the promotion of their training courses. Among these, the FEM - Future Education Modena; it is an international center for innovation in the educational field and sets itself the goal to increase the potential of education in society by improving the quality and impact of experiences educational through research, design and acceleration activities. Due to Covid-19, most of the courses promoted by FEM have been conducted online.

To ensure that online training course is as successful as in presence, it is necessary to start from the foundations; it is important to invest into design and structure following a process as rigorous and scientific as possible.

Keywords [1]

Design-Based Research, Education, Distance learning, e-learning

Introduction

Over the past ten years, the number of training courses carried out through online platforms has grown exponentially. E-learning platforms are considered among the most effective tools for design and manage a training course. Furthermore, the looming health emergency has pushed even further the use of innovative technologies for online training. There is no doubt that distance learning, whether it is synchronous or asynchronous, has considerable advantages. However, many people continue to be skeptical about the effectiveness of distance learning courses. Is it really possible to design a quality online course despite the numerous criticalities?

Often the potential of the tools to support distance learning is not appropriately recognized. Online education is growing more and more and it is necessary to modify classic teaching method used in a traditional classroom. Therefore, it is essential to deepen and know the major concepts of Distance Learning and Open and Distance Learning environments.

[1] Proceedings of the First Workshop on Technology Enhanced Learning Environments for Blended Education (teleXbe2021), January 21–22, 2021, Foggia, Italy

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To ensure that an online training course is successful, it is necessary to devote the right attention to its design, relying on industry experts – such as Instructional Designer, pedagogists, Content Editors, ICT (Information and Communication Technology) experts – never forgetting that to design is as much a science than as art; to design, in a broad sense, means to conceive, have intention to do something. Every teaching activity has in itself a design nature.

Digital culture and technologies for education

In the XX and XXI centuries, new technologies have allowed to integrate but above all support training through multiple remote resources, with particular regard to the use of the web.

The term ICT - Information and Communications Technology - refers to all technological processes and tools that are used to produce and improve knowledge and learning tools. The use of ICT to support educational processes is growing rapidly and steadily. The goal is to ensure learning in a lifelong perspective, that is, for all life, beyond the space-time limits imposed by traditional educational systems.

As Trevisol [1] states:

> *"The exponential development of technological systems, in particular ICT, changes the dynamics of learning. The abundance of information, knowledge and learning resources made possible by new IT systems also requires evolving capacities for research, indexing, storage of information, knowledge, tools, which do not necessarily have to be used when they are found, but can be activated later, when the situation requires it".*

It is precisely in this perspective, e-learning concept developed since the 1990s with the advent of telematic networks.

The term e-learning refers to a set of methodologies using the Internet and multimedia technologies to ensure distance learning experiences [2]. The ultimate goal of each e-learning system is to convey content. There are many tools and methods which e-learning can be organised; this involves a variety of flexible solutions by placing the subject at the center of an articulated and extensive training offer, ensuring that the student can have a dynamic role in learning; the focus is on the user. As Anna Dipace says [3]:

> *"The centrality of the student in the learning process is the element recognized by studies, researches and official documents as a key factor for the promotion and development of professional skills, social and cultural events relevant to society by university students. This centrality of the student sees it as a starting point for the teacher's reflection on his own didactic and evaluative action identification of what the student will have to learn at the end of a training course, whether it is a course of study or a single course".*

The choice of content delivery strategy should reflect the specific e-learning model that it is intended to implement, and should be functional to the learning style that this model aims to foster [4]. Technologies are able to shape what you learn, changing how you learn.

In Italy, in these same years, educational technologies were introduced in schools. Technologies have made to support and integrate teaching and learning methodologies that research had already identified before the advent of the computer [5].

The classic teaching model, also called "frontal", has therefore inevitably been modified by the new training needs, which see users in training use new tools such as smartphones and tablets, and move in new virtual environments, no longer constrained by space-time factors that distinguished classical-traditional training [6]. The use of e-learning methodology and technologies in learning processes brings important advantages, first of all the management, in a totally autonomous way, of their own training; furthermore, there is an increase in the quality of training, thanks to the possibility of providing immediate feedback on the quality and effectiveness of learning; the relationship between learner and teacher finds in the feedback the most important moment both quantitatively and qualitative, helping the subject to adjust and adapt his behavior in view of the objectives to be achieved and the teacher to assume information on the state of understanding, provide concrete answers to specific requests from the student, helping him to overcome doubts and errors.

Moreover, everything can take place synchronously or asynchronously, creating completely personalized training contexts, respecting the needs of the individual. Among the limits, however, we remember those related to problems of a technical nature (such as a poor internet connection) or those related to the lack of knowledge of technological and digital devices.

