Models and Instruments for Assessing Digital Competence at School

Antonio Calvani[1], Antonio Cartelli[2], Antonio Fini[1], Maria Ranieri[1]

[1]Università di Firenze, [2]Università di Cassino

calvani@unifi.it, cartan@unicas.it, antonio.fini@unifi.it, maria.ranieri@unifi.it

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Abstract

How digital competence can be defined and assessed? One of the most known instruments to certificate IT skills is the European Computer Driving License (ECDL), but it focuses on the mastery of specific technical skills while neglecting dimensions which are pedagogically significant.
In such a context, our research group developed a conceptual model for the notion of digital competence based on three dimensions: technological, cognitive and ethical. Grounding on this model, we worked out and tested an instrument (Instant DCA) to assess digital competence in students aged 15/16 years.

Introduction

In December 2006 the European Parliament and the Council released the Recommendation on Key Competences for Lifelong Learning (2006/962/EC), where a new framework for key competences is outlined. The emerging idea is clear: the traditional framework centred on literacy and numeracy and which have represented over the years the minimal goal educational institutes had to accomplish to prepare citizens, needs to be redefined in a more complex way. It has to encompass other new competences among which is digital competence.

However, while figuring out how this competence could be introduced into schools, we discovered that there are no adequate instruments to assess and promote this competence. Although theoretical analyses on this subject have increased over the last years and the use of ICTs is becoming more and more widespread in schools, current instruments and projects on this subject in educational contexts are really few. There are various certifications for basic IT skills, provided by foundations or private associations. The most renowned in Europe is the European Computer Driving License (ECDL). This project gained merit for calling the attention of educational institutions to the need for developing IT skills for all. However, over the last years the limits of this instrument have become more evident because it focuses on the mastery of specific technical skills with scarce emphasis on useful competences for everyday life (Alfonsi et al., 2006; Fini, 2007).

In the meantime other organizations and theoretical analyses have pointed out the need for an alternative vision to the one focalized on the mastery of technical skills: the competence we are dealing with entails a critical understanding of technologies, a cognitive and cultural background, and in particular the ability to select and manage information, along with relational and ethical awareness.

We have therefore designed and implemented a set of assessment tools called Digital Competence Assessment (DCA), which addresses students aged 15 to 16, and which consists of three sections: the first section is based on instant quantitative tests with automatic feedback (Instant DCA); the second one focuses on situated and complex tests (Situated DCA); the last one consists of projective tests (Projective DCA).

After a brief literature review, we shall introduce our conceptual model for digital competence and discuss the instruments we have developed, especially the Instant DCA, which is now available on the Internet for the schools that are willing to test it.

2 A conceptual framework for digital competence

The expressions Digital Literacy and Digital Competence are now gaining ground on the international level, both in literature and in the reports

produced by international bodies.

There is wide agreement among researchers that different types of literacies related to ICTs and more generally to the media, all converge to the concept of digital literacy (Tornero, 2004; Martin 2006; Midoro, 2007). This explains why, on one hand, there is a variety of terms used to refer to this concept (i.e. computer/IT Literacy, Information Literacy, Media Literacy, Media Education, just to mention some of the most common expressions), whereas on the other hand the emphasis is alternately placed on one aspect or another.

Gilster (1997) first used and defined the term digital literacy, emphasizing the ability for critical thinking rather than the IT skills.

In the span of ten years, the definitions have multiplied. Some authors underline that digital literacy is the result of a stratified and complex integration of capabilities, skills and knowledge. For example, Tornero states (2004): «Digital literacy merges capabilities: purely technical aspects, intellectual competences and also competences related to responsible citizenship. They all allow individuals to develop themselves completely in information society» (2004, p. 31).

Starting off from the theoretical perspectives of Media Education, other authors shift the accent on critical understanding of media and their social, economic and cultural implications (Buckingham, 2007; Pietrass, 2007).

Besides the theoretical reflection of these authors, it is also important to recall the works conducted by some organizations on the concepts of IT Literacy and Information Literacy.

