THE RESPONSIVE TEACHING/LEARNING REVOLUTION: THE IMPACT OF REQUESTS FOR THE PORTABILITY OF SERVICES AND CONTENTS FOR DISTANCE EDUCATION ON INSTRUCTIONAL MODELS AND TECHNOLOGIES

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ABSTRACT

The innovation that technologies are imposing on services and contents for distance education generally deals with the impact that the new technologies are having on learning habits and the lifestyle of end users. National and international studies and research have shown a continuous orientation of the “average user” towards the use of mobile technologies for information, data, pastimes, communication, socializing, higher education and professional training. Portability is therefore becoming an increasingly more discriminating factor for access and creation/sharing of knowledge that the internet mainly provides and supports. This preliminary sociological and cultural analysis is confirmed from the sales of the latest generation of smartphones and tablets, which are becoming even more predominant compared to their PC and notebook predecessors. This is progressively asking for an important review of methods and instructional design models as well as converting the design/production criteria of didactic multimedia contents according to the so called “responsive” programming and development logic and technologies. In other words, they make services and contents accessible and usable for long distance training via mobiles or desktops or any other type of device.

KEY WORDS: Distance Education, Instructional Design, Mobile Learning, Portability, Responsive Technology

INTRODUCTION

For all web communication operators and professionals, responsive web design represents a new frontier and an essential starting point to reset information access, knowledge and data as well as redesign the rules and principles of web usability.

Helped by the browser evolution and an increasingly greater and transversal spread of mobile technologies which is deeply changing user’s conditions, the “mobile user” experience is extremely different from the “desktop user” one. For this reason, services and digital contents are continuously being characterized as “adaptives”, or in other words, they give a machine-user based experience not only on the basis of intrinsic technology capacities of the single device and the potential of the infrastructures but also the conditions required by the user.

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Despite their technological high performance, advanced mobile devices like smartphones, tablets, netbooks etc. have a relatively low cost and are accessible to many. In virtue of its portability, they improve the timing and way of accessing the web for all communication activities such as socializing, information, leisure as well as learning, education, training and professional development.

Among the new ways of using the latest state of the art technologies, the presence of mobile devices in formal education systems is growing. In schools, the mobile learning world is becoming increasingly predominant through programs which allow the students to take advantage of their mobile device without added costs: this opportunity and lifestyle is well known among workers as Bring Your Own Device (BYOD). This is being constantly implemented within younger communities where there is a large spread of mobile devices.

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3 This expression refers to the company and schooling policies which permits having own devices anywhere. BYOD is making great progress in companies with around 75% of workers in developing countries such as Brazil and Russia and 45% in developed countries using their technology at work.
BYOD began within companies, but is spreading, with enormous success within the education and schooling field in Northern Europe and the United States. The reasons are not too different from the ones which made companies undertake this policy. If schools don’t have adequate budgets, allowing students to bring their own technological devices seems to be an excellent compromise in favoring teaching.
From research conducted by North American Technologies in 2013, the following data concerning the use of digital devices have emerged:

Within this general framework, the request for portable technologies and the recourse to tools, such as tablets, smartphones, etc. in order to access the Internet, is continuously growing, albeit, in a different way depending on the different geographical areas and the technological familiarity that the different populations manifest:
In particular, in Europe, the spread of mobile computing has extended into many sectors: in particular, CERI - Centre for Educational Research and Innovation - regularly mentions the so called new millennium learners\(^4\), to indicate the new ways of studying and the new types of students. A new schooling system emerges from the numerous EU studies and surveys, according to which “…by 2017, there will be 3.4 billion smartphones worldwide…”\(^5\). Students and teachers will be able to access their cloud-based\(^6\) applications via a web browser or a mobile application and share their virtual educational space, thus allowing access to courses, work classes, evaluations and other external resources in any moment and in any context.