The contribution of learning technologies can intervene on several levels [7]

- on the transformation in terms of active co-construction of knowledge;
- on social power relations, both internalized and implemented;
- on the formation of identity;
- on the most distributed physical and psychic spatial coordinates.

Nowadays it is necessary to think of an interdisciplinary approach that can combine the study of methodologies with the tools and organizational models through which the educational process is put into practice [8].

In this perspective, Media Education assumes a fundamental value. It is a media-centered learning and teaching process. It was born, in fact, in the 70s, period of maximum diffusion of the mass media. It aims to educate to the media, through the media and for the media. The media, in fact, represent the object and the instrument of training processes; it is not enough just to teach certain contents, but it is necessary to develop critical skills, problem-solving, synthesis, evaluation and lifelong learning. It is therefore necessary to understand the potential of the media and to develop the reasons for a positive use of the media [9]. Media Education should be considered a transversal competence, applicable in different contexts.

With the advent of digital media and technologies, it is also crucial to talk about Digital Literacy. It is a much broader concept than the simple ability to use digital devices; includes a wide variety of complex cognitive, motor, sociological and emotional abilities that are considered useful for users who want to make digital environments work effectively [10]. Even today, unfortunately, the level of digital and computer illiteracy is very high; also, the theme of Digital Literacy is connected with the world of work. Indeed, at least nine out of ten jobs require digital skills.

In this perspective it is also necessary to speak of multiliteracies, a concept deepened by Cope and Kalantzis. This term includes two fundamental aspects: that of multimedia and the presence of different communication languages; the combination of these elements is certainly not casual, but depends on a number of factors ranging from the cultural context in which the subject lives to his personal interests, including previous experience and knowledge acquired, the aims pursued, the knowledge of the people we meet [11]. The school, the main place to build an approach marked by multiliteracies, can succeed in this intent by providing a methodology classroom work based on situated experience, critical analysis, negotiation and continuous comparison. The transmission of language rules is no longer sufficient to move in a multimodal and multicultural context, considering that it is not just a matter of reproducing, but of favoring a dynamic process of language transformation [12].

Moreover, today's learning environments are very different from traditional ones. With the advent of new technologies, completely changes the environment where the educational process is put into practice. The importance of the place also widens in the contexts of University formation where the environment in which the learning progresses is very often diffused and open (on site and on line), not bound by boundaries and can be looked upon as the system in which intertwine elements of physical and/or virtual architecture and fundamentals of pedagogy and teaching.

Professionals interested in the design of training interventions are called to collaborate with the environment, and then to interact and create a constructive dialogue with this. In fact, as stated by Loperfido, Scarinci and Dipace [13]:

> *"The constant development of digital tools and environments in support of learning is generating a transversal change that crosses the daily life of teaching practices. We are witnessing a sort of social revolution due to the use and rapid evolution of new technologies and new virtual learning environments that stimulate the emergence of new communication systems and new forms of training that exceed the time space limit that has always allowed the distinction between formal, non-formal and informal contexts"*

Designing a training course: Design-based research

Didactics can be understood as the science of teaching, which in turn has recently been regarded as the science of design, *design science* [14]. In the last ten years, Design-based research has shown its potential as a methodology suitable for both research and design of technology-enhanced learning environments.

This is a very recent methodology, developed in the 90' thanks to Allan Collins and Ann Brown to reduce the gap between educational research and pragmatic educational needs in schools; there is a perfect balance between practice and theory.

It is, in fact, a research method in which the design, based on experience, is supported by phases of theoretical and experimental research; aims to develop the practice of teaching in real world situations, through a systematic, flexible and interactive research approach [15].

DBR's research methods can change according to design objectives and design context. In fact, it is not a unique research model but its planning and execution varies according to specific cases.

The main features [16] of the DBR include:

- Pragmatics: theory and praxis meet, in fact the value of the theory is evaluated by the extent to which the practice is improved.
- Founded: design is based on theory and based on relevant research, theory and practices; moreover, the design is carried out in real contexts.
- Interactive and flexible: designers are involved in design processes and collaborate with participants.
- Integrative: mixed research methods are used to maximize the credibility of ongoing research. Methods vary during the different phases as new needs and problems emerge; in this case the focus of the research evolves. Rigor is maintained in a targeted way and discipline is applied appropriately.
- Contextual: the research results are linked to the design process and the environment. The content and depth of the design principles generated varies.

DBR is a systematic but flexible methodology with four key steps [17]:

- Design;
- Implementation;
- Analysis;
- Re-design.

In e-learning we speak in particular of Instructional Design. The ID is a process aimed at identifying the methods, times and contents of the formative intervention, organizing the information in order to make them interesting and easy to learn by the students. Generally, the design process is based on one or more theoretical models called Instructional Systems Design (ISD). The instructional designer, instead, is the one who intervenes in the design of training events and in the realization of online training courses; is both a training expert and an ICT - Information and Communications Technology expert.