Over the last years the concept of IT Literacy has evolved towards more reflexive rather than technical approaches to ICTs, as emerged from the ICT Literacy Panel proposed in 2002 by the ETS (Educational Testing Service). In the ETS Panel the concept of ICT Literacy indicates the ability to use communication technologies and tools to access, manage, integrate, evaluate and create information in order to be able to integrate it successfully with everyday life. Grounding on this model, an ICT Assessment tool has been developed by the research group of PISA. This tool, which is still being tested, includes various sections: basic technical skills, short scenarios (dealing with basic functions of e-mail), web search (ability to select and evaluate internet research) and simulation task (a more complex area dealing with the understanding of experimental models).

At the same time, research on Information Literacy has been developing. In particular, in 2000 the Association of College and Research Libraries (ACRL) promoted new standards for the definition of Information Literacy, where the capacity of determining the nature and extent of the information needed and the ability to critically evaluate information are

indicated as essential components (ACRL, 2000, pp. 8-13).

Beyond the terms used, the awareness that we are dealing with a complex concept emerges from all the authors. Digital literacy or competence is not the result of simple elements of ability or instrumental knowledge, but rather a complex integration between cognitive processes and dimensions as well as methodological and ethical awareness.

Among the various expressions used, we adopted the term «digital competence» in order to be in line with the European Recommendation and also because the term «competence» is rapidly spreading in the educational language.

However, in our vision, this concept has to be preserved from any possible reductionism. The concept of digital competence we want to pursue is:

- multidimensional: it implies integration between abilities and skills of cognitive, relational and social nature;
- complex: it is not completely quantifiable with single tests; some aspects of this competence are difficult to assess, at least in the short term, and may remain concealed, requiring more time and very differentiated contexts before coming to surface;
- interconnected: it is not independent from key competences with which it overlaps (for instance, reading, problem solving, numeracy, logical, inferential, and metacognitive skills);
- sensitive to the socio-cultural context: it would not be reasonable to think of a unique model of digital literacy adequate at all times and in all contexts; the meaning of this literacy partly will change also according to the various educational settings (basic training, professional training, lifelong learning, specialized training).

A simple but exhaustive definition for our purpose is the following:

Digital competence consists in being able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations.

The capacity of facing new situations is an element which characterizes more and more the typical requirements of contemporary society: in any workplace individuals often have to use new tools and applications. The capability of adapting their own pre-existing knowledge to an unknown technology is therefore an aspect of great relevance, but scarcely enhanced in the educational context, where on the contrary, the tendency to verify the memorization of already acquired knowledge prevails.

Other aspects concern the ability to use technologies on three different levels: search for information, problem solving, and collaborative knowledge building. This last level must be supported by the capacity of acting in the cyberspace while safeguarding oneself and interacting with others in a responsible way.

The definition we proposed emphasizes the co-existence of dimensions characterised both on the technological, cognitive and ethical levels, and also their integration:

- technological dimension: being able to explore and face problems and new technological contexts in a flexible way;
- cognitive dimension: being able to read, select, interpret and evaluate data and information taking into account their pertinence and reliability;
- ethical dimension: being able to interact with other individuals constructively and with sense of responsibility using available technologies;
- integration between the three dimensions: understanding the potential offered by technologies which enable individuals to share information and collaboratively build new knowledge.

The chart below (Figure 1) summarizes the adopted model.