Figure 5. European User Internet distribution: data processed by wearesocial.com

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4 http://www.oecd.org/edu/ceri/
5 Data from http://ec.europa.eu/news/environment/140410_it.htm
6 Google Apps, for example, which offers email and a range of software applications is a popular cloud based service. Schools, universities, teachers or students who use Google Apps don’t need to keep a server; they simply need to make sure that they have devices and the necessary internet connection to access Google services. These services are free for users and income comes from advertising.
Recently, the European Commission launched an action plan called Opening up Education to encourage innovation and digital skills in schools and universities and to face the existing educational problems, where over 60% of 9 year old children attend schools which aren’t yet equipped with digital technology. “The Creative Classrooms Lab” led by the European Schoolnet, a public sector consortium financed by thirty education ministers and supported by the European Commission, was set up to deal with this need. Its office deals with all the policy needs of education, research and schools.

By 2030, it is believed that the formal education systems will be drastically different compared to the current ones; while schools will remain the chosen learning locations. New models of supplying education will be continuously outlined by adopting mobile technologies in order to embrace the students who were previously unreachable. A way in which education institutions can expand their range without increasing costs is represented by online education and remote teaching/learning.

The Khan Academy, for example is a non-profit educational organization whose mission is to offer high quality training to whoever, wherever. The site gives free access to over 3,900 videos of mini-lessons (YouTube) of the 230 million lessons offered up to now (Khan Academy, 2013). Another example is a new partnership between MIT and Harvard University called EDX which offers free online courses and where students have access to an online community.

The growing popularity of this new teaching is linked to the aforementioned BYOD: it gives the student the possibility of autonomously choosing specific applications for their tablet and facilitating the construction of their personalized learning environment with all resources, tools and materials aimed at a given didactic purpose.

In some state of the art American universities and schools, the exploitation of apps in iTunes and the Android market have also become essential for recruitment and enrolments. Some universities, like Missouri State, have incorporated their catalogues on the iTunes U apps, making it easier for students to download video conferences and other didactic material as well as subscribe to a course while on a Wi-Fi connection. Many applications allow for note taking and to send them immediately to friends/colleagues by publishing the material produced instantaneously on social networks. Students who use Evernote, for example can share digital notebooks and see images, videos and textual real time updates among each other.

Many institutions rely on handheld computers and substitute them with heavy laboratory devices which are almost always non-portable or particularly expensive. At Wooster College in Ohio, geology students use the iPad to study the peculiarities of the Icelandic territory and students who attend the Redlands college in Australia use this application to gather and share data about native rocks. Immediate access to the registration and use of analytical tools allows for a direct and active form of learning, even if not physically moving away from the location.

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8 http://creative.eun.org/partners
9 UNESCO, Turning on mobile learning, 2012
10 https://www.khanacademy.org/
11 https://www.edx.org
12 https://evernote.com/intl/it/
13 go.nmc.org/woost
In the past two years, many school and universities have launched pilot programs where each student has been given a preloaded tablet with useful didactic material. When, for various reasons, digitalization and virtualization of the learning/teaching process through mobile technologies isn’t possible anymore, many universities will make digital didactic materials through check out systems through which students can “borrow” parts of the course and complete their preparation (examples can be seen at Aurora Community College in Colorado, Richmond University or South Carolina University). The noble Stanford University of Medicine has recently distributed iPads to freshers in order to share the activities done in classrooms and laboratories.

In Europe, the European Commission has taken on a fundamental role in researching mobile learning, thanks in part to the countries who have contributed significantly such as the United Kingdom, Netherlands and Denmark. The “Mobile Learning Network” has been the largest and most diversified initiative of mobile learning in Europe. Set up between 2007 and 2010, the program involved almost 40,000 students and over 7,000 employees. A large effort was also made in the Netherlands to promote mobile learning through financed projects at a national level. This combined the work of research entities, applied science universities and important foundations like “Kennisnet” which supports didactics 2.0 in schools through the “Arena” project by concentrating on the increased reality.

