DIGITAL COMPETENCE FOR THE IMPROVEMENT OF SPECIAL EDUCATION TEACHING

Giuseppa Cappuccio
Giuseppa Compagno
Francesca Pedone

University of Palermo, Italy

The increasing digitization and globalization of the media, the broad diversification of media products, with the value-and ethical issues that it raises, proposes and confirms the reasons why media education is to be considered as an indispensable task for anyone involved in education. Thanks to specific educational interventions and appropriate evaluation tools for self-assessment, future educators should be helped to acquire the appropriate media skills necessary to develop the capacity to responsibly and autonomously choose proper media to design their media education courses. The media competence enhances teachers' ability to creatively modify learning spaces and to design a variety of stimulating activities in order to promote their pupils' independent and aware work.
This paper describes the research for the development of three digital skills, in the Academic Year 2014/2015 with 91 in service teachers attending their special education teaching qualification course at the University of Palermo.

Teachers have been involved for 75 hours in experiencing a training methodology for the promotion of media skills necessary to design paths of media education.

1 Introductory notes: special education teachers' digital competence

It is a common assumption that teacher education all over the world has to reflect what is going on in the field of practice. Therefore, information and communication technology (ICT) has to be clearly highlighted in the teacher training curriculum to bridge some of the gaps between actual school settings and teacher education.

Teachers play a decisive role in the uptake and use of technology in classrooms, and experience from teacher education programs is a crucial factor influencing new teachers' use of technology (Drent & Meelissen, 2008). Teacher education programs are, however, criticized for their failure to provide teachers with the necessary experiences related to the use of technology in teaching practices (Instefjord & Munthe, 2016). Competences in using ICT in teachers' professional work and learning constitute one of the main drivers of change when creating powerful learning environments and applying new approaches to teaching.

Digital competence was acknowledged and recommended as one of the eight key competences for lifelong learning for all citizens of the European Union (European Commission, 2006). Since then, a number of challenges have been made towards developing a common understanding of the notion of 'digital competence', and recently in a report from the Joint Research Centre of the European Commission, the Digital Competence has been defined as: the set of knowledge, skills, attitudes, abilities, strategies and awareness that are required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning and socializing (Ferrari 2012, 30).

Digital Competence can be defined as the critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society. Digital Competence is a transversal key competence which enables acquiring other key competences.

Teachers' digital competence is well distinguished from other technology users based on their focus on education and instruction, in addition to everyday digital competence in using technology for personal purposes such as e-mail, social communication and entertainment (Krumsvik, 2008). Some researchers (Kirschner *et al.*, 2008; Krumsvik, 2014) have suggested that teacher education programs should stimulate the pedagogical use of ICT to improve existing tea-

ching practice and contribute to the development of new, innovative teaching practices. Pedagogical use of ICT refers to how teachers use ICT to facilitate student learning and improve inclusion. In relation to the use of ICTs in education, the United Nations Convention on the Rights of Persons with Disabilities (2006) claims that ICT should be considered as a key tool for promoting equity in educational opportunities. For students to become teachers is essential to understand the potentials which educational technology offers in assisting teaching in inclusive classrooms and for accommodation of students with special educational needs. The reason for the importance of ICT in special education is a consequence of the many innovations that have occurred in the ways in which technology can support student with SEN. For this reason, the Italian ministerial programs for the training of specialized teachers for the support of pupils with disabilities provide 75 hours of training on ICT[1].

In this paper we explore further how teacher education aims to prepare pre-service teachers to use technology in their future classrooms. The case in this study is the special education teaching qualification course, run by the University of Palermo according to a teacher education reform to qualify specialized teachers for the support of pupils with disabilities (aged 6 to 18), implemented since 2015.

2 The research

Starting from the theoretical reflection on digital literacy and from the experiences already in store both at a national and international level (Calvani, Fini & Ranieri, 2009; 2011; Trinchero 2006; 2012; Jenkins, 2010), the research for the development of digital competences has been articulated into two actions: the first one has been finalized to plan and to elaborate a formative methodology that would develop specific digital competences of secondary school teachers; the second action tried to experiment and consolidate the formative methodology during technologies and education within the special education teacher training course. The research methodology has been both quantity and qualitative.