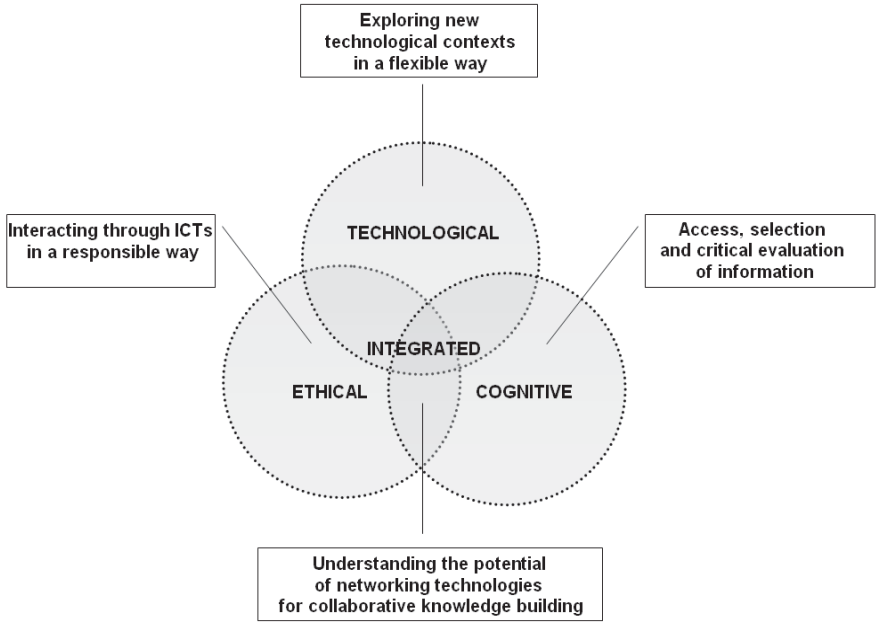

Figure 1 - Digital Competence Framework

3 How to assess Digital Competence?

What instruments could be used to assess digital competence and supply useful guidelines to promote it? How reliable could be such instruments considering the complexity of this competence?

On one hand, the traditional problem of making the choice between open or closed questions has to be faced. On the other hand, the awareness that, apart from the instruments themselves, any type of isolated testing over a period of time provides a partial and temporary representation of a person's situation, makes the task of designing the instrument a critical issue.

However, what matters most when choosing an instrument, is the awareness about the nature of the entity that has to be assessed. Some knowledge may be adequately assessed through multiple-choice questions. This is the case for certain cognitive skills such as linguistic or logical skills, but much less for critical (e.g. evaluating information) and ethical-collaborative skills or also for the ability to face new technological contexts. It could also be noted that some components involved in this competence could be assimilated quite fast: for example, some technological notions could be acquired in a relatively short time, even immediately. It is not so in cases of more structural skills (linguistic, logical and critical analysis of information), whereas other knowledge (for instance ethics on privacy, or on collaboration) may be shared on a formal level, but may need time before being effectively put into practice. Briefly, the digital competence assessment field may be divided into two main areas: the first is related to the possibility of acquiring information in a reasonably short time, and the second may require observation to be repeated over time, in order to obtain a more meaningful assessment of the student's reactivity to the educational inputs (Zone of Proximal Development according to the Vygotskian theory).

Within the first area, a section which may undergo a quantitative Instant test may be distinguished from a second section, where more complex tests should be carried out in real contexts (see Figure 2).

Up to now, we have developed tests which can be administered in a few hours (between 1 and 4). They can be divided into Instant quantitative tests (Instant DCA), Situated tests (Situated DCA) and Projective tests (Projective DCA). The Instant DCA tests will be shown in detail in the following section. We briefly add some comments on the Situated DCA and Projective DCA tests, which are still currently undergoing validation and will not therefore be discussed in this paper.

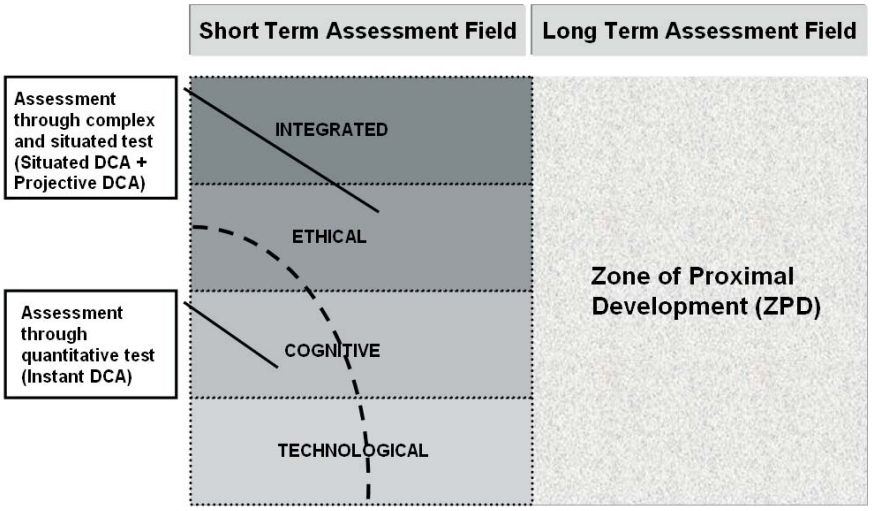

Figure 2 - Digital Competence Assessment.