In addition to the United Kingdom and the Netherlands, Denmark is one of the few countries in Europe where the government showed a certain interest for mobile learning. The Danish science minister gave 9 million Danish Coronas (about 1 million euros) to finance pilot projects centered upon cell phone didactics. In these projects, multimedia readers and podcasting were utilized in order to:

- Supply educational contents for students from schools to universities;
- Supply audio visual aids to specialized doctors;
- Help students suffering with dyslexia;
- Raise awareness on themes linked to health and sport for youngsters;
- Fight against obesity among the youth;
- Make continuous training courses flexible for workers.

In Switzerland and Norway, thanks to “Projectschool Goldau”, all students in their fifth year possessed an Apple iPhone 3G to use in a constant personal learning environment.

To complement this international and European framework and to better understand the potential of distance training systems in Italian schools and universities, it is worth mentioning the Italian ICT market trend and the level of familiarity that Italians have towards technology and Internet access as well as their preferences in choosing a suitable device.

In Italy, the use of mobile devices has exponentially grown in the past few years and especially among the so-called digital natives:

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14 The Geisel School of Medicine at Dartmouth College (USA), for example, adopted this type of program with the iPad by sharing its discoveries and resources via a web site: go.nmc.org/geisel
15 http://www.molenet.org.uk/
16 http://www.kennisnet.nl/
17 http://www.phsz.ch/research/ongoing-projects/
The 2013 CENSIS data is very clear in this respect: "Fiber optic connections are the most popular internet connections at the moment: 63.9% of internet users use it. Wi-Fi is growing considerably (40.9%, among the youth, 46.7%) and mobile connections have almost reached a significant amount (23.5%). Whoever adopted bio media quickly uses Wi-Fi or mobile connections on smartphones and tablets. There are the «mobile connected» ones (8.1% of Italian internet users), who connect themselves for an average of 3 hours daily, and 'super mobiles', who turn to mobile connections beyond the three hours and are therefore considered 'always on' (11.5%)"\textsuperscript{18}

\textsuperscript{18} http://www.censis.it/?shadow_comunicato_stampa=120930
NEW LIFESTYLES, NEW ACCESS TO KNOWLEDGE AND NEW TEACHING/LEARNING MODELS

The latest generation of technological devices are continuously getting closer to the cloud computing perspective by triggering various hypotheses in relation to the educational models of the 21st century; for some time, we have been talking about “learning without a continuity solution”, defined as the continuous learning through both formal and informal settings. Until a few years ago, there was a discrepancy between formal and informal learning, but nowadays, many experts are now asking themselves how mobile learning will overcome that barrier. Researchers in Singapore have concentrated themselves on how mobile technologies can facilitate primary school students within different contexts. Seamless, a three-year long Malaysian study, introduced the concept of mobile devices for learning with the aim of integrating personal learning tools and draft out a report on where the history of the individual student and the resources used by them are stored in order to educationally progress.

The research identified ten learning dimensions without a continuity solution, which included:

- Formal learning;
- Informal learning;
- Personalized and social learning;
- Learning through time;
- Experience through locations;
- Continuous access to physical and digital knowledge;
- Access to many types of devices;
- Diversified learning activities;
- Knowledge summary;
- Several pedagogic/andragogic models.

Further to this, mobile technologies improve in quality and progressively the costs fall: it deals with a natural movement towards digital mobile which could increase the educational opportunities for students worldwide and for those who aren’t so fortunate.

In any case, it is certain that technology will continue to change the way of “doing education” and it is important that the educators understand the extent of these innovations in detail by handling them so that it positively influences development rather than contrasting it.

The new teaching/learning forms will continuously be linked to individual creativity, shared knowledge, talent and the experience of the single student which will influence the other class members (virtual?). Training by searching influences the knowledge of each single participant by eliciting changes and strengthening the mental elasticity that appears indispensable today.

