The 'supply chain' of teachers' digital skills training. The TPACK traceability in the teachers' trainers

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ABSTRACT

Starting from the stimuli coming from the TPCK model [30], the work invites to discuss the type of technological competence required today by the teacher for a 'wise' [27] and effective use of digital tools at school. The 'supply chain' metaphor will be used in order to describe the epistemic process that transforms European priorities into national competences of teachers. Specifically, a model of 'traceability' of the TPACK - that from the DigiComp Edu Framework leads up to the local training in the school-centres pole through the Italian National Digital Plan (PNSD), obtained from a survey using a questionnaire - will be proposed in order to reflect on the coherence between the general priorities and the actual formulation.

CCS CONCEPTS

• Teacher Education • Digital Competences • Model of competence → TPACK, DigCompEdu

KEYWORDS

Digital Teacher Education, Technological Pedagogical Content Knowledge

ACM Reference format:

L. Perla, L. Agrati and V. Vinci. 2018. The 'supply chain' of teachers' digital skills training. The TPACK traceability in the teachers' trainers. In *Proceedings of the 6th International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM 2018) (Salamanca, Spain. October 24-26, 2018), F.J. García-Peñalvo Ed. ACM, New York, NY, USA, 9 pages.* https://doi.org/10.1145/3284179.3284284

TEEM'18, October 24-26, 2018, Salamanca, Spain
© 2018 ACM. ISBN 978-1-4503-6518-5...$15.00
http://dx.doi.org/10.1145/3284179.3284284

1 INTRODUCTION – The TPCK model

The teacher is increasingly called to change of perspective, to assume new paradigms of reference that judge his/her teaching technology [36]. The use of digital tools in teaching practice, in fact, would generally encourage the questioning of the typical accepted relationship between teacher (teacher), learners (student) and teaching / learning contents (knowledge) – as the mediation model [12] - but above all, from the teacher's point of view, the reading of the relationship with his own 'knowledge to teach' (TPK, [48]) and the way in which it is represented [15].

The literature offers some explanatory models of the teaching-learning dynamics underlying the use of digital teaching resources – v. 'mediatization' [43-44] - and the knowledge and skills required to the teacher in order to manage this complex dynamic [50, 23, 34].

The Technological Pedagogical Content Knowledge (TPCK) is a conceptual model that describes the knowledge and skills held by the teacher and used in the teaching practice [10, 32], a useful model for educators as they begin to use digital tools and strategies to support teaching and learning [2, 31].

It represents an extension of the well-known Shulman's 'Pedagogical Content Knowledge' (PCK) [47, 48] based on the conceptual distinction between specific knowledge of the teacher (*knowledge*), the knowledge of the disciplinary area (*content knowledge*) and the essential knowledge for the translation into an educative form of the disciplinary content (pedagogical content knowledge). The model of Mishra and Koehler [22, 31] proposes a complex 'integration' of the Shulman model with a further model referring to the specific skills of the technological area based on the distinction between technological knowledge of a specific discipline (technological content knowledge) and pedagogical technological knowledge (technological pedagogical knowledge). The complex 'technological pedagogical content knowledge', necessary for the teacher to translate the disciplinary contents according to pedagogical and technological criteria at the same time, is so obtained.

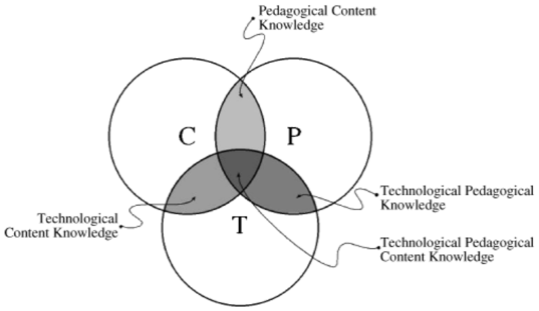

Figure 1: The TPCK model (Mishra & Koehler, 2009, p. 1025)

The teacher, when using digital resources in the teaching practice, has simultaneously to make choices regarding the knowledge (see Figure 1 - *Content Knowledge*,), the teaching content (*Pedagogical Content Knowledge*) and the mediation tool in a technological form – as digital (see *Technological Pedagogical Content Knowledge*). The TPCK model seems very elaborate and therefore effective in understanding the complexity of the teacher's knowledge [46]. But how much this model - epistemically useful - is in fact functional to the descriptions of the competences? How much is comparable to the teacher's digital competence models known today? A short comparative reading is given below.