The addressees of the experimental intervention were 91 secondary school teachers attending the special education in-service teacher training course run by the University of Palermo. The research plan chosen was that of the quasi-experimental design with one group only embodying both the group of control

---

[1] Studies of both pre-service and in-service teachers have shown that attitudes towards inclusive education were influenced by the type of education and academic preparation they received (Lambe & Bones, 2008). Positive attitudes are not on their own sufficient however to ensure effective practice. Developing well considered quality and innovative learning experiences during pre-service education can help promote positive attitudes by equipping beginning teachers with the skills, dispositions and confidence necessary to teach effectively in an inclusive classroom setting (Lambe *et al.*, 2013).

and the experimental group.

2.1 The hypothesis

Within the research, we expected that at the end of the experimental action, the group's performances of the development digital competences concerning the technological, the cognitive and ethic dimension would meaningfully be increased.

Therefore, we hypothesized that the formative methodology used during the Educational Technologies classes would improve teachers':

- selective ability, or rather the knowledge of how to extract from a quantity of information those necessary to solve a problem;
- ability of 'sailing', or rather to orient within hypertext structures;
- ability to know how to read and understand texts;
- ethical competence referred to the responsibility to be assumed for the consequences in the media activity. We also hypothesized that the adoption of the e-portfolio in the training of in service teachers develop their self-evaluation skill leads improve their ability of conscious reflection and makes their technological expertise explicit.

2.2 Assessment methods

We used different assessment tools in order to monitor and evaluate initial competences, intermediate improvements and final outcomes of the project. The overall strategy was aimed at improving the digital teaching skills of those teachers involved in the research. Before designing the exercises and selecting the methods suitable for the evaluation of the intervention results, we clearly defined which characteristics were most relevant for school success. The initial assessment of students' characteristics required triangulation, comparison and integration of information gathered from different sources. In particular, we used the Instant DCA (Digital Competence Assessment) by Calvani, Fini and Ranieri (2011) for the survey of the digital competences, for the construction of the profiles of digital competence and the e-portfolio of the activities (declined by every profile of competence), and for the tests administered during the course.

2.2.1 The Instant DCA

The Instant DCA is considered as a rapid tool of assessment which can be used by schools, group of schools or even teachers working in single classes. It offers a completely automatic user-friendly assessment method. Operatively the three dimensions (technological, cognitive, ethical) are divided into subca-

tegories. The technological dimension was limited to three subcategories, two of a practical nature (recognizing interfaces and solving common problems) and a more abstract one (understanding how the underlying technology works). As to the cognitive dimension, which is the most significant one, Calvani, Fini and Ranieri (2011) have focused on activities such as extracting important data from a text, judging the reliability of information, comparing contrasting information, organizing data in tables and making inferences. Such activities represent an arena where traditional literacy and digital competence clearly overlap. The ethical dimension is divided into three subcategories: safety, respect and awareness of technological inequalities.

As the authors' purposes were mainly oriented towards educational goals, we enriched the test with some open questions for the cognitive and ethical dimensions. It allowed the teachers to briefly express their comments along with their answers. These answers of course are not considered in the quantitative 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. We used the Instant DCA because it is in line with the three crucial dimensions that, according to Jenkins (2010), justify the educational intervention on the media: the first one is related to the access to technologies (participation gap), the second one refers to the critical understanding of the media (transparency problem) and the third one concerns the ethical dimension.
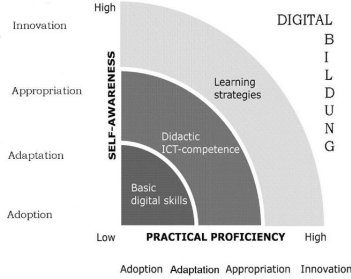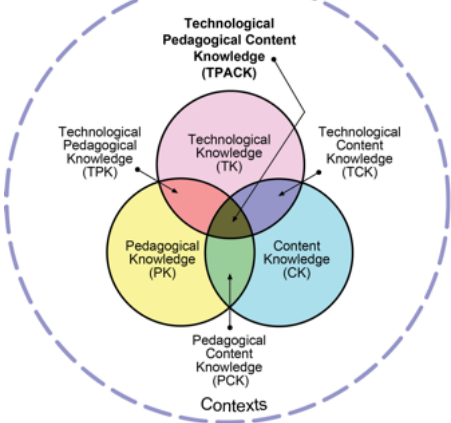
2.2.2 The e-Portfolio to self-assess digital competence