Social computing will open a large variety of new channels for knowledge distribution, which will facilitate access and exchange of formal and informal learning materials; already now, blogs

19 http://www.seamless.com.sg/about.html
20 http://lsl.nie.edu.sg/people/researchers/wong-lung-hsiang
21 The computing sector deals with the study of phenomena linked to the commission between social behavior and computing systems.
can be used among groups of students to build a body of interrelated knowledge with posts and comments and wiki is used to set up repositories, suitable to collect materials and organize different contributions. A well-structured wiki allows teachers to gather ideas, materials and links by creating a resource which is maintained in a permanent way and which can be easily extended allowing anyone to contribute.

Therefore, the transformation in the ways of studying and learning due to new technologies isn’t only the changing ways of access to knowledge of final users and beneficiaries of these processes. Teachers and lecturers need to remodel the teaching processes by seriously taking the potentials of technologies into account and acting on the changing lifestyles and learning methods of students. In other words, within the schooling and university context of a digital “native” generation, the students, who are obviously oriented towards the use of technologies, envisage the need to form a generation of digital “strangers”. In other words, teachers, who often come from an extremely traditional teaching approach ignore the potentials of technology in training and even more serious is that they often underestimate the social and cultural impact.

The fundamental questions therefore is: how do you teach in an age of Facebook, Twitter and YouTube? How do you reinvent the role of pedagogy and andragogy when information learning is deeply penetrated within the Internet backbone and which continuously transforms the space-temporal study conditions and ways to access knowledge as well as the primary resources of curiosity, attention and concentration of individuals?

Therefore from the traditional face-to-face teaching/learning process and from the more recent knowledge sharing process, we can progressively achieve social learning.

It is worth remembering that the growing number of users/students that possess mobile devices unconsciously encourage the level of “personalization” of the PLE – Personal Learning Environment: this creates a small but significant break from the traditional idea of school or university as single locations and communities dedicated to the acquisition of knowledge creating the LCMS platform – Learning Content Management System – designed for structured and formal online learning/teaching services and contents.

Another transformation that mobile technologies are experiencing is the progressive gamification of learning/teaching processes, or rather the ludic use of study objects in non-ludic contexts to allow for greater levels of user involvement. With this, there is the assignment of points, to reward those who obtain positive results in knowledge and/or shared knowledge and information from social networking websites. Communication, socialization and enjoyment thus mix themselves within the learning/teaching processes by always leaving a huge space for manoeuvre and personalization for the user, who is often the “player” within the training/game path. To better understand what we mean for “gamification” and what its practical application in distance training is, we can make reference to the following paragraph.

Furthermore, mobile technology allows for the expansion of experiential and location-based learning, consenting, for example, visits and explorations of historical sites in similar and realistic virtual environments, where 3D technologies are more appealing and encouraging.

Even in this case, the boundary between learning and edu-tainment becomes more weak. The response to this risk of technological overexposure with a consequent cognitive overload and loss of didactic focus is implicit in the good practices of instructional design, or in other words, in the complex of narration techniques and methods aimed at transferring knowledge and
learning. Whoever designs remote learning paths must always consider the balance among the various factors: the real needs of “things to know” by the final user; his/her level of familiarity with the technologies; his/her autonomy in selecting and gaining learning content from the exhibition and visual representation form; his/her capability in correctly integrating the formal and informal learning aspect; his/her willingness to let him/herself go from an emotional point of view; the final overall effectiveness of the implemented teaching/learning path. In substance, if the reality “increases” together with an increase in the technological complexity load, cognitive capabilities and personal elaboration on who learns should “increase”.

And for this reason, the instructional designers must always keep the new accessibility and usability imposed by mobile technologies into account.

The teachers themselves should know and master the methodologies and techniques of instructional design in order to orientate the training paths within new technological environments and re-calibrate the learning aims to pursue. New technologies for training require new knowledge and skills from those who learn and especially teachers: ability to design paths and interactive and multimedia didactic objects, knowledge of the main functionalities and services/contents of the e-learning platform, general notions and competencies of content management for the web, knowledge of the social learning tools available on the web, usability notions of didactic contents for mobile devices, ability to implement and manage training events in real time, etc. and – more generally – a sensitivity to the changes that technology imposes with continuously accelerated patterns.

