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From technologies for a few to technologies for all. Analysis of inclusive technologies perception in teachers in training

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Abstract

The paper presents the results of a survey conducted with teachers of lower and upper secondary schools who attended, in e-Learning mode, the specialization course for support in 2020 at the University of Macerata (Italy). The purpose of the survey was to: (1) extrapolate the teachers' point of view on the inclusive use of technologies at the beginning of the laboratory, (2) highlight the presence or absence of an inclusive logic underlying the teaching approach generally chosen in the use of tools and technological applications and finally, (3) analyze teachers in training perception about the skills they think they have learned at the end of the laboratory. Referring to the principles of Universal Design for Learning (UDL), the inclusive logic underlines the importance of knowing how to design educational interventions mediated by technologies that can be used by all students (not only those with Special Educational Need) therefore the presence/absence of the design aspect in teachers in training was considered fundamental to set up the laboratory path. In addition, the creation of the laboratory on the Teams platform has allowed teachers in training to learn and experience the inclusive potential that e-Learning can have if supported by a good design framework. In the contribution, the results of the investigation and the organization of the laboratory will be presented.

KEYWORDS: TIC, Inclusion, Teaching, Active Participation.

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1. Introduction

Inclusion, like active participation and belonging (Felder, 2018) to an educational and social context made of equality and mutual respect (Kiuppis et al., 2014; Koutsouris et al., 2020; Bochicchio, 2017), is the logic that must support the creation of learning environments in schools (Fraser et al., 2003; Goh et al., 2002; Pinnelli, 2020) based on the collaboration and active participation of teachers (Bhroin et al., 2020; Bush et al., 2020) and students (Jolliffe, 2007) considered these as an integral part of the school system regardless of the characteristics of their functioning (WHO, 2001).

The inclusive logic arises from a critical reflection connected to cultural, political, and practical-methodological transformation (Booth et al., 2014) and its application in the school context depends on the way in which teachers think about didactic and relational practices and prepare learning paths accessible to all students. Therefore, the question of teacher training becomes important (Gil-Flores et al., 2017) with particular attention to support teachers, (De Anna et al., 2015; Pinnelli, 2020) who must not only possess specific skills on disability but methodological, didactic, technological, and relational skills necessary to implement inclusion practices for the whole class (Fedeli et al., 2019; Pennazio, 2017a). Among the variables for improving the quality of inclusion, Information and Communication Technologies (ICT), as demonstrated by national and international literature (Calvani, 2010, 2020; Calvani et al., 2014; de Anna, 2012; Hamburg et al., 2015; Higgins et al., 2012; Pinnelli, 2020; Sánchez Utgé et al., 2017) were found to

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be effective in fostering teaching/learning processes for all students. Some research, (Fedeli et al., 2019) conducted with teachers who have attended training courses in the past to become support teachers, have shown that these teachers generally associated, at the beginning of the course, the use of ICT for inclusion to specific tools for disability that refer instead to the use of Assistive Technologies (AT) (Cook et al., 2002). Starting from these considerations, the contribution presents the results of a survey conducted with teachers of lower and upper secondary schools who attended the ICT laboratory in 2020 as part of the "Support course" at the University of Macerata. This survey is significant because it shows a change in the initial perception of teachers in training (regardless of the ability to use technologies) about the value of applying ICT tools for inclusion, as demonstrated in other research in the sector (de Anna, 2016; Covelli, 2016; Pagliara, 2016). The identification of tools considered by teachers useful for inclusion also highlighted the abandonment of the specialist dimension.

2. Inclusive technologies and teacher training

The introduction of technological tools in inclusive school environments requires an overall redesign (Calvani, 2020) of the training activities based on new teaching models, methods, and techniques (Jonassen, 2010; Novak, 2002) guided by the pedagogical perspective of meaningful learning. This redesign must be accompanied by more active didactic strategies (simulations, problem solving situations, cooperative learning, tutoring) (Bonaiuti et al., 2013; Calvani, 2014; Johnson et al., 1994; Kagan et al., 2009) that make possible and support the dialogical processes, the productive confrontation, the negotiation of meanings, the construction of knowledge. The teacher's design intentionality and his teaching mediation capacity therefore become fundamental in the integration of tools involved in the learning process with the pre-established objectives (disciplinary and technological) and the activities / modalities through which it is thought to reach them (Antonietti, 2003). The creation of technological teaching allows for school inclusion on three levels: (1) operational, (2) access to content, (3) development of skills (Chiappini et al., 2004). As part of this teaching, technologies respectively assume roles that correspond to specific ways of understanding educational action: (1) compensatory tools, to "do" (inclusion on the operational level); (2) tools to develop disciplinary skills and competences in learning contexts that respond to students' training needs (inclusion in terms of skills development); (3) tools to learn knowledge and content in compliance with the methods of access to the most appropriate information for students (inclusion in access to knowledge) (Chiappini et al., 2004).

The introduction of a technology into the classroom can generate inclusion if the same technologies have been made accessible through the use of adequate TA (Cook et al., 2002; Scherer, 2005) and by the type of design that supports the overall teaching intervention by the teacher (Tipton, 2020; Zayyad, 2019). This reflection refers to the plan of accessibility/usability and design. The design is based on the principles of Universal Design for Learning (Rose et al., 2000; Vinci, 2012; Zascavage et al., 2009) according to which digital technology allows an easier and more effective personalization of student learning paths provided that its use is carefully planned and flexible (Carruba, 2018; King-Sears, 2009; Vinci, 2012).

It is possible to identify two roles for technologies: (1) support in performing exercises (training and strengthening of skills); (2) environment to organize collaborative, metacognitive and remote work (Chiappini et al., 2004; Ranieri, 2010). Thinking from an inclusive perspective, this last role should prevail as it is connected with the creation of inclusive learning environments (Baldiris Navarro et al., 2016).