2 TEACHERS DIGITAL COMPETENCES FRAMEWORKS

Notes for over 10 years now [19, 6] and useful for mapping digital skills, several conceptual models - Web Literacy [38], MediaSmarts [24], DigComp [18] - are nowadays available. All this maps refer to awareness - as well as communication aspects, literacy, ability to relate - on the ability to develop content on the basis of criteria such as *responsibility* (ethics, advocacy, access), *security* (private and public), *freedom* of expression or authentication / accreditation.

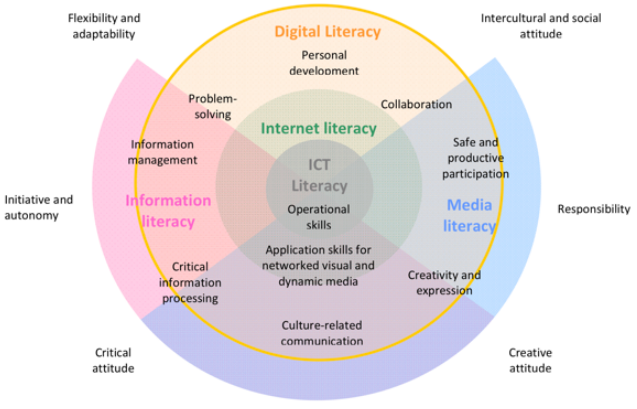

Figure 2: Digital Competence landscape (Ala-Mutka, 2011)

The DigComp [18], in the case, has been adopted as the European reference framework for digital skills as a tool aimed at allowing a shared description of citizens' digital skills [1]; it has been used in education in Europe to elaborate schedules for compulsory education, teacher training and adult courses [7].
The structure of the framework is modular and involves 5 areas of digital competence, 21 skills and 3 levels of proficiency (Fig. 3):

- *Information*: 'identify, locate, retrieve, store, organize and analyze digital information, judging its relevance and purpose';
- *Communication*: 'communicate in digital environments, share resources through online tools, link with others and collaborate through digital tools, interact with and participate in communities and networks, cross-cultural awareness';
- *Content-creation*: 'create and edit new content (from word processing to images and video); integrate and re-elaborate previous knowledge and content; produce creative expressions, media outputs and programming; deal with and apply intellectual property rights and licenses';
- *Safety*: 'personal protection, data protection, digital identity protection, security measures, safe and sustainable use';
- *Problem-solving*: 'identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, creatively use technologies, solve technical problems, update one's own and others' competences'.

It offers examples of competence, skills and attitudes, examples of applicability of the model in education and employment.

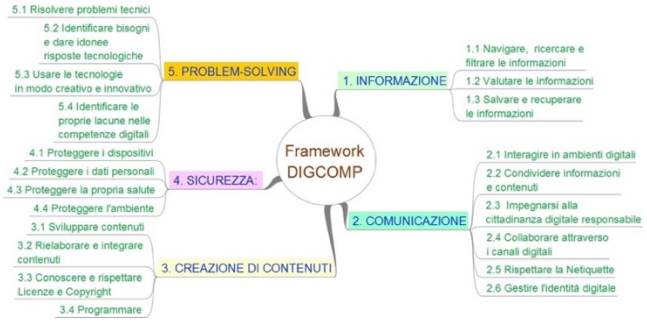

Figure 3: DigComp Framework (Ferrari, 2013)

2.1 The TPACK 'clues' in DigComp

Apart from the areas of more technical skills for which digital resources maintain their function of 'media' that favor respectively (1.) information, (2.) communication and (4.) security of users, at a general look it is possible to see how, instead, the areas of competence 'Content-creation' (3.) and 'Problem-solving' (5.) are activated in specific sub-areas for which have a description of the digital competence of the teacher

in which to find possible connections with the TPCK model. It is opportune to focus on 3.1 'Developing content', 3.2 'Integrating and re-elaborating content' and 5.3 'Innovating and creatively using technology', excluding the aspects related to legal responsibility (3.3) and the programming (3.4), on one hand, and to the technical-instrumental ability (5.1, 5.2) and self-assessment (5.4), on other.