**NEW INSTRUCTIONAL DESIGN MODELS APPLIED TO RESPONSIVE TECHNOLOGY**

Virtual labs and virtual classrooms, complex simulations and serious games and immersive learning in three dimensional environments: the relationship with new technologies often implies that the normal human sensory perception should deal with data and information which has been gathered, selected, processed and transferred electronically according to a way which isn’t practicable through the five senses.

Mobile devices, smartphones, PCs with webcams or other sensors, special glasses for three dimensional viewing, devices which provide audio or “increased” processing realities through added sensitive information via a meta-perception approach are technologies that must orient themselves towards edu-tainment rather than to mere entertainment, by trying to keep the ludic aspect distinct from the training one. These paths must not move away from their educational aim.

Thus, if it’s true that technological development of ludic elements, like for example, the interaction with other players or the connection to systems and services like social networks\(^\text{22}\), GPS, etc. enrich the didactic experience by extending form and content, then it is just as true that the preventative management is determining – already in the design stage - all of these variables.

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\(^{22}\) In this regard, it is worth mentioning the MMOG (massive multiplayer online games) for computers that are capable of also supporting thousands of players contemporarily on the Internet.
What is certain is that the request of a similar “ludic” approach to education has incremented in the past few years thanks to the extension of social and mobile games designed for smartphones and tablets.

In the gamification process:

- the activity can be learnt easily;
- the actions of the player can be measured and evaluated;
- feedback can be given to the player in a timely fashion;
- the objectives requested are short or mid-term;
- the management of resources is one of the capacities requested;
- acquisition of a positive reinforcement as a reward.

By interactively exploiting and mixing enjoyment in an intelligent way, gamification can become a very effective way to channel messages and introduce active behavior. In order to favour these performances, the game must promote the creation and narration of interesting plots through appropriate avatars, intended as imaginary alter-egos of the user, by keeping in mind that the game is structured on the search of a solution where there is a challenge to face and a problem to resolve. The ludic interaction allows the user to view common situations from different perspectives. Among the new and more complex products linked to gamification, there are Alternative Reality Games (ARG), which are experiences that require various media types to involve the highest number of users based on the resolution of enigmas within a boundary between game and reality.

Nevertheless, the introduction of gamification techniques in educational practices isn’t difficult, in that we need to consider:

- the very high development costs and the market share for the producers;
- the resistance to innovation by educational institutions;
- schools which are reluctant to substitute the traditional manual didactics;
- the prejudices of the educational community;
- the difficulty of evaluating ludic learning;
- the different access to computing devices than can notably vary from one institution to another as well as from one area to another.

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24 In 2006, this was already discussed: http://www.lastampa.it/2006/04/27/blogs/over-game/alternate-reality-game-giocare-a-meta-tra-internet-e-il-mondo-reale-N5DQQP95VmISnAFbwOBcl/pagina.html

25 The NMC Horizon Report
Nowadays, it is evident that the growing request for portable services and contents for the web, including those characteristics of distance education systems, requires a rethink in the design path criteria and multimedia objects and an in-depth study of technologies that are physically available and applicable these days.

For example, Flash technology that once monopolized the multimedia production destined for the web has been abandoned (now it is an obsolete and incompatible technology with the new portability criteria).

New programming and development programs have begun to be studied and applied (for example, HTML 5) which is capable of supporting the needs of service/content design for distance education systems, by also changing the expectations of the final quality of the product, or rather partially sacrificing the recourse to interfaces and contents which are particularly rich and varied from a multimedia and interactive point of view and which enhances the usability and portability.

For example, compared to the possibility of multimedia didactic contents on offer which are typical for desktop users/learners, today, it isn’t recommended to force mobile users/learners to download particularly heavy audio/video contributions to their device: the battery life needs to be taken into consideration. This once again, means looking at the treatment criteria of multimedia contributions by changing the design towards usability and portability and prefer, in this case, a smaller sized “audio/video” contribution with greater significance or even convertible into a downloadable text.