The Situated tests consist of a set of 4 x 2 (type and level of complexity change). In the first typology of test (Technological Exploration) students have to deal with an unknown technological interface and learn how to use and master it. In the second typology (Simulation) data must be empirically processed and hypotheses on possible relationships have to be formulated. In the third typology (Inquiry) relevant information pertaining to a predefined subject must be critically selected and gathered. Lastly, in the fourth typology (Collaborative Wiki) students have to draft a document together following criteria of collaborative activity management.

The Projective DCA is conceived as a means to meaningfully assess students' attitudes in the medium run. It consists of a set of drawings aiming at exploring the awareness the subject has of the emotional and social impact of the use of ICTs, especially with children and in intercultural contexts. The drawings come with structured assignments in order to orient towards answers within a range of predefined concepts.

4 The Instant DCA

The Instant DCA is as a wide-ranged instrument sensitive to various types of knowledge (linguistic and conceptual skills), which can be gauged with a structured test. It has been conceived as rapid means of assessment, and can be administered by scholastic institutes or single teachers. The complete version of the test is made up of 85 items, including multiple-choice questions

or matching items and a small group of short questions. A shorter version of the test is also available. The items in each level (technological, cognitive and ethical) were further classified in detail (see Figure 3):

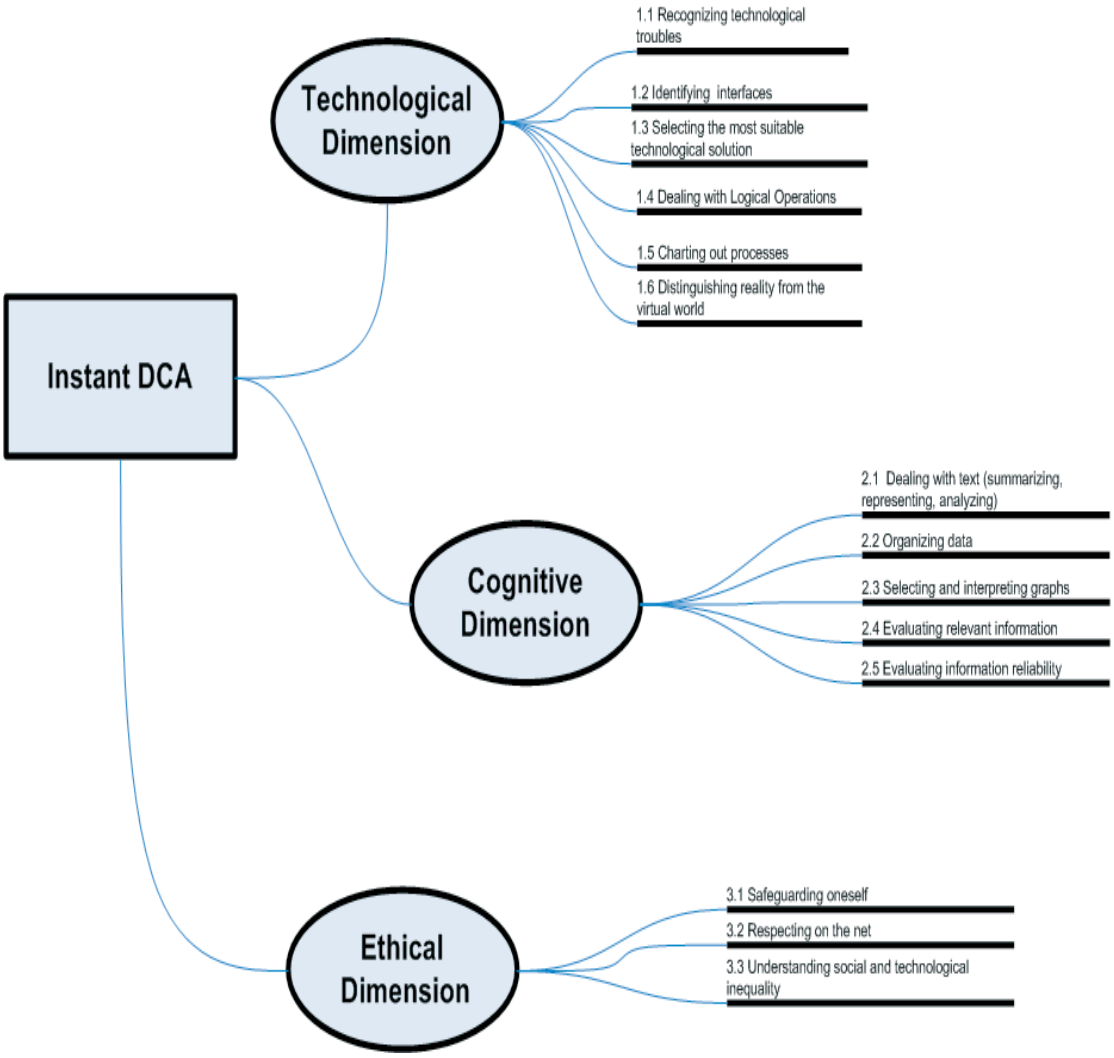

Figure 3 – The Instant DCA's Map

As our purposes were mainly oriented towards educational goals, we enriched the test with some open questions for the cognitive and ethical dimensions. This would allow the students to briefly express their comments along with their answers. These answers of course are not considered in the quantita-

tive computation, but may be useful to the teacher for an in-depth evaluation of the test results. Some items are also followed by feedback explaining why answers are right or wrong, with some suggestions for a deeper study of the issues.

With respect to the ICT-PISA assessment, we did not test the basic technical skills and the short scenarios (see section 2), inasmuch as such skills, in our case, were considered as prerequisites. Instead, we created a section of tests similar to simulation tasks in the Situated DCA. Whereas in the Instant DCA the items related to web searching and evaluation of the relevance and reliability of information remained the same. In the tests we conducted, the technological viewpoint was however more related to "the ability to identify and resolve" the common critical inconveniences one faces when working on the computer and the capacity to understand typical interfaces, rather than that of possessing specific expertise on certain types of software or set-ups.