These following three sub-skills:

3.1 *Developing content* – 'Create content in different formats including multimedia; edit and refine content produced in first person or by others; express yourself creatively through digital media and technologies';

3.2 *Integrate and rework* – 'Modify, select and integrate existing resources to create new, original and relevant knowledge and content';

5.3 *Innovating and creatively using technology* – 'To innovate with technology, to actively participate in collaborative digital and multimedia production, to express oneself creatively through digital media and technologies, to create knowledge and solve conceptual problems with the support of digital tools'

are described through knowledge, skills and attitude on which it is useful to dwell (Table 1).

Table 1: The DigComp competences related to TPACK

Competences	Knowledge	Skills
3.1 *Developing content*	Knows that digital content can be produced in a variety of forms Understands how meaning is produced through multimedia (text, images, audio, video)	Is able to use basic packages to create content in different forms (text, audio, numeric, images) Is able to create knowledge representations (e.g. mind maps, diagrams) using digital media Is able to edit the content in order to enhance the final output
3.2 *Integrate and rework*	Contributes to the public knowledge domain (e.g. wikis, public forums, reviews)	Is able to create knowledge representations (e.g. mind maps, diagrams) using digital media Is able to remix different existing content into something new Can create new by mixing and matching old
5.3 *Innovating and creatively using technology*	Knows how to find the relevant knowledge for the solution of theoretical problems understands how meaning is produced through multimedia and technologies	Is able to build meaningful knowledge through interaction with digitally available resources Is able to use a variety of media to express oneself creatively (text, images, audio, and movie)

According to the classical definition of Mishra & Koehler [30], the TPACK is the understanding that emerges from the interactions between content, pedagogy and technological knowledge; it is more than the sum of all three individual components; it 'requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones' (p. 66).

The Mishra & Koehler' essential nuclei - *representation of concepts*, *developing new knowledge* - seem to be present within the knowledge and skills of the framework related to the three areas taken into consideration. However, the other important core-components - the pedagogical techniques related to teaching and learning - seems to be missing.

It can be stated that the mapping of the digital skills of the teacher proposed by the DigComp seems in general inspired by the TPCK: it prevails the ability to represent and create new knowledge, the aspects related to the mediation of the contents are less present and even less so are the learning processes of the students.

It is worth noting that a greater focus on the teaching content mediation and the learning processes of students seems to characterize the new DigCompEdu Framework [42] – figure 4.

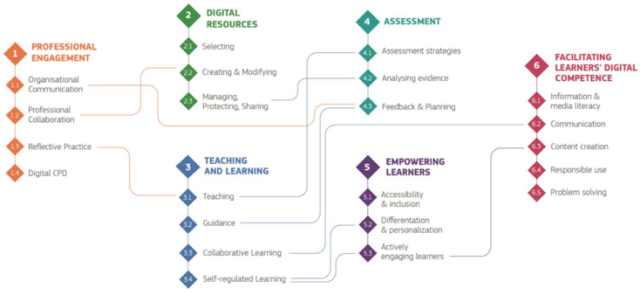

Figure 4: DigCompEdu Competences areas (European Union, 2017)

In the new DigCompEdu framework it is possible to find competences directly addressed to the pedagogical domain concerning the management of teaching activities and the personalized support to the learning processes of the students [41, 11], as:

3. *Teaching and learning* – 3.1. *Teaching* 'To plan for and implement digital devices and resources into the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction';

5. *Empowering learners* - 5.2 *Differentiation and personalization.* 'To use digital technologies to address learners' diverse learning needs, by allowing learners to advance at different levels and speeds, follow individual learning pathways and goals'.

This allows to state that in the DigCompEdu framework it is possible to find even more references to the TPCK model: in addition to the processing and representation of knowledge, also the knowledge of student learning processes.

3 THE 'SUPPLY CHAIN' OF TRAINING OF TEACHERS' DIGITAL SKILLS

According to the everyday language and in the economic fields [25], 'supply chain' refers to a system of organizations, actors, activities, information, and resources involved in moving a product or service from 'supplier' to 'customer'; it involves the transformation of original resources and components into a finished 'product' that is delivered to the customer. Beyond the original meaning, the 'supply chain' expression is useful in order to represent the complex system of organization but also to reflect on the inevitable modifications and adaptations [16].
The metaphor of the 'supply chain' could represent the system that connects European priorities, national measures and effective local interventions about the training of teachers' digital skills. The basic question is: how much of the TPCK model is transformed in the 'supply chain' of teacher training to digital skills - from Europe to local training? How much is lost? What is transformed? The Italian 'supply chain' comes from the 'European reference framework for digital skills' and refers to the new National Plan of Teachers Training through the National School Digital Plan. It follows a descriptive analysis of this components in order to highlight this 'unrecovered' transformations.