Here we report on the use of the e-portfolio to assess some aspects of the ITC (75 hours) classes within the special education in service teacher training.

Learning to be a teacher is a complex process and a developmentally based portfolio that is open-ended, performance based and authentic (in that it is classroom based) offers a multi-dimensional approach to assessment that acknowledges this complexity. Portfolios are argued to be suited for not only learning purposes, but also assessment purposes (Admiral *et al.*, 2011) as they represent: «a way to define, display, and store evidence of a teacher's knowledge and skills that is based on multiple sources of evidence collected over time in authentic settings» (Delandshere & Arens, 2003, 58).

The development of a professional portfolio allows the performance of in service trainee teachers to be assessed in different ways by offering the means to collect, organize, interpret and reflect on their learning and practice. Portfolios also help in service trainee teachers understand and reflect upon the expectations of professional standards, in a functional, adaptable and portable way (Lambe *et al.*, 2013).

The theoretical framework for the e-portfolio construction contains the Digital Competence Framework by Calvani and colleagues (2009) described above as well as the two models proposed by Krumvik (2008) and by Koehler & Mishra (2009) summarized in the following table:

Digital Competence Model (Krumsvik, 2007; 2014). The model puts the spotlight on four core components: basic ICT skills, didactic ICT competence, learning strategies, and digital bildung, which is the intersection between the first three components.	
TPACK framework (Koehler & Mishra, 2009). In the figure, three interdependent components of teacher knowledge are incorporated: content knowledge, pedagogical knowledge and technological knowledge. The interactions between these three knowledge, create four other types of knowledge: technological content knowledge, technological pedagogical knowledge, pedagogical content knowledge and, finally, technological pedagogical content knowledge (TPACK) (Harris, Mishra & Koehler, 2009).	

The three models have been further integrated with another one, named "Knowledge Areas" associated with teachers' digital competence: technology proficiency, pedagogical compatibility and social awareness (Zhao *et al.*, 2002). Technology proficiency is understood both as teachers' technical competence and as the knowledge of how to use a specific technology in teaching. The pedagogical compatibility is referred to the compatibility between teacher's pedagogical beliefs and technology. Social awareness is focused on the impact of teachers' understanding of and ability to negotiate social aspects of the school culture. This integration model was necessary because digital 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 (Calvani *et al.*, 2008).

In Figure 1, the concepts are referred to in relation to the overarching concept "Teachers' digital competence".
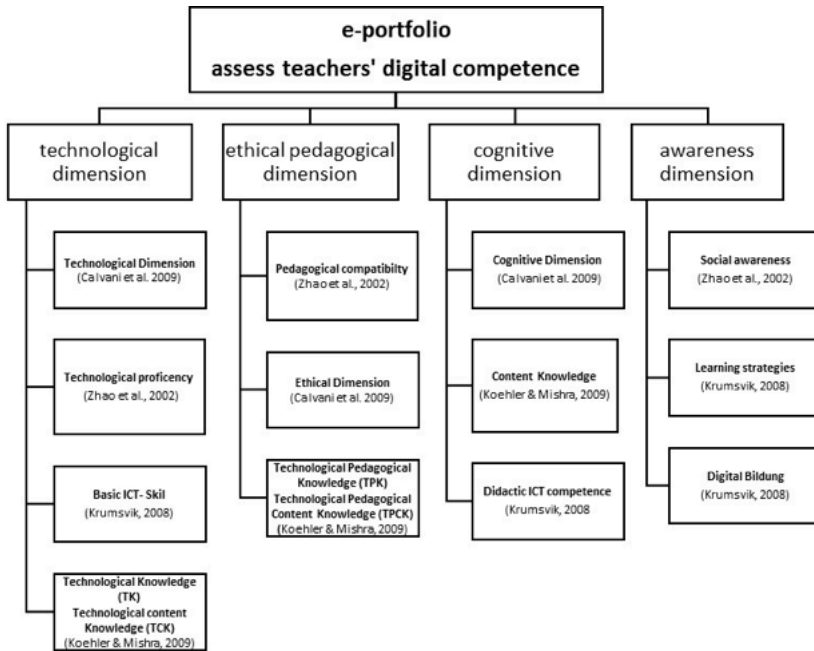