As Vinci (2012) claims, technologies are part of those "tools" that mediate the relationship between teacher and student, convey information and knowledge, allow the teacher to implement multimedia teaching that uses different media to communicate knowledge through stimulation of different sensory channels and linguistic codes.

In order to include technologies in the context of inclusive teaching, however, it is not enough that teachers know and are able to use them, but it is essential that they also know how to choose technologies in according (1) to their educational/didactic objectives, (2) to the operating characteristics of each one, inserting them correctly with regard to times (when), spaces (where) and ways (how) in design of a specific class with its specific needs. In this perspective, the teacher becomes a learning co-designer (Kalantzis et al., 2012; Vinci, 2012).

Educational innovation through digital technologies depends by the initial and in-service training of teachers who are called to reformulate traditional teaching-learning methods by using the potential that ICT offers in terms of pedagogical accessibility and inclusion (de Anna, 2012, 2014a; Sánchez Utgé, 2016).

2.1 The ICT laboratory

The ICT e-Learning laboratory (Ministerial Decree of 30 September 2011), carried out at the University of Macerata with first and second grade secondary school teachers, was aimed at guiding students to acquire skills to design inclusive teaching-learning interventions mediated by technologies. The laboratory was divided into five modules: (1) Computer accessibility and network resources (10 h); (2) Adaptations with technologies (15h); (3) Collaboration and metacognition with e-technologies (20h); (4) e-books and animations (20h); (5) The creation of a multimedia product (20 h). During the modules, the teachers in training were able to gain experience with: (1) the accessibility functions of

the computer (speech synthesis, magnification, color discrimination, etc.); (2) the basic programs (Word, PowerPoint, Excel, Publisher, Google Forms); (3) the creation of educational resources and applications by using different software (Cmap, Padlet, Quizlet, Google Keep, Canva, Epubeditor, Animaker, PowToon, MovieMaker, ScreenCast, Araword). The teachers worked in groups on the Teams platform and they have learned how organize an inclusive e-Learning path.

3. Materials and Methods

3.1 The research design

The laboratory aimed at making teachers in training to acquire the skills necessary to design inclusive educational interventions (mediated by technologies) it was preceded by an investigation phase. It had the purpose of: (1) extrapolating the beliefs of teachers with respect to the inclusive meaning of technologies and their initial knowledge on the use of technological supports; (2) highlight the presence or absence of an inclusive logic in the didactic approach generally chosen in the use of technological tools and applications and, finally, (3) analyze the perceptions of teachers in training about the skills they believe they have learned at the end of the laboratory. These perceptions made possible to evaluate the presence of a predisposition to design in teachers. The first two aspects were fundamental to set up the laboratory in order to respond to the needs of the teachers.

A qualitative methodology was used for the survey.

For the initial phase, a questionnaire was prepared through the Google application, administered online, consisting of four questions:

1) What is inclusive didactic?
2) What support can technologies provide for inclusion?
3) Do you know any inclusive technology?
4) What are the areas of competence that a teacher should have to use technologies in a conscius an inclusive way?

For the final phase, only one question was administered (always online with the Google application) with the aim of evaluating the perceptions of the teachers in training about the skills they believe they have learned at the end of the laboratory (What do you think you having learned from the laboratory)?

The contribution offers an analysis of the answers given to the four initial questions and to the final question considered fundamental to (1) understand the teachers' initial perceptions of the inclusive value of technologies, (2) justify the organization of the laboratory presented in the previous paragraph and (3) evaluate its effectiveness from the point of view of the acquisition of design skills, based on the final considerations offered by the teachers.

3.2 Participants

Teachers from lower secondary school (52.1%) and upper secondary school (47.9%) participated in the survey for a total of 96 teachers (N = 96).

Most (53.1%) of the teachers are in the age group between 30-40 years, so they are rather young teachers, with a teaching experience (65.6%), ranging from 1 to 5 years for most of them (60.9%). However, more than half of the teachers (59.4%) declared that they never had experience as a support teacher and for those who have had it (94.9%), it is an experience of about 1-5 years. Less than half of the teachers, 36.5% declare that they have attended training courses on ICT, while 63.5% declare that they have not attended any courses.

The analysis of the personal data made it possible to obtain initial information on the teachers in training also confirmed by the subsequent answers to the questions. (1) Being quite young teachers, they have a good level of confidence in the use of technologies and this was confirmed by the questions about the frequency of use of technological supports in daily teaching; (2) despite they haven't experience and specific training on support, many of them have shown from the beginning that they have a clear understanding of the logic of inclusion and (3) the importance of having design models for the inclusive use of technologies.

These aspects, as will be shown in the following paragraphs, represent an element of evolution with respect to the approaches to technologies shown by teachers in previous training courses of this type, where their approach was mainly of a compensatory type, i.e. learning the use of specific technologies in relation to various types of disabilities.

4. Results

The analysis of the answers provided by the teachers in training in relation to the questionnaire was carried out according to the methodology of Qualitative Content Analysis (Schreier, 2012) and it highlighted the conceptual categories represented within the maps shown below.

Within each map it is possible to observe, for each conceptual core, each category (represented with ovals) and the respective elements (represented with box).

The first question “What is inclusive didactic?” aimed to (1) bring out the idea of inclusion possessed by each teacher, considered fundamental as a determining element in the choice of specific teaching strategies and methodologies (active, cooperative learning, tutoring, flipped classroom, metacognition); (2) hightlight in teachers the presence “design forms” to organize accesible path for all with the use of technologies.

Map 1 highlights, in relation to the conceptual core “Inclusive didactic”, the presence of eight categories (accessibility, participation and involvement, overcoming difficulties, didactic strategies and

methodologies, didactic activities, design, use of tools, learning environment) with their respective distinctive elements.

