Materiali e documenti

Psycho-pedagogical research in a Double-degree programme

edited by
Guido Benvenuto and Maria Serena Veggetti

University Press

Sapienza Università Editrice

Collana Materiali e documenti 53

Psycho-pedagogical research in a Double-degree programme

edited by
Guido Benvenuto and Maria Serena Veggetti

SAPIENZA
UNIVERSITÀ EDITRICE
2020

Sapienza Università Editrice
Piazzale Aldo Moro 5 – 00185 Roma

www.editricesapienza.it
editrice.sapienza@uniroma1.it

Iscrizione Registro Operatori Comunicazione n. 11420

ISBN 978-88-9377-131-3

DOI 10.13133/9788893771313

Pubblicato a marzo 2020

Impaginazione/layout a cura di: autore/curatore

In copertina: Viktor Aleksandrovič Guruzhapov, *Studio* (2019), olio su cartone, cm 30 x 20.

To all the students who believed in this course of study and in an international perspective.

And to keep alive the memory of our collegue Viktor Aleksandrovič Guruzhapov, suddenly disappeared.

Table of contents

13. Technologies for active and collaborative learning

Donatella Cesareni, Nadia Sansone

13.1. Technologies and school: in which theoretical framework?

If we look at the history of mankind, we immediately see how technology has changed habits, work, leisure, and in general the possibilities of human life, from the beginning up until now.

From the invention of the wheel to the most sophisticated digital technologies we carry inside our smartphones showing us the way home or allowing us buying a train ticket, technology has helped people improve somehow their life.

The Soviet psychologist Lev Semionovič Vygotskij (1934), already at the beginning of the last century, made us reflect on the fundamental function that the "tools", from the club to the hammer, to the complex machinery, have in changing the environment in which we live. Human beings live in an environment that is transformed by the tools that were produced by previous generations.

In addition, among them we also have inventions that change people's minds. Let's think about how writing affected human mental and cognitive structures.

According to Walter Ong (1982), writing has transformed the human mind more than any other invention. Alphabetic writing makes thought an object, transforming it into text. The text allows thinking to be articulated in a sequence of concepts, arguments and

demonstrations; the same conceptual abstraction is a cognitive process that would be impossible without the support of writing.

But Socrates warned us against the dangers of writing. Though Socrates has never written, his thought is reported to us by Plato: writing would have led to a loss of the mnemonic capacities of the new generations to come, entrusting their knowledge to paper.

Later in history, other technologies have been "criticized". The advent of the calculator has led many to say that we would no longer be able to do calculations by heart. Nowadays digital technologies are accused of bringing our children to a lesser depth of thought. Point is we certainly modify our minds, maybe losing some abilities, but also acquiring others.

Today's researches confirm that our brain is highly plastic, capable of reorganizing its structure following the type of the input it receives and organizing the contents in a different way, leading people to think differently.

Children born after 1995 are defined by Marc Prensky (2001) as digital natives, since they were born in a world heavily modified by technology; if we agree with Bruner (1996), that culture shapes the mind, growing in a culture dominated by technology inevitably brings changes to the way information is processed. By using different media, men come to think differently.

Thus, our youngsters, immersed in a system of interaction and communication with machines since childhood, have undoubtedly developed a different way of thinking, a greater speed of reaction, a capacity for parallel thinking, an expansion of spatial memory and the ability to work on multiple levels (multitasking). But what have they lost? An aspect that for many teachers appears to be compromised is the reflective capacity, the ability to stop, reason and learn from the experience.

Are we then facing a catastrophe?

We are certainly in a period of transition and the school has an enormous responsibility to ensure that this turns to be an advantage for our culture instead of a problem.

Indeed, for Bruner (1996), the school's aim is both to transmit the values of a culture and to train young people to be able to change it, so that the culture does not stagnate, dying in the end.

But this can only happen if students and teachers are able to speak the same language. How is this possible? Let's consider Prensky's concepts of digital cleverness, digital dumbness and digital wisdom (2009).

Today's adolescents show some "digital cleverness" when smartly using their devices, but without fully understanding how to exploit the possibilities offered by the devices themselves and by the web in general. Sometimes they show "digital dumbness" when using technologies to hurt someone (Cyberbullying) or to look for shortcuts and avoiding commitment, as in constructing texts by pasting online materials without even worrying about the validity of the sources.

"Digital wisdom" is instead expressed as the capability to use technologies to enhance one's abilities.

Therefore, teachers set themselves up as digitally wise, when they are able to organize learning contexts in which students can use their digital cleverness to enhance their skills, and teachers guide and monitor the quality of the process. Technologies are part of children and adults' everyday life and must therefore rightfully enter a school that wants to open up to the world, using the typical tools of the social context in which it operates to teach new generations to create and share knowledge.

And to do this it is necessary, as Prensky suggests, that teachers learn to speak the digital natives' language without forgetting their own. It is in this direction that technologies must be introduced at school, that is to promote a real change, by putting students at the center of their learning path. In fact, it is even more important than simply entering schools, to adopt these new tools based on new learning methods.