Let’s see in detail what we mean by “usability” in the mobile technology era and what the main rules to follow are in the general design of multimedia didactic objects as well as what
technological solutions need to be used for graphics, programming and development. Generally, web usability is the application of usable principles within those settings where web navigation can be considered as a general paradigm in order to design and implement a graphical interface. The ISO/IEC 2001\(^{26}\) normative defines the usability as “the capacity of a system in being understood, learnt, used and attractive for users when under specific conditions”.

- The understandability of a site concerns the effort needed to understand the system.
- The learnability concerns the effort needed by the user to learn from the system.
- The usability refers to the effort required by the user to use the system from its controls.

The usability is the level in which a product can be used by particular users to achieve certain objectives effectively, efficiently and satisfying in a specific context, intended as:

- Effectiveness like precision and completeness with which users reach specific objectives;
- Efficiency like the resources used in relation with the precision and completeness that the users achieved the specific objectives;
- Satisfaction, free from problems and a positive attitude on how the users achieved specific objectives through the use of the product.

Whoever designs user materials must realize that new technologies require complex programming/developing languages for the production of multimedia interactive objects: the choice between HTML programming rather than PHP, ActionScript instead of Silverlight, the use of audio/video montage in After Effects or the rendering in 3D Studio Max can affect the usability of the object. Its compatibility with the typical SCORM requirements of distance education platforms and navigation through the most common browsers also need to be considered. In particular, who designs, implements and supplies education through technologies must always keep the characteristics of responsiveness imposed by mobile technologies into account.

In the development of multimedia and interactive objects for mobile technologies, the user interface can be adapted under several aspects:

- presentation, including the support and the interaction techniques;
- layout;
- graphic attributes;
- navigation structure;
- dynamic activation;
- deactivation of interaction techniques;
- content, including text, labels, images, videos.

In order to make mobile devices more useful and pleasant at the same time, vocal interfaces that can take on an important role in different contexts are being experimented for:

- users with visual disabilities;
- users in movement;
- when the visual channel is occupied.

\(^{26}\) http://www.iso.org/iso/catalogue_detail.htm?csnumber=22749
The vocal interactive applications have specific features that make them different from the graphical, simultaneous and persistent ones. Vocal technology is improving in any case\textsuperscript{27} and navigation based on a vocal menus are accurately designed to consider the needs of continuous feedback in order to verify the state of the application, which should give ad hoc instructions to reduce storage, effort and support the management of specific events (no-entrance, no-match, help).

Particular attention must also be paid to the choice of a graphical line, as well as the normal accessibility and usability constraints which these reconstructed environments must have such as the traceability conditions towards the platforms they are implemented in.

The statistical (icons, images, graphs) or dynamic (motion graphics) representations are nothing but one of the possible ingredients of multimedia. The most modern interface of mobile devices is linked to a design which is flat, linear, simple, without three dimensional effects like shadows, thickness, gradients, but well placed images and few color contrasts with different use of characters. The graphical and visual appeal of the latest generation of devices is characterized therefore by absolute simplicity which should be pleasant, easy to understand and readable for the user.

From the point of view of a general working approach, the graphic design criteria and tools remain unchanged. However, the design layout has changed to cope with the mobile version, which evolves itself by generally offering more graphical objects in the tablet and desktop layouts. The animations should be thought/studied and not produced directly just as it was done in the past with Flash technology. The study and production of transitions and interactive animation effects will be done by the programmer in close collaboration with the graphic designer who will outline the guidelines (what type of animation was thought of and designed for that specific object).

When the layout for a responsive site is designed, the first thing to avoid is horizontal scrolling. Secondly, the main content should be shown towards the top of the screen. In substance, when a smartphone site/object is designed, it is vital to “forget” the desktop version and think about a selection of contents. The navigation must be immediate and the contents proposed need to be reduced in quantity by inserting abstracts followed by buttons which allow for the download of the whole text. When the mobile version is designed, the page must be leaner and strictly contain what is needed. The content is effectively what must be shown to the user. The thumb thus becomes the “unit of measurement of the mobile site”, because the thumb controls the devices (logic of touch and not click). The design of graphic elements must therefore keep the so called “fat finger” into account and avoid buttons which are too small or too close to each other.