3.1 The Italian National School Digital Plan

Th OECD [39] see Italy in first place for the ICT training needs of its teachers: at least 36% said they were not sufficiently prepared for digital teaching, compared to a European average of 17%. The educational reform of 2015 intervened - among other needs - on the digital training of teachers through the National Digital School Plan (PNSD). PNSD is the orienting document of the Italian Ministry of Education for an overall strategy trough the modification of learning environments and the promotion of digital innovation in the School [33, 14, 35].
As regards the training of teachers, the PNSD confirms the centrality of the competence to *content-creation* - as the DigComp framework - but also seems to welcome the didactic and pedagogical components, as introduced by DigCompEdu [42] – v. figure 4 - at least on a theoretical level.
Indeed, the document explains the objective of promoting 'open' educational resources linked to the ability to transform digital resources, the possibility to use, in an integrated form, learning resources of different origins but also the possibility of collaborative self-production of learning contents (action n. 23). It, therefore, refers to characteristics differentiated according to *curricular coverage resources* (which provide a context and a common thread, validated and compliant with national guidelines, and are structured according to the disciplinary path followed) or *integrative resources* (in-depth analysis, additions, sources, etc., which do not have curricular coverage and are often granular and unstructured).
The document, however, clarifies (action n. 25) that the training of school staff has been characterized until now by the referring purely and simply 'to basic literacy on technologies without enhancing digital skills training, as a means of enhancing learning and key competences. In particular, it is necessary to strengthen the skills related to the comprehension and production of complex and articulated contents even within the digital communicative universe, in which sometimes granularity and fragmentation prevail' (p. 78) [37].

3.1.1 From European priorities to the technological training needs of teachers

With Ministerial Decree 797 of 19 October 2016, the National Training Plan for teaching staff was adopted for the 2016-2019 three-year period. The document represents an institutional framework of in-service training; defines priorities and financial resources, outlining from 2016/2017 a coherent system of interventions for training and professional development [45]. The Plan aims to promote the connections between national priorities, the training plans of schools and their networks and the professional needs of teachers.
The training of school staff in digital skills aims to ensure an effective and full correlation between educational and organizational innovation and digital technologies. In this context, the Plan is the main instrument for implementing all the actions of the National Digital School Plan on the basis of the principles contained therein. The fundamental objective is to strengthen the preparation of teaching staff for the use of digital, using the language of teaching and promoting the active teaching with conviction.
Into the document some strategic lines are defined:
• promote the link between teaching and methodological innovation and digital technologies;
• promote the relation between organizational innovation, planning for autonomy and digital technologies;
• enhance the action of the digital animator and innovation team;
• strengthen the digital culture and skills of school staff, with reference to all the dimensions of digital skills (transversal, computational and "digital citizenship"), vertically and transversally into the curriculum;
• promote media education in schools of all levels, for a critical, conscious and active approach to the culture, techniques and languages of the media;
• stimulate the production of Open Educational Resources (OER) to foster sharing and collaboration with a view to promoting the culture of openness,
but, above all, the new government which, from the European level, manages the training of the teacher at a territorial level:

- the Ministry of Education (MIUR) is the control room as well as monitoring the entire governance system; it develops the National Teacher Training Plan every three years and sets quality standards based on the priorities indicated by European documents.
- the Regional Education Office (USR) assumes to all effects the peripheral management of the MIUR (as 'task force') choices; it supports and monitors training in the various regional areas.

- each 'Polo school' - as Training Centers - plans the training for the schools of its territory through the Scope Training Plan in reference to the National Plan and the guidelines indicate by the USR.
- each school develops its own School Training Plan in reference to the Scope Training Plan, to its Self-Assessment Report and to the professional development plan of each teacher;
- each teacher expresses his training needs individually in the Professional Development Plan and in the School Training Plan.

38 interprovincial and 18 regional Training Centers have been identified for the organization and management of digital training courses for teachers, who would become referents of the design and the intervention for a digital school – as 'Digital Animator'. The Training Centers organize peer training activities, making use of competent teachers on the subject, identified on the basis of provincial and regional lists prepared by the respective regional educational offices following the presentation of voluntary candidatures.