The second question "What support can technologies provide for inclusion?" had the purpose of extrapolating the position of teachers in training about the inclusive value of technologies attributable to the use of the same according to the logic of the UDL. This approach is fundamental in thinking of technologies not as specific tools to cope with deficits and disabilities (typical dimension of AT Assistive Technologies), but as multimodal and multimedia facilitators/mediators to design and implement educational paths to satisfy the needs of all students stimulating active participation and collaboration. Map 2 highlights, in relation to the conceptual core "ICT support for inclusion", the presence of eleven categories (facilitation of learning, collaboration, expansion of information, learning/ teaching support, flexibility and accessibility of

MAP 1 – TEACHERS' PERCEPTIONS ON INCLUSIVE DIDACTIC

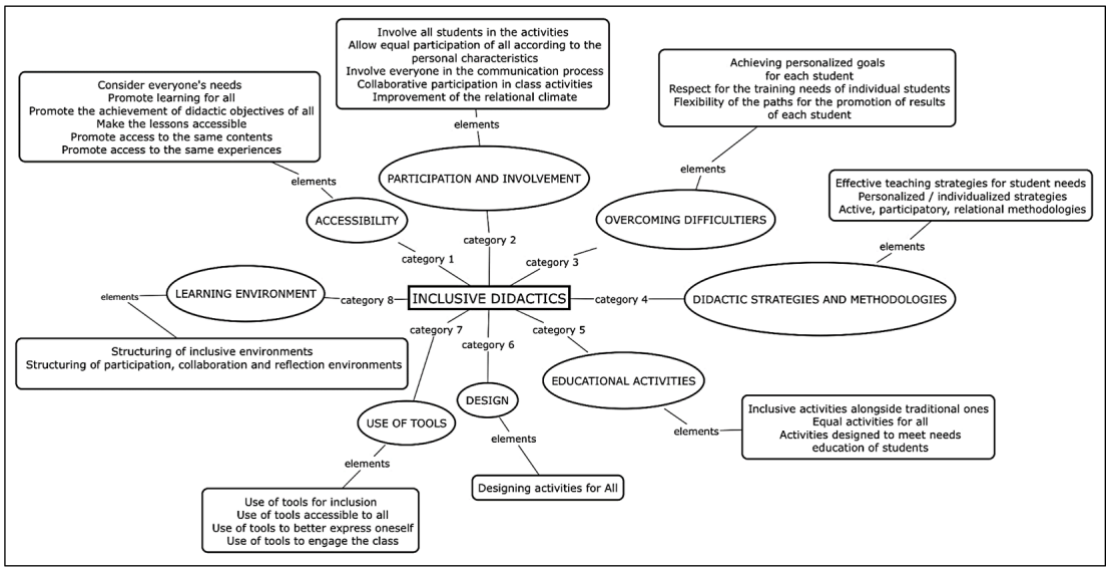

Table 1 - Conceptual categories related to Inclusive didactis.

MAP 2 - TEACHERS' PERCEPTION ON THE INCLUSIVE VALUE OF ICT

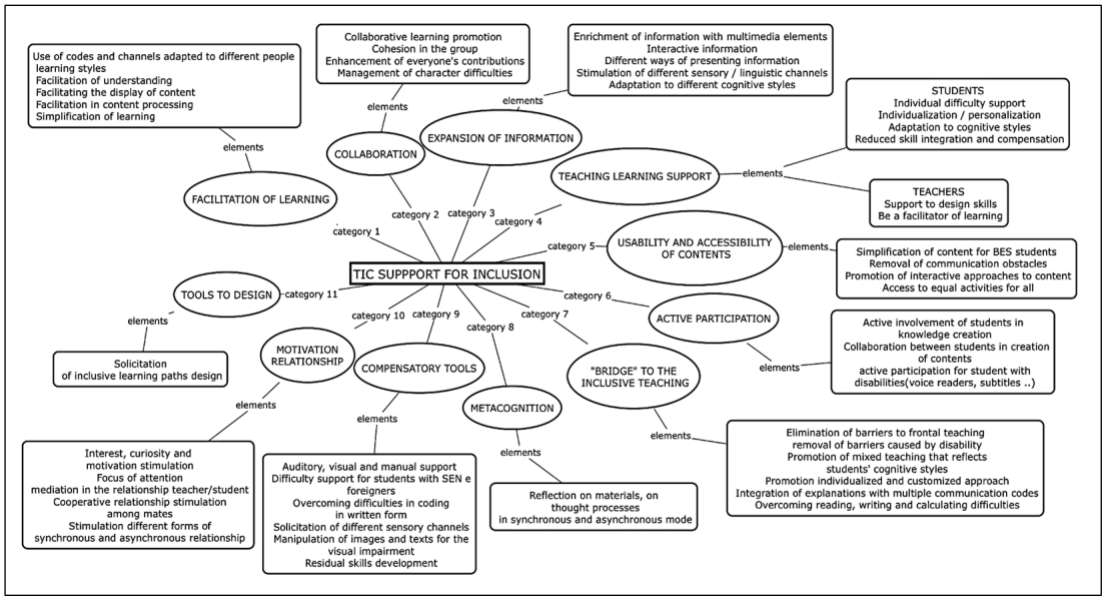

Table 2 - Conceptual categories related to the inclusive value of ICT.

contents, active participation, "bridge" for inclusive teaching, metacognition, compensatory tools, motivation and relationship, tools for design) with their respective distinctive elements.