As opposed to the old technologies used for development of objects used in desktop versions, today, the most popular technical programming/ development languages for the production of complex didactic objects via a “responsive” approach are: HTML5, CSS3, jQuery, Bootstrap, jQuery Mobile, etc. For online solutions: AngularJS, Json, Php, SCORM, etc.

Lastly, it is worth reflecting on when and why it is preferable to have online use rather than offline use. The response to a multimedia didactic production which provides its usage without internet and removable devices (CDs, USB keys, direct downloads) guarantees that there is a greater flexibility in its use, but precludes several impossible functionalities to implement without having an internet connection.

\textsuperscript{27} Google voice search and navigation map or iPhone’s Siri
Below is a summary of the pros and cons of Internet usage:

<table>
<thead>
<tr>
<th>OFF-LINE</th>
<th>ON-LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td><strong>Pros</strong></td>
</tr>
<tr>
<td>• Possibility of using content offline.</td>
<td>• Use of a database.</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td><strong>Cons</strong></td>
</tr>
<tr>
<td>• Use is limited to devices which have removable storage systems or mobile devices which have at least accessed the internet once only.</td>
<td>• Report/tracking systems.</td>
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<tr>
<td></td>
<td>• Authentication systems.</td>
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<tr>
<td></td>
<td>• Automatic updates of contents.</td>
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<td></td>
<td>• Georeferencing.</td>
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<tr>
<td></td>
<td>• Audio/video streaming.</td>
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<tr>
<td></td>
<td>• Notification systems.</td>
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<tr>
<td></td>
<td>• Impossible to use the content offline.</td>
</tr>
</tbody>
</table>

Figure 8. Pros and Cons of Internet usage in distance education

Every so often, all technology mentioned above must be selected, applied and eventually personalized for the production of complex multimedia didactic products (videolessons, virtual labs, simulations, serious games, photo/video-gallery, interdisciplinary paths, exercises, complex exercises, etc.), suitable both for offline and online use internally or externally to SCORM 1.2 compliant platforms which respect the minimum requirements of the languages mentioned up to now. This, within the general respect of the didactic design needs and learning aims that the learning objects seeks.

The layout should be produced with responsive structures suitable to the correct visualization on all fixed and mobile devices (smartphones, tablets, PC/MACs). In this respect, the didactic contents should be thought out thoroughly in order to favor its use by small/medium sized telephones; it is advised therefore to avoid, when possible, very long textual contents in favor of downloadable materials and thus avoiding the fragmentation/dispersion of didactic contents on various devices.

The same consideration needs to be done for the minimum sizes of interactive graphical elements for smartphones or tablets, where sensitive click/touch areas should be presented in a greater way than traditional ways like the mouse.

The exercise components should be reconsidered by exclusively exploiting the standard HTML modules and avoiding dragging objects or interactions with 3D objects wherever possible. Audio/video streams should be necessarily provided through new audio and video TAG in HTML5 in formats which are ideal for mobile streaming as well as being compatible with all browsers currently available on the market. Therefore, the player controls can’t be personalized graphically.

The compatible audio/video formats for responsive technology should be selected among: Mp4s, WebM and Ogv. The audio formats, among: Mp3 and Ogg.
The traditional instructional design approach to formal systems of distance education has been overcome nowadays: the technological revolution, their penetration in the final user's lifestyles, the decisive influence on ways, time and learning locations brings about a general, systemic and capillary rethinking of the design and production criteria of services and contents for remote teaching/learning.

Nevertheless, the challenge remains that of shaping, personalizing – also "stressing" – technology until it continues to respond with effectiveness and efficiency to the educational needs of the final users and the expectations of knowledge acquisition, skills and abilities that these express, and more generally, to the spread, sharing and value of knowing.
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