The courses activated in the 6 training centres of the Bari district, in Puglia, chosen based on the priorities of the PNSS and the training needs intercepted in the training plans were n. 23.

Most of the courses (n. 13) aimed general objectives - on methodological innovation, broken down by school level and by level of detail; 6 propose training in computational thinking (coding), 3 of which are integrated with the use of programming software (G Suite, Scratch) or robotics (SAM LABS). Only two courses, on the other hand, approach technology in an 'instrumental' way, i.e. aimed at building skills in other areas, such as entrepreneurship and digital citizenship.

This complex organization ensures, on one hand, the reference to the European and national priorities and, on the other hand, listening to the specific needs of each single school and even each individual teacher, in a mediated manner.

Within this general framework, it is possible to know how the 'supply chain' of the teacher's digital skills is divided up: from the European and national priorities, to the territorial and scholastic plans, right up to the specific needs of the single teacher.

4 SURVEY ON DIGITAL SKILL BELIEVES of TRAINEE TEACHERS

The exploratory research study has been conducted by the *DidaSco Research Group* at the University of Bari (Department of Education). It provided the representation of teacher's technological skills in the framework of the National Plan for Teacher Training by the technological area trainers.

The research refers the Teachers' Thinking and Teachers' Professional Knowledge studies [47, 48, 49, 10, 13] and focused on the embedded pre-reflexive knowledge of teachers [51, 5, 4, 20], often remained 'implicit' in educational activities. Specifically, the study aimed at understanding and fostering the point of view of trainers about teacher's technological skills, acknowledging the professional knowledge as implicit and pre-reflexive.

The specific purpose of the exploratory survey is to understand how some technological area trainers articulate their training proposals according to the outgoing teacher's technological skills, focusing on the competence articulated according to the descriptors of the European Framework DigComp [18, 3, 29] and DigCompEdu [42]. So, it is possible to understand the system that connects European priorities, national measures and effective local interventions about the training of teachers' digital skills (as mentioned above, how the 'supply chain' of the teacher's digital skills is divided up, from Europe to local training). The study has been carried out by submitting a 20-question questionnaire including multiple choice and open questions to technological area trainers who made courses in the school year 2017-2018.

The population of the considered area is of 23 expert trainers. The sample identified is 13 elements with characteristics proportionate to the reference population. The participants who replied to the questionnaire proportionally represent the characteristics of the reference population (Table 2).

The questionnaire has been submitted to the trainers by using Google Forms and it is split into 3 sections:

1) *Personal details*;
2) *Representation of Digital skills,* in which it is possible to understand trainers' representations about teachers' digital skills according to the European reference framework that involves 5 areas of digital competence (*Information, Communication, Content-creation, Safety, Problem-solving*) and trainers' representations about the disciplinary areas that favour the integration of the technologies on the didactic level. The questions in this section are specified below:

- *How would you define the teacher's digital competence?*
- *Regarding the creation of teaching content, it is more important for the teacher to know...*
- *Which order of importance would you assign to the teacher's following skills for developing digital content?*
- *Based on your experience, in which of the following subject areas is it easier to integrate teaching technologies?*

3) *Representation of Digital skills for teaching*, dealing with teachers' digital skills directly addressed to the pedagogical domain concerning the management of teaching activities and the personalized support to the learning processes of the students. The questions in this section are specified below:

- *How much the following skills stimulate the professional involvement of the teacher?*
- *How much each of the following skills affects the use of digital resources?*
- *How much each of the following skills facilitates the teaching-learning process?*
- *Which order of importance would you assign to the following teacher's skills in the evaluation field?*
- *How much each of the following teacher's skills is functional to empower the students?*
- *Which order of importance would you assign to the following teacher's skills in facilitating the digital skills of the students?*

The last in the third section is an open-ended question:

"*Describe a specific episode in which a teacher worked effectively by combining content, technologies and teaching approaches in an activity with*

the class. Please include in the description what content was taught, what technology was used and what teaching approach (i) was implemented".

In this *Proceeding*, we focus only on some questions of the survey, which will be presented in its entirety at the end of the ongoing research.

4.1 Data analysis

Table 2: The characteristics of the sample

Genre	Age	Years of teaching	Qualification
6 women	Mean: 50 years	20-year teaching average	Master's degree or post-graduate degree (6);
4 men			Bachelor's degree (3);
			High school diploma (1)

8 teachers out of 10 have taken on roles of reference or coordination in the school institution, specifically as support for teachers, as the PNSD digital innovation members team, within the areas of: digital technology, three-year plan of the training offer, evaluation, educational continuity, teacher training. 60% of trainers taught in secondary school; 40% in primary school.