Fig. 1 - e-portfolio assess teachers' digital competence

The e-portfolio is structured in four main sections, partially according to the structure proposed by Rossi and colleagues (2007): My professional profile, Selection, Reflection and Projection.

In the first section, "My professional profile", in service trainee teachers have presented themselves, their needs, their expectations and possible difficulties. In service trainee teachers have shown the learning path previously carried out, any work experience pertaining to the theme of the ICT and school inclusion. In this way, they could make explicit connections between the learned theory and the practice experiences. In this section in service trainee teachers were invited to question about what they knew in relation to the ICT and to inclusion.

The Selection consists of a tool to upload documents of every kind. It is possible to associate a comment to each document selected explaining the motivation of the choice, so the in service trainee teachers have been invited to reflect on the knowledge and skills acquired as well as on the way to use them in the reality of working life.

The Reflection was focused on: the comparison between prior knowledge and new ones; the meaning attributed to the issues covered by the regulations; operational mode considered more effective for new learning; their limits and potentials about the topics covered.

Projection phase the in service trainee teachers need to fill in a form with three fields, explaining the objectives, the level reached and the level still to be reached.

Each author created an index or a concept map of headed pages on which the key elements for assessment were stored. Each 'page' also facilitated a narrative with links leading directly to evidence of competence which can be presented in a range of ways[2].

A framework of key assessment dimension was offered to in service trainee teachers for personal considerations when constructing their e-portfolio. The aim was to encourage the group to reflect fully on their learning so as to provide a range of evidence that showed cognition, observations and interpretations.

3 The experimental process

The activities of the formative methodology, experimented during special education teaching qualification course, pinpoint the three areas adapted by the Instant DCA (technological dimension, cognitive and ethics). The experiment involved 91 teachers of secondary school, aged 31 to 61, who attended the special education teaching qualification course in July, September and December 2015 and was articulated into three main steps.

In the first phase (10th – 31st July), we administered the Instant DCA, we introduced the e-portfolio and we created activities for the development of the three digital competences. In this first phase, while building the activities within the classes of Educational Technologies, we introduced the ordinary factor. Contemporarily, we proceeded to planning the activities for the promotion of the digital competences. At the end of this phase, we had 15 activities finalized to strengthen the entry competences, analysis, evaluation and production of the messages; five activities for every digital (technological, cognitive and ethics) competence.

The second phase (4th September 2015 – 5th February 2016) of the intervention was characterized by the introduction of the experimental factor. The intervention covered a time range of 60 hours. We had a 4 hour weekly meeting

---

[2] The portfolio has compulsory, structured activities and voluntary activities and may contain: selected written documents; screen shots of online discussion and reflective activities; ideas regarding teaching; observational notes on their teaching, and reflections upon their teaching practices; photographs; assignments (both individual and collaborative); resources designed and used during classroom practice; lesson planning documents and evaluations; summaries of relevant theories; tutor and school observations of classroom practice; case studies; evidence of good practice and so on.

for a total of 15 meetings. During every meeting two activities related to two different digital competences were administered. In this second phase, every five meetings we asked the trainees to compile a section of the e-portfolio.