The third question "Do you know any inclusive technology?" was aimed at extrapolating the incoming knowledge of teachers in training. Specifically, the aim was to understand whether these teachers, despite not having (most of them) experience in teaching support, identified the inclusive value of technologies in: (1) hardware (eg adapted keyboards) and software (eg speech synthesis, reading for specific learning disorders)

MAP 3- INCLUSIVE TECHNOLOGIES IDENTIFIED BY TEACHERS

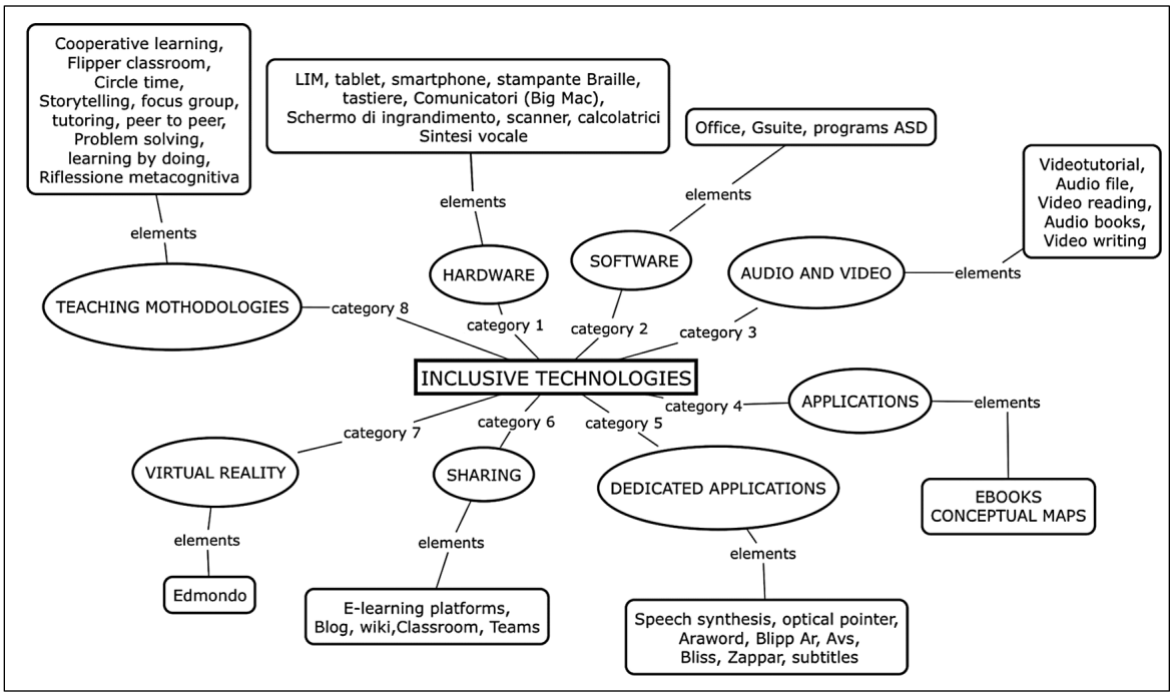

Table 3 - Conceptual categories relating to the identification of inclusive technologies.

MAP 4 – AREAS OF COMPETENCE OF INCLUSIVE TEACHING IDENTIFIED BY TEACHERS

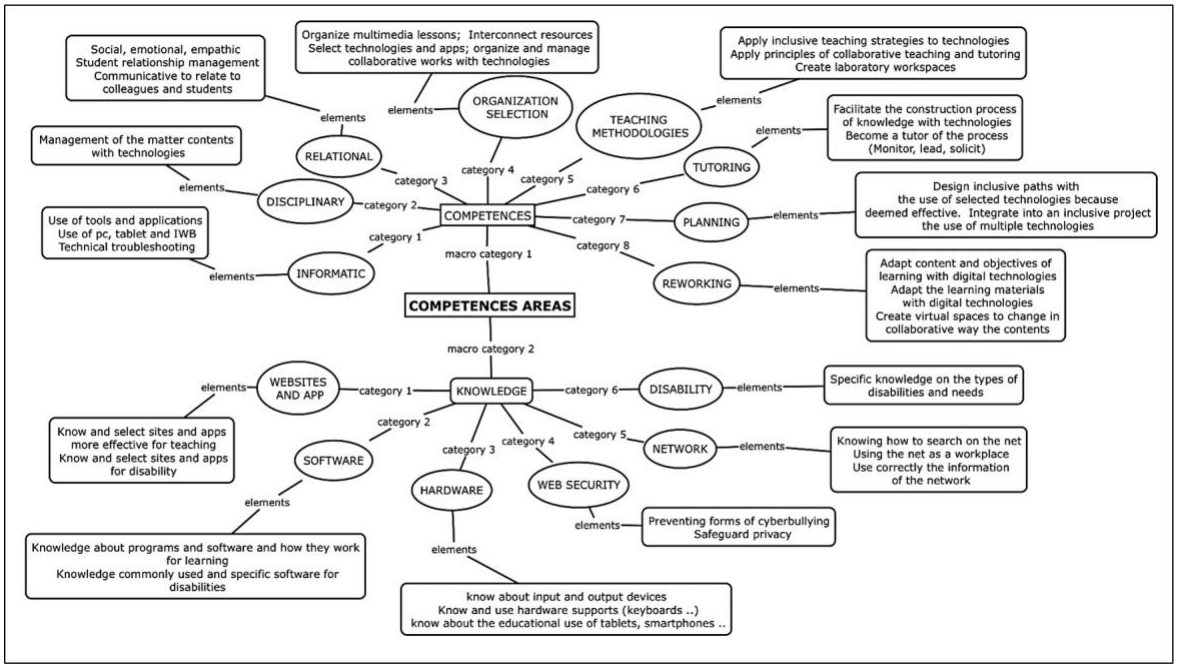

Table 4 - Conceptual categories relating to competence areas.