The first open-ended question – *How would you define the teacher's digital competence?* – shows different representations about the concept of "teacher's digital competence". About half of respondent trainers define it as a "key competence" in order to improve quality of teaching (*key competence to manage innovations*; *key competence to promote motivating teaching*; *ability to exploit the potential offered by new technologies to collaborate and share effectively with the various actors of the scholastic world*; *knowing how to apply the methodological skills of the curricular disciplines, with the help of technology to improve teaching, by getting it*); some trainers underline the importance of digital competence in teaching (*It's fundamental*; *It's a necessary expertise*); others highlight the difficulties of teachers in the use of digital technologies (*Teachers have little digital competence especially those who have been teaching for more than 20 years*; *it is a very important competence, but still not very widespread*). The next question deals with the 5 areas of key components of digital competence identified by the European reference framework for digital skills.

Key components of digital competence - European reference framework DigComp	**Mean**	**Mode**	**Standard variation**
Information and data literacy	4,3	5	1,1
Communication and collaboration	4	5	1,1
Digital content creation	4,3	5	1
Safety	4,2	5	1,3
Problem solving	3,6	5	1,3

Key components of digital competence - Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
Information and data literacy	-	1	1	1	6
Communication and collaboration	-	1	2	2	4
Digital content creation	-	1	-	3	5
Safety	1	-	-	3	5
Problem solving	1	-	3	2	3

The analysis shows a higher average score for the items *Information and data literacy* and *Digital content creation*, lower for the item *Problem solving*. Regarding the *Digital content creation*, trainers believe that it is more important for the teacher to know how to *develop digital content* (6/10). None of the respondents chose the *programming* item.

Digital content creation	N.
Developing digital content	6
Integrating and re-elaborating digital content	3
Copyright and licences	1
Programming	-

Which order of importance would you assign to the following teacher's skills for developing digital content?	Mean	Mode	St. var.
1. Ability to use basic packages to create content in different forms (text, audio, numeric, images)	4,1	5	0,8
2. Ability to create knowledge representations (e.g. mind maps, diagrams) using digital media.	4	5	1,2
3. Ability to use a variety of media to express him/herself creatively (text, images, audio, and movie)	3,8	5	1,3
4. Ability to edit the content in order to enhance the final output	4	4	0,9

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
Ability to use basic packages to create content in different forms (text, audio, numeric, images)	-	-	3	3	4
Ability to create knowledge representations (e.g. mind maps, diagrams) using digital media.	1	-	1	4	4
Ability to use a variety of media to express him/herself creatively (text, images, audio, and movie).	1	1	1	3	4
Ability to edit the content in order to enhance the final output	-	1	1	5	3

The answer with a slightly higher average score and lower standard deviation is the first, the answer which obtained a slightly lower average score is the third.

To create new content from existing resources, how important are the following teacher's skills?	Mean	Mode	St. var.
1. Ability to use edit functions to modify content in simple, basic ways	3,8	4	1,2
2. Ability to create knowledge representations (e.g. mind maps, diagrams) using digital media	3,7	4	1,3
3. Ability to use appropriate licences for authoring and sharing content	3,9	4	0,7
4. Ability to remix different existing content into something new	3,9	5	1,1
5. Ability to create new by mixing and matching old	4,2	4	0,9

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
Ability to use edit functions to modify content in simple, basic ways	1	-	2	4	3
Ability to create knowledge representations (e.g. mind maps, diagrams) using digital media	1	1	1	4	3
Ability to use appropriate licences for authoring and sharing content	-	-	3	5	2
Ability to remix different existing content into something new	-	1	3	2	4
Ability to create new by mixing and matching old	-	1	-	5	4

The analysis shows a higher average score for the item n. 5, followed by n. 3 and n. 4. Interestingly, the answer with a lower average score is the second.

The last section of the questionnaire - *Representation of Digital skills for teaching* - deals with teachers' digital skills directly addressed to the pedagogical domain concerning the management of teaching activities, according to the DigComEdu Areas ('Synthesis of the the DigCompEdu competence descriptors').