In the third phase (12th February – 10th March 2016), we administered the Instant DCA and we analyzed data.

4 Data collection and analysis

The analysis of the data collected made it possible to grasp the changes that occurred in the teachers; evaluative moments represented an opportunity to make adjustments and reorganizations.

In the initial and final stage of the research process, the Instant DCA questionnaire administered to investigate the technological dimension, the ethical dimension and the cognitive dimension of the students in the face of digital media.

The interviewed teachers who have attended the special education teaching qualification course in the academic year 2014/2015, were 91. Most of them were aged between 31 and 61 years and around 92% came from eastern Sicily, the remaining 8% came from the province of Palermo. 79% of the trainee teachers graduated and the remaining 21% had a degree. While attending the course, the teachers taught in school technical disciplines related to the fields of technology, commerce or hotel management.

4.1 Initial recognition

The initial analysis of the data collected through the Instant DCA test shows a situation which is not exactly brilliant for the trainee teachers surveyed. Examining the scores obtained by the teachers the results achieved are lower than expected.
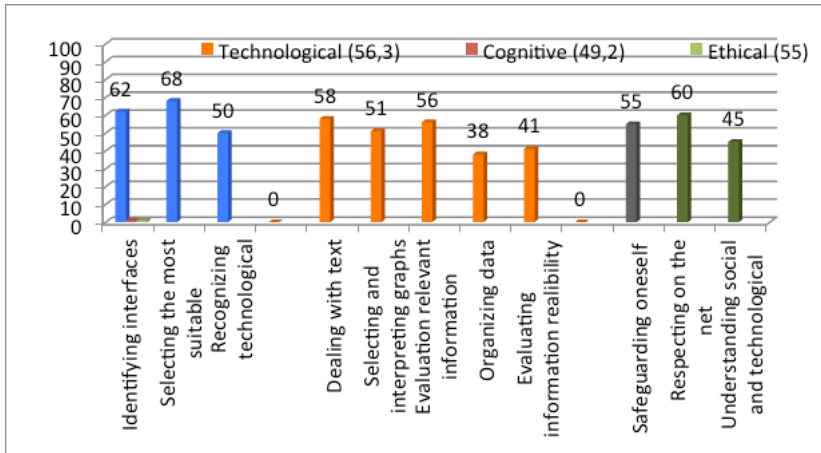
Fig. 2 - Instant DCA analysis

As regards the technological dimension teachers, compared to the analyzed data, may be considered to be sufficiently competent in identifying digital interfaces and symbols and in the resolution of common technical problems while only 41% of them reaches an average value in a more conceptual understanding of the technology.

As to the cognitive dimension, only 46% of respondents reaches the average value of the score as regards the abilities to read, filter, interpret and evaluate data and information from different media, based on their relevance and reliability. In particular, the lowest values were recorded in those questions recalling manipulation, interpretation and drawing of inferences from data organized in graphs and tables as well as facing formal logic problems.

Data referring to the ethical dimension are of a wide variety: the answers to the questions show that teachers (49%) understand, disapprove and recognize behaviors that are against the dignity and respect of the person and of the differences among people; relating to the protection of privacy and personal safety teachers show to have definite ideas and a good grade of awareness.

5 Final detection

5.1 Evaluation of Instant DCA

With the application of the T test for repeated measures, we have ascertained the significance of the differences between the means of the measured data with the Instant DCA, beginning and end of the experimental intervention. The probability that we have chosen to accept as significant the t values has

been to ≤ 05 (confidence interval for the difference of 95%). The statistical results allow us to say that the average value of the range, at each investigated size (technological, cognitive, ethical), significantly raised after achieving the intervention. The results obtained by the trainee teachers were compared to those of the normative sample (Calvani, Fini & Ranieri, 2011).