Those who work in this field are responsible for the planning, development, evaluation and management of training processes. Design means, in a broad sense, to conceive, to have the intention of do something. Every teaching activity has in itself a design nature.

The ID, as mentioned above, deals with instructional system design; there is no single definition for this discipline but some possible descriptions have been identified [18]:

- It is a systematic process to translate the general principles of learning and education into plans for teaching activity;
- It is a process by which classroom or computer-based education is carried out from a reference system for the design and development process, ensuring that the training needs of learners are met;

- It is science and art, based on research in the field of education psychology and learning theories to lead the student to the acquisition of knowledge and skills.

ISD is a systematic process that translates the general principles of learning and education into plans for didactic activity. The ultimate goal is to create engaging, effective and learning experiences in line with the goals of the organization. It is called an "iterative process" as it requires constant evaluation and *feedback* [18]. Also, thanks to it, the learning process (whether it develops within the traditional methodology or through distance learning) it refers to a system that focuses on the training needs of learners.

The four key elements of Instructional Design are:

- students / learners;
- the teaching methodology;
- learning objectives;
- the evaluation methods.

Among the models of Instructional System Design, the most famous is the ADDIE - Analysis Design Development Implementation Evaluation, developed since the '70s [19]. The aim of this model is to plan, develop, manage and evaluate an educational process in order to ensure adequate performance by pupils. The model is structured according to a path that follows five phases, chained together:

- *Analysis*: this first phase of analysis is necessary to define the needs and objectives formative. It also identifies the methods of delivery and the places where it is they will carry out the activities;
- *Design:* this is the phase of structuring the educational path. They come in fact detailed objectives, didactic strategies, selection of resources etc.
- *Development:* this is the phase of development in which the process is filled with contents and training devices are adapted to the real context;
- *Implementation*: the implementation phase of the process, in which the classrooms and technological supports are set up;
- *Evaluation*: that is the evaluation phase of the project, in all its aspects.

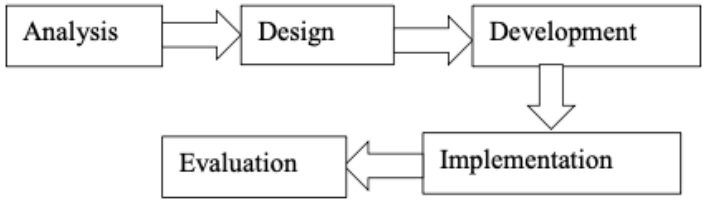

Figure 1: ADDIE Model [20]:

This model can be applied both in the presence and online; if you decide to apply it online, the design phase must be more rigorous and detailed.

In addition, when it comes to Instructional Design, it is important to remember that both experts in the field and students are involved, who must necessarily develop specific skills. Indeed, as Martin and Ritzhaupt state [21]:

> *"Students entering the field of instructional design must possess a wide array of competencies to be successful in their future roles. Competencies are the knowledge, skills, and abilities professionals need in their roles, while standards speak to a pre-defined level of quality or attainment of those competencies. Competencies and standards are essential aspects to advance professionals in this field. Several professional organizations guide the development of competencies and standards. They also have certification programs for instructional designers and instructional programs"*.

FEM – Future Education Modena: action strategies and training offer

Online education is developing more and more and is inevitably modifying the classic teaching method used in the classroom. Furthermore, following the imminent health emergency, the concept of Distance Learning is fundamental. It is a remote learning system, based on the use of platforms accessible via the web and the so-called LMS - Learning Management System. This term refers to those programs or application platforms that allow the provision of courses in e-learning mode, with the aim of ensuring the development of a specific educational project. Thanks to an LMS, online courses can be distributed and, in general, all online activities can be tracked. In addition, Distance Learning can take place both in synchronous and asynchronous form.

The fields of application of DL are increasingly wide. In Italy there are eleven non-state telematic universities, legally recognized by the MIUR. There are also free and paid courses provided by some training and research centers. Among these, in fact, the FEM - Future Education Modena.

Future Education Modena is a project created and managed by Wonderful Education in collaboration with PTSClas and Social Fare, financed by the Modena Foundation and part of Ago - Modena Fabbriche Culturali. It is an international center for innovation in the educational field and sets itself the goal to increase the potential of education in society by improving the quality and impact of experiences educational through research, design and acceleration activities; develops a strong competence infield of educational planning through an initial partnership of over 40 subjects of national and international, coming from the world of university and research, innovation and business, civil society and the world of science and culture. FEM is a welcoming place open to citizens, characterized by highly innovative spaces, which host a rich calendar of educational, social and dissemination activities - about 1500 in the three years between lectures, laboratories, experiments, events, professional courses - aimed at the whole society: children, students, school world, young people and adults interested in developing and accelerating their skills for the future.