How much the following skills stimulate the professional involvement of the teacher? (Professional Engagement)	Mean	Mode	St. var.
1.1 Organizational communication	3,7	5	1,4
1.2 Professional collaboration	3,8	5	1,3
1.3 Reflective practice	3,5	5	1,6
1.4 Digital Continuous Professional Development (CPD)	4	5	1,4

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
1.1 Organisational communication	-	3	2	-	5
1.2 Professional collaboration	-	3	1	1	5
1.3 Reflective practice	1	3	1	-	5
1.4 Digital Continuous Professional Development (CPD)	1	-	3	-	6

The highest average score is attributed to the item 1.4: trainers believe that one of the most important skills to stimulate the professional involvement of the teacher is that of knowing how '*to use digital sources and resources for continuous professional development'*. Instead, the lowest average score instead is attributed to the '*reflective practice: to individually reflect on, critically assess and actively develop one's own digital pedagogical practice and that of one's educational community'*.

How much each of the following skills affects the use of digital resources? (Digital Resources)	Mean	Mode	St. var.
2.1 Selecting digital resources	4	5	1,3
2.2 Creating and modifying digital resources	3,7	5	1,4
2.3 Managing, protecting and sharing digital resources	3,9	4	1,1

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
2.1 Selecting digital resources	-	2	2	-	6
2.2 Creating and modifying digital resources	1	2	-	3	4
2.3 Managing, protecting and sharing digital resources	1	-	1	5	3

The highest average score is attributed to the item 2.1 in order 'To identify, assess and select digital resources for teaching and learning. To consider the specific learning objective, context, pedagogical approach, and learner group, when selecting digital resources and planning their use'.

How much each of the following skills facilitates the teaching-learning process? (Teaching and Learning)	Mean	Mode	St. var.
3.1 Teaching	3,6	4	1,2
3.2 Guidance	3,9	5	1,5
3.3 Collaborative learning:	4,1	5	1,1
3.4 Self-regulated learning	4,2	5	0.9

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
3.1 Teaching	1	1	1	5	2
3.2 Guidance	1	1	2	-	6
3.3 Collaborative learning	-	2	-	3	5
3.4 Self-regulated learning	-	-	3	2	5

The highest average score is for item 3.4, 'To use digital technologies to support self-regulated learning processes, i.e. to enable learners to plan, monitor and reflect on their own learning, provide evidence of progress, share insights and come up with creative solutions'. The lower average score is attributed to the first item 3.1, in order 'To plan for and implement digital devices and resources into the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching interventions. To experiment with and develop new formats and pedagogical methods for instruction'.

Which order of importance would you assign to the following teacher's skills in the evaluation field? (Assessment)	Mean	Mode	St. var.
4.1 Assessment strategies	3,6	5	1,5
4.2 Analyzing evidence	3,7	4	1
4.3 Feedback and Planning	3,7	5	1,5

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
4.1 Assessment strategies	1	2	2	-	5
4.2 Analyzing evidence	-	2	1	5	2
4.3 Feedback and Planning	1	2	1	1	5

As regards the field of evaluation, the highest average score is attributed to the items 4.2 *Analyzing evidence* and 4.3 *Feedback and planning*. It is interesting to note that the scores ascribed to the evaluation question are globally lower than the other DigCompEdu domains.

How much each of the following teacher's skills is functional to empower the students? (Empowering Learners)	Mean	Mode	St. var.
5.1 Accessibility and inclusion	4,3	5	1
5.2 Differentiation and personalization	3,7	5	1,4
5.3 Actively engaging learners	3,9	5	1,6

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
5.1 Accessibility and inclusion	-	1	1	2	6
5.2 Differentiation and personalization	1	1	2	2	4
5.3 Actively engaging learners	2	-	1	1	6

The highest average score is attributed to the first item 5.1 – 'To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital technologies'. The lowest score is of 5.2, 'To use digital technologies to address learners' diverse learning needs, by allowing learners to advance at different levels and speeds, follow individual learning pathways and goals'.