In the chart below you can see the increase in average scores from the start of the intervention to the end of it.
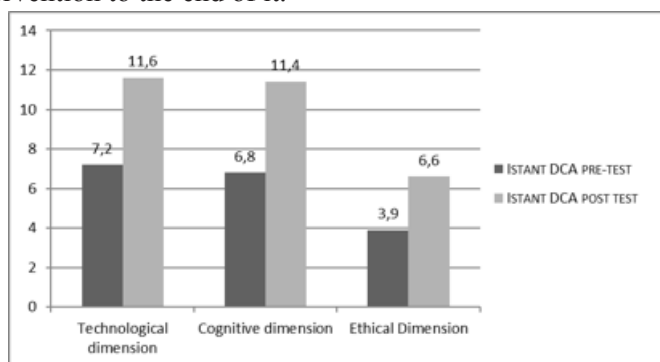

Fig. 3 - Instant DCA pre-test and post-test average scores.

The elaboration of the trainee teachers' T confirms that the improvement in average scores is significant. This means that the operating assumptions regarding the enhancement of digital skills have been verified.

Table 1
DIFFERENCES BETWEEN PRE-TEST AND POST-TEST IN THE EXPERIMENTAL GROUP (n = 154)

ISTANT DCA	AVERAGE	DEV. STD.	T	SIG. (2-CODE)
pre-test technological dimension	7	1,6	24,1	<0,001
post-test technological dimension	11,2	1,9		
pre-test cognitive dimension	6,8	1,9	22,4	<0,001
post-test cognitive dimension	11,4	1,8		
pre-test ethical dimension	3,94	1,2	22,7	<0,001
post-test ethical dimension	6,6	0,7		

In particular, as to the technological dimension, there occurred two main assumptions concerning: a) the selective capacity, namely being able to extract necessary information to solve a problem from a certain quantity of it; b) the ability to "surf" the know how to steer in hypertext structures. Trainee teachers observed a significant improvement both in identifying critical technical situations and choosing the most appropriate strategy to solve them and in describing

a data flow and dealing with the distinction between real and virtual.

Regarding the cognitive dimension, it has been verified the hypothesis concerning the ability to read and understand texts. In particular, at the end of the experimental intervention, teachers show significant improvements in finding the substance of information, distinguishing relevant information from those not appropriate and reworking the contents in graphical and hypertext, in presenting a critical attitude towards the information on the web.

Finally, the hypothesis concerning the ethical competence in being able to take responsibility for the consequences in the medial activity has been verified. Significant improvements in this dimension refer both to the management of personal information and to the increase of awareness of the potential risks of the network, respect of others, identification of the values promoted by the product, evaluation of a media message seizing the points of view and intentions in it.

5.2 Evaluation of the e-portfolio

The use of the e-portfolio as a means of course assessment was evaluated by the participating group of 91 trainee teachers. The methods of data collection took the form of an analysis carried out thanks to the use of a check list with 22 indicators deduced from the research (Calvani *et al.*, 2008; Koehler & Mishra, 2009; Krumsvik, 2012; Pedone, 2009; Zhao *et al.*, 2002), of which the frequency was observed.

Two independent trained assessors[3] assessed the trainee teachers' completion of the tasks required for the e-portfolios. We used a detailed assessment form which listed the assessment criteria and the products to be included in the trainee teacher's e-portfolio. Data analysis followed a qualitative approach. Key themes or common threads were identified by reading, re-reading and coding the e-portfolio.

The analysis of the e-portfolios made by the 91 teachers joining in the activities, confirms the strengthening of digital competence in trainee teachers as detected through quantitative analysis of questionnaires. Here follows a synthesis of the frequency percentages detected from the analysis of 91 e-portfolios briefly commented.

As regards the *technological dimension*, the following frequency percentages have been detected:

1. Recognizing technological trouble	91%
2. Identifying interface	89%

---

[3] The coding is shown on the consensus reached by the two conductors after having compared and discussed the results of ambiguous cases, Cohen's Kappa = 0.66.