MAP 5- IDENTIFICATION OF LEARNING ACHIEVED WITH THE LABORATORY

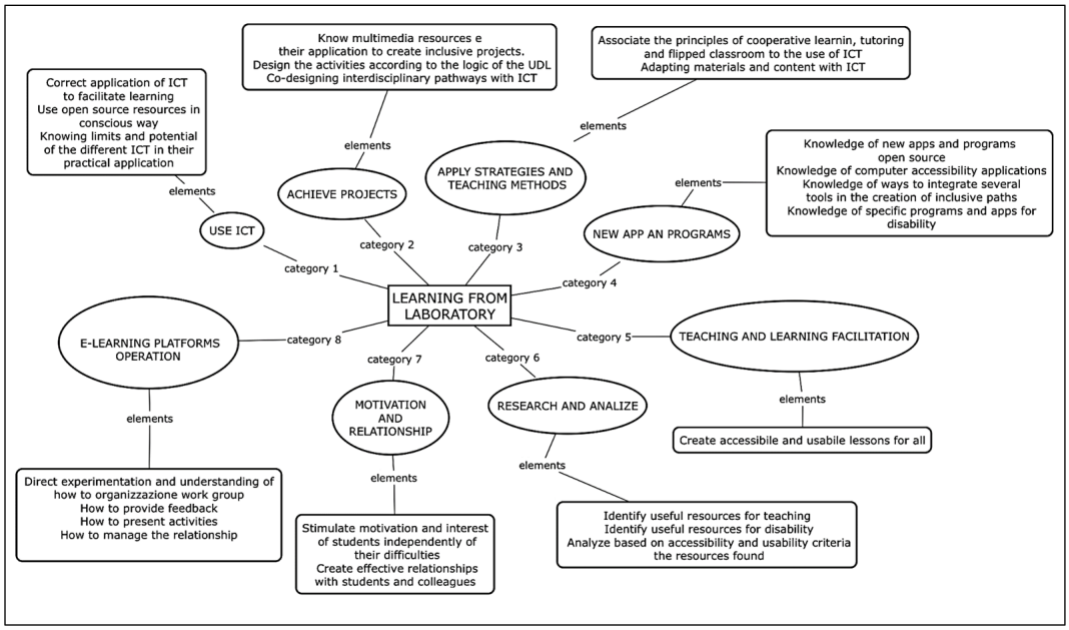

Table 5 - Conceptual categories relating to the learning achieved with the laboratory.

specific for special educational needs; (2) specific hardware and software to teaching a discipline to student with BES; (3) tools and applications born not with the aim of inclusion but for their characteristics can make teaching inclusive and encourage the active participation of all students. Map 3 highlights, in relation to the conceptual core "Inclusive technologies", the presence of eight categories (hardware, software, audio and video, applications, dedicated applications, sharing, virtual reality, teaching methods) with their respective distinctive elements.

The fourth question "What are the areas of competence that a teacher should have to use technologies in a conscius an inclusive way?" it had the purpose of verifying whether the teachers considered essential the possession of a technical competence only or if instead they led to the effective an inclusive use of technologies also in areas of competence relating to teaching, design, relationship, to communication. In fact, to promote inclusive processes it is not enough to have high-level technical skills but it is essential to know how to insert technological tools in a design framework that justifies their use and makes the proposed path coherent and interdisciplinary. Map 4 highlights, in relation to the conceptual core "Areas of competence", the presence of two macro categories "skills" and "knowledge" with the categories connected to them: eight categories for the first macro category (Informatic, disciplinary, relational, organizational and selection, methodological and didactic, tutoring, design, re-elaboration) and six categories for the second macro-category (sites and apps, software, tools, web security, network, disabilities). The respective distinctive elements are identified for all categories.

Finally, the last question asked at the end of the laboratory "What do you think you have learned from the laboratory you attended?" had the objective of connecting the teachers' initial expectations (influenced by their idea of inclusion and inclusive teaching, by their conception of technologies as only compensatory tools or facilitators and mediators of the learning path) with the perception of what has been learned and with changes occurred in their way of thinking about inclusive teaching with the use of different technologies. The aim was to evaluate the overall satisfaction of teachers in training with respect to the path taken. Map 5 highlights, in relation to the conceptual core "Learning from the laboratory" the presence of eight categories (use of ICT, achieve projects, apply teaching strategies and methodologies, new APPs and programs, facilitation of teaching and learning, research and analyze, motivation and relationship, functioning of e-Learning platforms) with their respective distinctive elements.

5. Discussion

The categories relating to the conceptual cores "Inclusive education" (map 1), ICT support for inclusion (map 2) and "Areas of competence" (map 4) are taken into consideration, highlighting the existence of some connections that stimulate reflections on the relationship: teaching – use of technologies – skills.

5.1 Category – Design

The first recurring category is design, which occupies a predominant space as a fundamental element in inclusive didactic and as a tool that allows effective and useful inclusive technological paths to be implemented to reach objectives and contents that cannot be obtained only with traditional teaching, in according with the literature (Calvani, 2020; Tipton, 2020; Zayyard, 2019). The design is intended like a framework that supports, justifies and gives value to the use of one or more technological tools. These tools are chosen because they allow to generate paths in which all students, regardless of their functioning characteristics, can actively participate, achieve objectives, build their knowledge, use the information made available to the teacher in different ways (reading, listening, watching) in an individual and/or collaborative way and produce materials that reflect their potential. From a didactic point of view this design recalls the principles of UDL (King-Sears, 2009, Zascavage et al., 2009; Rose et al., 2000) and is realized thanks to the potentiality of different technological tools, as observed by teachers in training (edit images and text, add images and text and speech synthesis, insert audio and video files, different writing systems such as Araword). The analysis of the skills considered by teachers in training fundamental for using ICT in an inclusive sense, it has highlighted, in according with the leterature (Pinnelli, 2020; Calvani, 2020), that the design competence is perceived as a priority by teachers in training. It is an innovative aspect because highlights, compared to the first "Support courses" (Fedeli et al., 2019; Pennazio, 2017a), a change in the conception of the inclusive use of technologies linked to a more knowledge of the inclusive didactic. The departure from the concept of integration has generated a vision of technologies as tools to create inclusive learning environments (Pinnelli, 2020) supported by careful design in which technologies interact with disciplines, with objectives, with methodologies and didactic strategies, relational dynamics, evaluation methods.