Which order of importance would you assign to the following teacher's skills in facilitating the digital	Mean	Mode	St. var

skills of the students? (Facilitating Learners' Digital Competence)			.
6.1 Information and media literacy	4,3	5	0,8
6.2 Digital communication & collaboration	3,8	5	1,2
6.3 Digital content creation	4,1	5	0,8
6.4. Responsible use	3,7	5	1,4
6.5 Digital problem solving	3,4	5	1,5

Range of variation (min 1; max 5)	**1**	**2**	**3**	**4**	**5**
6.1 Information and media literacy	-	-	2	3	5
6.2 Digital communication & collaboration	-	2	2	2	4
6.3 Digital content creation	-	-	3	3	4
6.4. Responsible use	1	2	-	3	4
6.5 Digital problem solving	1	3	-	3	3

The last question shows a higher variability than the previously. The highest score is attributed to 6.1, 'To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organize, process, analyze and interpret information; and to compare and critically evaluate the credibility and reliability of information and their sources', followed by the item 6.3 'To incorporate assignments and learning activities which require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licenses apply to digital content, how to reference sources and attribute licenses'. The item with a lower score is 6.5 'To incorporate learning and assessment activities which require learners to identify and solve technical problems or to transfer technological knowledge creatively to new situations'.

5 RESULTS AND DISCUSSION

As known, the European reference framework (DigCom) uses 5 specific areas of digital competence - *Information*, *Communication*, *Content-creation*, *Safety*, *Problem-solving* - in order to describe the totality of the techno-pedagogical knowledge [46] of teachers. Analyzing of the questionnaire, it emerged that the expert trainers of the school-centers emphasize the competence of the construction of the contents (*Content-creation*) as a peculiar aspect of the techno-pedagogical competence to be developed in the teachers. This specific competence is basically described as the ability to mix old and new contents (with no particular interest in their ability to represent them).

Furthermore, the European framework relating to the professional profile of the educator (DigCompEdu) - as noted – describing the educational profile through the 6 areas - *Professional Engagement*, *Digital Resources*, *Teaching and Learning*, *Assessment*, *Empowering Learners* and *Facilitating Learners*. The analysis of the questionnaire showed that teachers' trainers emphasize the ability of the teacher to develop their skills in a continuous process and, in particular, consider the sub-capacities to select digital resources (2.1), to self-regulating their own learning (in the pedagogical and technological area - 3.4 Self-regulated learning) and to monitor the evidence in the own learning (*4.2 Analyzing evidence* and *4.3 Feedback and planning*) more important than the others.

Regarding the functional capacity to enhance students' learning – the 'pedagogical' domain - the analysis shows that for the experienced trainers the teachers need to use the sub-skills: to make resources accessible (*5.1 Accessibility and inclusion*), to involve students through technologically mediated activities (*5.3 Actively engaging learners*).

6 CONCLUSIONS

As is known, evidence-based research has now confirmed that the use of technology in the classroom [21, 6] if on the one hand improves learning - in particular by virtue of interactivity, as a communication channel and in reference to peculiar contents (eg as mind-tool - [28] - at the same time, by providing multitasking thinking, it favours the lowering of cognitive control [40, 6].

The teacher is responsible for the new generations in generating critical awareness of the implications of their use of technology. For this reason, digital competence implies a simultaneous presence of knowledge and technical mastery, together with critical thinking and ethical-social skills [1, 18, 26, 6] on the part of both the student and the teacher.

The TPACK helps us to better understand the 'pedagogical' aspect (strategies of learning and adaptation / personalization for the tools) and the real mediation of contents (how and how much the use of digital media modifies the contents to be taught by creating a new one).

In conclusion: the trainers seem to possess a complex representation of techno-pedagogical competencies of the teachers. Furthermore, the technological and pedagogical components of the TPCK model have a direct connection with the European competence structures and their traces are easily found in the representations of teachers' trainers.

It is possible to argue that along the line of the so-called 'supply-chain' - which, in metaphor, transforms the framework of expected skills into skills actually included in the courses aimed at teachers – the complexity of the TPCK model is not lost: all the components can be found, even if they are highlighted some - such as the ability to create digital content and to facilitate the accessibility of students with learning difficulties.

The teachers' trainers seem to have a complex [46] (and realistic) representation of the pedagogical-technological skills of the teachers: they trust in the teachers' ability to modify the existing and adapt it to the needs of the students. Trainers' representations describe a teacher more as an adaptive content *creator* than a simple *user* of existing resources.

ACKNOWLEDGMENTS

This work was partially supported by the Research program 11-17, type B - Research title: The professional development of the in-service support teacher through the collaborative research device: training and institutional impacts, M-PED / 03 - University of Bari. Period: 1 September 2017 - 1 September 2018. Rector's Decree n. 2597 of 29/08/2017.

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