3. Selecting the most suitable technological solution	87%
4. Dealing with logical operation	55%
5. Charting out processes distinguish reality from the virtual world	69%
6. Knowing the relationship between subject matter and technology including knowledge of technology that has influenced and is used in exploring a given content discipline	45%

As to the qualitative analysis we observe a gap between the high frequency of the indicators related to the identification of interfaces and symbols and solving common problems, on the one hand, and the frequency of the indicators related to a higher conceptual understanding of technology, on the other hand.

Varied data are found also within the *ethical & pedagogical dimension*:

7. Knowing the influence of technology on teaching and learning as well as the affordances and constraints of technology with regard to pedagogical designs and strategies	71%
8. Recognizing the complex interaction among the principle knowledge domains (content, pedagogy, technology)	55%
9. Safeguarding oneself	49%
10. Respecting on the net	69%
11. Understanding social and technological inequality	73%

If, on the one hand, it has been found that a high percentage of trainee teachers understand how teaching and learning can change when particular technologies are used in particular ways and recognize and although they recognize and disapprove behaviors being against the dignity and respect of the person and of the differences among people, on the other hand, the percentage of portfolios in which the trainee teachers show to give importance to the protection of privacy and personal safety greatly reduces. In a high percentage of e-portfolios it was found the knowledge of how various technologies can be used in teaching, and the understanding that using technology may change the way teachers teach.

The frequency percentages relative to the *cognitive dimension* are as it follows:

12. Dealing with text (summarizing, representing, analyzing)	55%
13. Organizing data selecting and interpreting graphs	51%
14. Evaluating relevant information	53%
15. Evaluating information reliability	44%
16. Making relevant observations with the ongoing work	72%
17. Knowing the subject matter to be taught (ICT for special educational needs)	86%

In the cognitive dimension, the most critical points refer to the trainee teachers' ability to evaluate information reliability. Moreover, only in half of the e-portfolios analyzed we found indicators of the ability to read, filter, interpret and evaluate data and information from different media, based on their relevance. Not very high percentages were also observed in those items requesting to manipulate, interpret and draw inferences from data organized in graphs and tables and those that put them in comparison with formal logic problems. The percentages increase dramatically for those indicators related to both the ability to make relevant comments on the activities and to the knowledge of the course discipline.

We may state that the *awareness dimension* is actually the one in which the highest frequencies of e-portfolios were found:

18. Recognizing his/her own strengths and weaknesses	93%
19. Recognizing the typical causes of his/her mistakes	78%
20. Critically reflecting on his/her learning path	91%
21. Self-assessing himself/herself realistically	89%
22. Explaining his/her learning strategies	81%

The analysis of the e-portfolios revealed a high trainee teachers' ability to recognize their own strengths and weaknesses, the typical causes of their mistakes as well as the ability to identify and explain the learning strategies used routinely, guiding them to mature self-evaluation skills for their own learning, thus realizing their progress along with the difficulties encountered. The use of the portfolio has therefore helped them develop reflection and self-assessment skills that are critical for the professional awareness and to excel in any area of life

The compilation of the e-portfolio has clarified the thoughts that accompany each production and usually follow the learning process. The narrative reconstruction of the learning process has allowed trainee teachers to formalize structures and concepts and to recognize what they have learned.

Conclusion

The intervention, carried out also through the use of new media and information & communication technologies, has provided new possibilities for structuring university educational activities in specific learning environments, so as to become much more communicative processes differentiated and complex as well as more effective and motivating.

Thanks to the implemented activities, the 91 teachers involved have improved: the selective capacity, to extract correct information necessary to solve a problem, the ability to efficiently use hypertext structures, the ability to read and

understand texts, and the ethical competence in being able to take responsibility for the consequences in the activity medial. The development of a professional e-portfolio allows the performance of trainee teachers to be assessed in different ways by offering means to collect, organize, interpret and reflect on their learning and practice. The findings of this study suggest that developing an e-portfolio at this stage can offer multiple benefits as an assessment tool, allowing assessment to be a continuous process, developmental and performance based. Conclusions should always be tentative if applied to a different context.

We are aware that the conclusions that have been reached are based on a non-probabilistic sample and do not allow undue generalizations. It is also necessary to consider the possibility that, in addition to the treatment, other uncontrolled variables may have influenced the improvements observed.