5.2 Category - Didactic strategies and methodologies

The second category that occurs more frequently is "teaching strategies and methodologies" which is identified by teachers in training as a fundamental variable of inclusive teaching. The absence of methodologies of active teaching (e.g. cooperative learning, tutoringig, peer to peer) and individualization /personalization strategies that overtake the more traditional forms of teaching, it is perceived by teachers in training as a barrier that hinders the creation of an inclusive environment. This is a category strictly connected to the previous one (design) and it uses the technologies like "a bridge" to realize itself. In this perspective technologies are considered by teachers in trainer like multimodal and multichannel tools/strategies to build collaborative path, to create and modify contents, to promote active interations with teachers and mates. (Bush et al., 2020; Bhroin et al., 2020; Jolliffe, 2007). In this way, the real and / or virtual classroom becomes a collaborative environmen that support the knowledge building and it satisfies everyone's needs. Even the aspect of metacognition and, therefore, of metacognitive teaching (Ranieri, 2010) finds in the positions of teachers in training a greater possibility of implementation with the use of technologies (building a presentation with Canva, creating an e-Book that contains contents but also activities; for example, require to return in a reflective way to contents, to synthesize, to create connections, to have a clear understanding of the mental processes necessary to solve a task). The analysis of the skills considered fundamental by teachers in training identifies, in accordance with the literature (De Anna et al., 2015; Sánchez Utgé et al., 2017), the possession of didactical/ methodological competences essential for proposing technological paths. Without adequate knowledge of how a strategy/methodology must be managed (e.g. cooperative learning, tutoring have rules that must be respected) it is not possible to associate a functional use of the technological tool because this adds rules (e.g. tool sharing) during the use of the traditional methodology. Therefore, the main teachers' need is the knowledge of these methodologies applied to technologies.

5.3 Category - Participation and involvement

Participation and involvement emerge as a third recurring category. Inclusive teaching promotes (1) the participation of all students (regardless of their functioning characteristics) in the life of the class (eg discussing with classmates and teachers, expose their position with respect to certain contents, attend in communication) (Bush et al., 2020; Bhroin et al., 2020; Jolliffe, 2007) (2) and active collaboration (Johnson et al., 1994; Kagan et al., 2009), that enhancesthe contribution that, every student can offer with respect to his potential. Also in this case, technology is identified by teachers in training as fundamental in guaranteeing an equal and active participation of all students in class life this is guaranteed in the case of severe disabilities, also by the use of TA (Cook et al., 2002; Scherer, 2005; Tipton, 2020; Zayyad, 2019). These can support and help the student in the possibilities of expressing themselves (communicators, optical pointers), of writing (braille keyboards), of listening (subtitling tools also present in computers as an accessibility) and to participate in the activities proposed with technologies not specifically dedicated to disability. Among the skills considered fundamental by teachers in training there is the "tutoring", where teacher became tutor to support with specific actions (e.g. monitor, solicit, guide, provide feedback, advise) the knowledge building process mediated by technology of students.

5.4 Category – Accessibility

Closely connected with the previous category, it was indicated by the teachers in traing "Accessibility" which is understood, in inclusive didactic, as the possibility of guaranteeing the ideal conditions so that all students are able to achieve the same objectives and the same knowledge respecting their needs and their cognitive characteristics (Chiappini et al., 2004). Obviously in the case of severe disabilities, objectives and knowledges can be simplified, reduced but must fall within the same disciplinary area, in the same content (summarized in its founding core) to ensure access to the same experiences. In this process a fundamental role is attributed by teachers to technologies that allow you to manipulate and simplify content (e.g. Google Keep allows you to capture a text in paper version, transform it into OCR making it editable, to this text it is possible to add a speech synthesis, a video file, or associate a text in Araword). Competence considered essential by teachers to promote accessibility is "Organization and selection" understood (1) as the ability to organize multimedia lessons by interconnecting different resources in order to make the content presented usable in different ways; (2) the ability to select technologies and APPs suited to the content to be conveyed and the characteristics of the students.

5.5 Category – Motivation and relationship

Another category that emerged is "motivational/ relational" which in inclusive didactic refers to the teacher's ability (1) to motivate through engaging lessons and through an encouraging relational style), (2) to stimulate students to continue learning tasks despite the difficulties, helping them to find appropriate strategies for their cognitive characteristics and useful for improving their performance (Heafner, 2004). According to the teachers, it becomes essential to create flexible paths with the use of technologies in which it is possible to organize learning materials using various codes and formats (slides, flash cards, concept maps, design, interactive bulletin boards), focusing attention and motivation of the student who is always actively involved. In this perspective, the relational – motivational skills of the teacher (Ranieri, 2010) are considered fundamental both to understand, on an emotional level, which technology is most suitable according to the needs of students, and to manage the relationship with students / colleagues in in the choice of technologies to use.

5.6 Category – Tools

The last category highlighted by the teachers is "use of tools" that in inclusive didactic, refers to the indispensability of technological tools to create learning paths that can be followed by all students with their own specific methods (individualization/personalization). The emphasis on tools, at the level of inclusive technologies, inevitably includes specific tools and APPs for disability (compensatory) that fall within the scope of TA, emphasizing the importance of creating a dialogue between the various technologies used. But the emphasis placed on the tools also includes all those useful for expanding information (enriching it with video, images, audio, texts). The range of technologies considered inclusive by teachers in training will be analyzed later. It is important at this stage, to underline that the competence connected to the category tools is (1) information technology (understood as technical knowledge, of management and resolution of any problems); (2) of re-elaboration of information in digital format; (3) disciplinary connected to the ability to choose and manage the the most suitable tool and application to convey the specific content of each discipline in relation to the student's needs.

5.7 Conceptual core: Inclusive technologies

The analysis of the categories contained in the conceptual core "Inclusive Technologies" has led to an interesting observation: teachers in training do not consider as inclusive technologies only those dedicated to students with disabilities (TA), but the commonly used technologies to which they associate the use of active teaching methodologies (cooperative learnng, flipped classroom, circle time, story telling, tutoring, peer to peer, problem solving, metacognitive reflection).