Due to Covid-19, most of the courses promoted by FEM have been conducted online. Of consequently, online training courses have been developed according to the “Open and Distance Learning” approach. With “Open and Distance Learning” we mean all forms of learning where the effectiveness of training is not linked to the presence of the teacher and students in the same place. The training interventions designed according to this methodology place the learner at the center of the system and introduce elements of flexibility in the choice of the didactic path, in places and times of delivery, in the organization and structure of the course, in the rhythms of learning, in the forms of support and in the moments of evaluation [22]. The courses developed according to this approach are therefore characterized by:

- attention to the trainees, their needs and characteristics;
- the possibility of activating individual or small group courses, in relation to knowledge possessed and the learner's expectations;
- the autonomous management of training, in terms of learning rhythms and place of study;
- the use of didactic materials specially prepared to allow maximum autonomy in the training process;
- the presence of the figure of the “tutor” who carries out the functions of guiding and supporting users.

One of the most successful courses promoted by FEM is called “Per una didattica efficace (anche) a distanza: un percorso su progettazione, valutazione e inclusione”- “For effective (also) distance learning: a path on design, evaluation and inclusion”.

It is a training course promoted to offer participants a panorama of theories, models and tools that are functional to distance teaching and its effectiveness. The course, starting from a framework of reference based on evidence-based learning and on the main neuroscientific discoveries, has had the intent to provide the participants with training opportunities, reflection and sharing on issues related to design and evaluation in distance learning.

The training course, for a total of twenty-five hours, was organized as follows:

- 8 2-hour meetings in interactive webinar mode:

Each webinar was organized in two parts: a theoretical-practical presentation part, and a practical application part. The practical application part was different for each session (while maintaining common traits), also depending on the content. There will be short, fully laboratory activities for small groups and interactive activities through feedback sessions with the entire group in training, always in distance teaching mode.

- 9 hours dedicated to teachers' individual activities, supported by tutors for the entire duration of the process

The in-depth work was managed through the Google Classroom environment, appropriately organized and customized before the start of the path, for maximum clarity of fruition and overall management of the path as a single learning process.

Through the Google Classroom environment, they were:

- Manage all course materials, also properly organized during the course;
- Managed the activity of mentoring on the activities carried out.

The first training meeting was carried out via the WebEx platform, which was replaced starting from second meeting given the technical complexity and the relatively limited number of participants. Has been chosen and used the Google meet environment which allowed a lively and rich interaction with one also an equal exchange in video and voice with the participants. At the end of each meeting, the day next, all the material - including the recording of the meeting, the presentations used and different food for thought - it has been suitably loaded on the platform, to allow you to follow the path also in asynchronous mode.

In addition, 8 preparatory laboratory activities were proposed upon release of the certificate and therefore mandatory for those who have not followed the webinars live and strongly recommended to all participants. The total number of teachers enrolled in the training course is 121, while the members of the Google Classroom dedicated to the course are 61.

The route started on Wednesday 27 May 2020 and ended on Monday 6 July 2020.

At the end of the course, participants were given a satisfaction survey, in which they were asked to express a general opinion on the course, the strengths and weaknesses. Analyzing the weaknesses, many said that they had difficulty following the course in synchrony due to the many work and school commitments. Instead, the most emphasized strong point was its unfolding online, with the possibility of performing not only in synchronous but also in asynchronous. And so, the use of the “Open and Distance Learning” methodology has brought FEM a lot of advantages: first of all, the possibility to increase the number of participants by overcoming the time-space barrier typical of the courses in presence. The feedback received was positive and encouraging. The path was very successful, so much so that it was repeated in the following months.

Conclusion

In light of what has been said and analyzed, it is clear that e-learning, whether it is lifelong learning or open learning, is transforming training models. Indeed, the advent of digital technologies has had and will continue to have a significant impact both in everyday use and in teaching practices.

As can be seen from the project implemented by the FEM - Future Education Modena, with right theoretical assumptions, the right attention and design, you can get noteworthy results. Designing means implementing all possible strategies to achieve a certain goal, to bring about effective change.

The course just described was just the starting point for FEM. Given the great success, the number of online courses has been significantly increased. Furthermore, in addition to the increase in the number of participants, the “Open and Distance Learning” approach has also given the possibility to improve the quality of the trainers of the courses. In fact, teachers from different parts of Italy and Europe were invited to the courses promoted subsequently.

Being able to guarantee learning for everyone, respecting everyone's needs in every condition, time and place, is a challenge that contemporary society declares to want to confront

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