Acknowledgments

REFERENCES

Admiraal, W., Hoeksma, M., van de Kamp, M. T., & van Duin, G. (2011), *Assessment of teacher competence using video portfolios: Reliability, construct validity, and consequential validity*. Teaching and Teacher Education,27(6), 1019-1028.

Calvani A, Cartelli A, Fini A, Ranieri M, (2008), *Models and Instruments for Assessing Digital Competence at School*. Journal of e-Learning and Knowledge Society, 4, 3, 183 – 193.

Calvani A., Fini A.,& Ranieri M. (2009), *Valutare la competenza digitale. Modelli teorici e strumenti applicativi*. TD-Tecnologie Didattiche, 48(3), 39-46.

Calvani A., Fini A.,& Ranieri M. (2011), *Valutare la competenza digitale. Prove per la scuola primaria e secondaria*. Trento: Erickson.

Delandshere, G., & Arens, S. A. (2003), *Examining the quality of evidence in preservice teacher portfolios*. Journal of Teacher Education, 54, 57-73.

Drent, M. & Meelissen, M. (2008), *Which factors obstruct or stimulate teacher educators to use ICT innovatively?* Computers & Education, 51, 187-199.

Ferrari, A. (2012), *Digital Competence in practice: An analysis of frameworks*. Sevilla: Joint Research Centre of the European Commission IPTS. DOI: 10.2791/82116.

Jenkins, H. (2010), *Convergence Culture: Where old and new media collige*. New York: University Press.

Harris, J., Mishra, P., & Koehler, M. (2009), *Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology*

integration reframed. Journal of Research on Technology in Education, 41(4), 393-416.

Instefjord,E. & Munthe, E. (2016), *Preparing pre-service teachers to integrate technology: an analysis of the emphasis on digital competence in teacher education* curricula, European Journal of Teacher Education, 39:1, 77-93, DOI:10.1080/026 19768.2015.1100602.

Koehler, M., & Mishra, P. (2009), *What is technological pedagogical content knowledge (TPACK)?*. Contemporary issues in technology and teacher education, 9(1), 60-70.

Kirschner, P., Wubbels, T., & Brekelmans (2008), *Benchmarks for teacher education programs in the pedagogical use of ICT*. In J. Voogt & G. Knezek (Eds.), International handbook of information technology in primary and secondary education (pp. 435–477). New York: Springer Science/Business Media

Kress, G. (2010), *Multimodality: a social semiotic approach to contemporary communication*. NY: Routledge.

Krumsvik, J.R. (2008), *Situated Learning and Teachers' Digital Competence*. Education and Information Technologies, 13 (4): 279–290

Krumsvik, J.R. (2014), *Teacher educators' digital competence*, Scandinavian Journal of Educational Research, 58:3, 269-280, DOI: 10.1080/00313831.2012.726273

Lambe, J. and Bones, R. (2008), *The impact of a special school placement on student teacher beliefs about inclusive education in Northern Ireland*. British Journal of Special Education, 35: 108–116. doi: 10.1111/j.1467-8578.2008.00381.x

Lambe, J., McNair, V. & Smith, R. (2013), *Special educational needs, e-learning and the reflective e-portfolio: implications for developing and assessing competence in pre-service education*, Journal of Education for Teaching, 39:2, 181-196 DOI:1 0.1080/02607476.2013.765191.

Rossi, P.G., Magnoler, P., & Giannandrea, L. (2008), *From an e-portfolio model to e-portfolio practices: some guidelines*. Campus-Wide Information Systems, 25(4), 219-232.

Trinchero, R. (2006), *Valutare l'apprendimento nell'e-learning. Dalle abilità alle competenze*. Trento: Erickson.

Trinchero, R. (2012), *Costruire, valutare, certificare competenze. Proposte di attività per la scuola*. Milano: Franco Angeli.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. (2002), *Conditions for classroom technology innovations*. The Teachers College Record, 104(3), 482-515.