The categories of this conceptual core include, (1) hardware (IWB tablets, smartphones, computers, and specific hardware such as Braille printers, communicators ect.), (2) software (Office, GSuite and software dedicated for example to students with DSA), (3) Audio and Video (tutorials created by the teacher or available on the web, audio books etc.), (4) Applications (to create e-books and concept maps), (5) Dedicated applications (speech synthesis, optical pointer, Araword), (6) sharing tools (e-Learning platforms, blogs, wikis, Teams, classrooms etc.), (7) Virtual Reality (Edmondo). The identification of the categories confirmed a positive aspect in an inclusive sense: since the start of the laboratory, the teachers have demonstrated that they possess the foundations of an inclusive logic that does not aim at the realization of specialized interventions reserved for students with disabilities but at creating paths made accessible to all from the outset in compliance with UDL design principles (King-Sears, 2009; Rose et al., 2000; Zascavage et al., 2009).

5. Conclusion

The initial attitude of the teachers of "predisposition towards the logic of inclusion" made it possible to create the laboratory according to the articulation in modules presented in paragraph 2.1 (taking into account the emerging needs of teachers in training). Since vision of technologies was already connected with the principles of inclusion, teachers was help to (1) understand how commonly used technological tools, software and apps

can be used in teaching with an inclusive value; (2) apply inclusive teaching methodologies and strategies to the same technological tools; (3) implement projects, including interdisciplinary ones, in which the use of the various technological tools is justified and represents an added value from the point of view of inclusion; (4) research/select new open source applications and evaluate their effectiveness; (5) learn how to create inclusive paths by associating the use of multiple technological applications. At the end of the course, the teachers declared that they felt satisfied with the laboratory for the positive response with their initial expectations. Map 5, presented in the "Results" paragraph, shows in detail the main categories relating to the conceptual core "learning from the laboratory"; it highlights how these coincide with the initial needs expressed by the teachers. The interesting aspect of this survey is that teachers in training have shown from the beginning that they know that inclusive optics requires not focusing attention only on the use of Assistive Technologies but that it is important to consider the potential that ICT makes available to design learning environments in which an inclusive teaching prevails, in according to the principles of Universal Design for Learning (UDL). The starting point must always be didactical design.

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Franco Bochicchio wrote the paragraphs,1, 2.

References

Antonietti, A. (2003). Contesti di sviluppo-apprendimento come scenari di scuola. In: C. Scurati (ed.), *Infanzia scenari di scuola*. Brescia: La Scuola, 31–56.

Antonietti, A., Colombo, B., & Nuzzo, C. (2015). Metacognition in self-regulated multimedia learning: integrating behavioural, psychophysiological and introspective measures. *Learning, Media and Technology*, 40(2),187-209, DOI: 10.1080/17439884.2014.933112

Baldiris Navarro, S., Zervas, P, Fabregat Gesa, R., & Sampson, D.G. (2016). Developing Teachers' Competences for Designing Inclusive Learning Experiences. *Journal of Educational Technology & Society*, 19(1), 17-27.

Bochicchio, F. (ed.). (2017). *L'agire inclusivo della scuola. Logiche, metodologie e tecnologie per insegnanti ed educatori*. Lecce: Libellula, Tricase.

Bonaiuti, G., Calvani, A., & Piazza, D. (2013). Increasing classroom engagement and student comprehension through the use of clickers: an Italian Secondary School Experience. *REM Reasearch on Education and Media*, V,1, 95-107.

Booth, T., & Ainscow, M. (2014). *Nuovo Index per l'inclusione. Percorsi di apprendimento e partecipazione a scuola*. Roma: Carocci.

Bhroin, Ó.N., & King, F. (2020). Teacher education for inclusive education: a framework for developing collaboration for the inclusion of students with support plans. *European Journal of Teacher Education*, 43 (1), 38–63, DOI: 10.1080/02619768.2019.1691993.

Bush, A., & Grotjohann, N. (2020). Collaboration in Teacher Education: A cross-sectional study on future teachers' attitudes towards collaboration, their intentions to collaborate and their performance of collaboration. *Teaching and Teacher Education*, 88, 7–24. https://doi.org/10.1016/j.tate.2019.102968.

Calvani, A. (2010). La competenza digitale: un modello di riferimento per la scuola. In: A. Calvani, A., Fini, & M., Ranieri, *La competenza digitale nella scuola. Modelli e strumenti per valutarla e svilupparla* Trento: Erickson, 35 – 63.

Calvani, A. (2013). L'innovazione tecnologica nella scuola: come perseguire un'innovazione tecnologica sostenibile ed efficace. *LEA – Lingue e letterature d'Oriente e d'Occidente*, 2, 567– 584.

Calvani, A. (2014). *Come fare una lezione efficace*, Roma: Carocci.

Calvani, A. (2020). *Tecnologie per l'inclusione*. Roma: Carocci.

Calvani, A., & Vivanet, G. (2014). Tecnologie per apprendere: quale il ruolo dell'Evidence Based Education? *Journal of Educational, Cultural and Psychological Studies, ECPS Journal*, 10, 83– 12.

Cañas, A. J., Carff, R., Hill, G., Carvalho, M., Arguedas, M., Eskridge, T., (2005). Concept maps: Integrating knowledge and information visualization. In S.O., Tergan & T., Keller (Eds.), *Knowledge and information visualization: Searching for synergies*, Heidelberg/NY: Springer Lecture Notes in Computer Science, 205 – 219.

Carruba, M.C. (2018). *Accessibility and well-being in the classroom*, Boston: Tojsat.

Chiappini, G., Dini, S., & Ferlino, L. (2004). Tecnologie didattiche e disabilità. In D. Parmigiani (ed), *Tecnologie per la didattica. Dai fondamenti dell'antropologia multimediale all'azione educativa.* Milano: Franco Angeli, 233-248.

Cook, A.M., & Hussey, S.M. (2002). *Assistive technologies. Principles and Practice*. St. Louis: Mosby.