The tests were implemented through the Open Source LMS Moodle (http://moodle.org) using the functionalities of the Moodle "Quiz" module and adapting them in order to improve the usability of the students' user interface. The general questions on the site are stored within the system, whereas a specific area reserved for each class/school is activated, when requested. Each reserved area is provided with all the types of tests, the documentation to be used, background and follow-up questionnaire, and trial tests to help the user feel at ease with the technological environment. In this way teachers may independently carry out the tests with their own groups of students, without external support from the DCA research group.

The first version of the Instant DCA test was tried out in some Italian schools with students aged 15/16. Through an initial item analysis and with the comments of students and teachers, the first run of the test allowed us to eliminate some questions (either too easy or too difficult) and modify others. In particular, feedback from students was encouraging: they liked the questionnaires, especially their "neutrality" with respect to specific technologies. The usefulness and originality of the ethical dimension was generally appreciated.

The process of revising and evaluating the tests was likewise open to teachers, researchers, university students and collaborators from research institutes, and is still currently underway.

The online version of the Instant DCA test is available at:
www.digitalcompetence.org/moodle.

5 Conclusion

Digital competence stands as an important challenge for the educational systems of the new century. Understanding that this concept cannot be reduced

to a single component, nor can it be assessed with just one type of test is the real crucial point. The adoption of a flexible and integrated approach is therefore needed, without renouncing to define criteria that allow to compare data gathered from the various schools.

In this perspective, despite the great bulk of theoretical analyses, it is surprising the lack of concrete instruments which could allow schools to independently assess digital competence, thus supplying the necessary guidelines for their possible development.

We have presented an assessment tool for digital competence (Instant DCA) oriented to 15/16 year-old students from English or Italian speaking schools.

The next steps of the research aim at increasing the statistical reliability of the instrument and promoting the building of a community of teachers interested in sharing experiences in the use of such instruments.

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