Covelli, A. (2016). Inclusion Quality Indicators in the Training of teachers. In L. de Anna, *Teaching accessibility and inclusion*. Roma: Carocci, 130–142.

de Anna, L. (2012). Progetto Firb "ret@ccessibile. Insegnamento-apprendimento insieme e per tutti in un progetto di vita". *L'integrazione scolastica e sociale*, 11(3), 225–228.

de Anna, L. (2016). *Teaching accessibility and inclusion*. Roma: Carocci.

de Anna, L., Gaspari, P., & Mura, A. (2015). *L'insegnante specializzato. Itinerari di formazione per la professione*. Milano: Franco Angeli.

D.M. del 30 settembre 2011 http://www.gazzettaufficiale.it/eli/id/2012/04/02/12A03796/sg

Fedeli, L., & Pennazio, V. (2019). An explorative study on teacher training. The use and impact of technologies within a specializing course for special needs. In B.M., Rice, & A., Threlkeld (ed), *Global Perspectives on Inclusive Teacher Education.* Hershey, PA: IGI Global, 58–81.

Felder, F. (2018). The Value of Inclusion. *Journal of Philosophy of Education*, 52(1), 54–70.

Fraser, B.J., Goh, S.C. (2003). Classroom Learning Environments. In: J.P., Keeves (eds). *International Handbook of Educational Research in the Asia-Pacific Region*. Springer International Handbooks of Education, 11, 463–475. Dordrecht: Springer, https://doi.org/10.1007/978-94-017-3368-7_32.

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior*, 68, 441-449.

Goh, S. C., and Khine, M. S. (Eds.) (2002). *Studies in educational learning environments: An international perspective*. Singapore: World Scientific.

Hamburg, I., & Bucksch, S. (2015). ICT-based approaches to support learners with disabilities. *Journal of educational policy and entrepreneurial research, JEPER*, 6, 1–12.

Heafner, T. (2004). Using technology to motivate students to learn social studies. *Contemporary Issues in Technology and Teacher Education*, 4(1), 42-53.

Jonassen, D.H. (2010). *Learning to solve problems: A handbook for designing problem-solving learning environments.* New York: Routledge.

Kalantzis, M., & Cope, B. (2012), *New Learning: Elements of a Science of Education* (2nd ed.), Cambridge: Cambridge University Press.

King-Sears, M. (2009), Universal design for learning: Technology and pedagogy. *Learning Disability Quarterly*, 32(4), 199–201.

Kiuppis, F. & Hausstätter, R.S. (ed.). (2014). *Inclusive Education twenty years after Salamanca*. New York: Peter Lang.

Koutsouri, G., Anglin-Jaffe, H., & Stentiford, L. (2019). How well do we understand social inclusion in education? *British Journal of Educational Studies*, 1-18. https://doi.org/10.1080/00071005.2019.1658861

Moricca, C. (2016). L'innovazione tecnologica nella scuola italiana. Per un'analisi critica e storica. *Form@re. Open Journal per la formazione in rete*, 1 (16), 177–187.

Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or appropriate propositional hierarchies (liphs) leading to empowerment of learners. *Science Education*, 86(4), 548-571.

Pagliara, S.M. (2016). Use of Different Media and Technologies in the Inclusive Educational Didactis. In L., de Anna, *Teaching accessibility and inclusion.* Roma: Carocci, 7 – 83.

Pennazio, V. (2017a). *Formarsi a una cultura inclusiva. Un'indagine dei bisogni formativi degli insegnanti nel corso di specializzazione per il sostegno*. Milano: Franco Angeli.

Pennazio, V. (2017b). Tecnologie inclusive. In F., Bochicchio (ed), *L'agire inclusivo della scuola. Logiche, metodologie e tecnologie per insegnanti ed educatori*. Lecce: Libellula, Tricase, 281-322.

Ranieri, M. (2010). La competenza digitale: quali definizioni e politiche per conseguirle? In A., Calvani, A., Fini, & M., Ranieri, *La competenza digitale nella scuola. Modelli e strumenti per valutarla e svilupparla*. Trento: Erickson, pp. 13-31.

Rose, D., Meyer, A. (2000). Universal design for individual differences. *Educational Leadership*, 58(3), 39–43.

Sánchez Utgé, M., Mazzer, M., Pagliara, S.M., & de Anna, L. (2017). La formazione degli insegnanti di sostegno sulle TIC. Analisi dei prodotti multimediali del corso di specializzazione per le attività di sostegno. *Italian Journal of Special Education for Inclusion*, V, 1, 133–146.

Schreier, N. (2012). *Qualitative Content Analysis in Practice*, London: Sage.

Scherer, MJ. (2005). Assessing the benefits of using assistivetechnologies and other supports for thinking, rememberingand learning. *Disabil Rehabil*, 27, 731–739.

Tipton, K. (2020). Curriculum Developers' Experiences Adopting Assistive Technology. In An Educator

Preparation Program. *All Theses And Dissertations*. 314. https://dune.une.edu/theses/314

Vinci, V. (2012). Ambienti Tecnologici inclusivi. In P.C., Rivoltella, P.G., Rossi (a cura di), *L'agire didattico.* Brescia: La Scuola http://nuovadidattica.lascuolaconvoi.it/agire-educativo/la-mediazione-plurale-nel-lavoro-educativo/ambienti-tecnologici-inclusivi/.

WHO World Health Organization (2001). *The International Classificationof Functioning, Disability and Health*: *ICF*. Geneva: WHO.

Zayyad, M. (2019). Incorporating Assistive Technology for students with disabilities. In M., Shelley & S.A., Kiray (eds.). *Education Research Highlights in Mathematics, Science and Technology*. ISRES Publishing, 271–285

Zascavage, V., Winterman, KG. (2009). What middle school educators should know about assistive technology and universal design for learning. *Middle School Journal*, 40 (4), 46-52.