A solid basic framework in this sense is offered by the socio-constructivist perspective, according to which learning is an active process that takes place essentially within the interaction with others and with the objects belonging to the culture in which we live (Bruner, 1996; Vygotskji, 1934). On one hand, in fact, one learns by participating, collaborating, and discussing (hence, the importance of teamwork, which is a process to fully enter into school strategies). On the other hand, one learns by using tools which mediate the relationship between individuals and objects.

Learning is finally conceived as an active process of knowledge building, linked to doing (Dewey, 1938), and producing artifacts, cognitive or concrete, that are meaningful for students.

To renew teaching and learning process according to this framework, Paavola, Engestrom and Hakkarainen (2010) developed a pedagogical approach, defined as a Trialogical Approach to Learning. This approach integrates "monological" (cognitive) and dialogical (situated cognition) approaches to learning, with a third element: the intentional processes involved in collaboratively producing knowledge artifacts that are shared and useful for the community.

Crucial in this approach is the use of technologies, tools that allow to create and share, process and transform, organize different artefacts, making visible and transforming knowledge practices.

We will see in the third and fourth paragraph how this approach can guide the planning of educational activities in secondary schools and universities. In the following paragraph, we will offer a brief overview of the possible use of technologies in the school, specifically referring to different ages.

13.2. Kindergarten and Primary schools: Kids and computer

How can we use digital technologies with children aged 4 to 10 years?

In the early years of the introduction of computers in schools, Taylor (1980) proposed a distinction in the use of technologies as Tutors, Tutees and Tools.

To act as Tutors were the old CAI type programmes, which were based on the behavioristic approach of Programmed Instruction: preparing an ordered sequence of topics and knowledge and defining assessment tools for each sequence. If you pass the test, these programs offer a positive reinforcement that allows you to continue along the path.

Along with the change of the theoretical framework, moving from behaviorism to cognitivism and constructivism, programmes of this type were criticized, since they considered the student as a simple empty container to be filled with information. The constructivist

approach, instead, considers learners as those who build their knowledge by interacting with information and interpreting it. So, the focus of educational research has shifted towards the other two definitions, that is computer as a Tutee and as a Tool, which have remained valid until today.

Seymour Papert (1980) was the first to state that the student should not be "computer-programmed", instead they should teach the computer (their Tutee), by reflecting their own way of thinking. This is the case of the Logo language, a programming language of extreme simplicity but of great power allowing children to draw geometric figures by imparting simple commands to a "turtle" on the screen. Through the Forward or Backward commands of a certain number of steps, and the Right and Left of a certain number of degrees, children can construct geometric figures on the screen. They can also teach new commands to the turtle, and programme specific sequences to build small animations. According to Papert (1980), Logo is not just a programming language, but a "training ground" for thinking, and learning from one's mistakes.

Coding and educational robotics are nowadays an evolution of the pedagogical ideas of the Logo language. Papert's work, indeed, was continued within the MIT by Mitchel Resnick, who, working with his colleagues from the "Lifelong Kindergarten" research group, created the Scratch programming language, a real computer language specifically designed to be understandable and usable even by children (Resnick, 2013). Scratch grammar is based on a series of colorful programming blocks that children can connect to create more or less complex programmes that can range from simply moving a character to creating stories or video games. In recent years programming or coding activities have been introduced in schools in many European countries, including Italy, according to the actions prescript within the National Digital School Plan. As for the Logo, its creators' basic idea is that programming favors the possibility of reflecting on problem solving strategies and the ability of dividing complex problems into simpler parts; besides, the activity carried out in a playful and collaborative way can also promote trial and error learning and collaboration.

Another important direction is that of educational robotics, which can use either already set up robots (such as the Bee Bot),

programmable even by 4 to 8-years-old children or robot construction kits to be programmed remotely through computers and tablets. Obviously, educational robotics too has been the subject of much research in education. Through a systematic review of the literature, Benitti states that, even if the examined studies often present methodological difficulties, it is possible to affirm that "educational robotics have an enormous potential as a learning tool, including supporting the teaching of subjects that are not closely related to the Robotics field" (Benitti, 2012, p. 988).

But the most important direction emerging from school over the years has been, above all, the use of the computer as a Tool, a flexible tool, allowing to write and publish a text, create archives of stories, build the school newspaper, communicate with students from other schools, perform research on databases or organize data collected in surveys, build multimedia presentations and so on.

Computers can act as important tools to help children exploring the world of writing, through word processing programmes. There are numerous educational values in the use of word processing tools at school, first the possibility of thinking about the structure of the text itself and of revising it many times. Furthermore, since the early years of the introduction of computers in schools, educational research has revealed the potential of technologies to foster collaboration, if used as a support to active teaching. The shared screen, in fact, makes it possible to have tools and work materials available to everyone and each child can intervene with their own contribution.

Moreover, technologies allow us to open up to the world outside the school; through the Internet, forms of network collaboration with other classes can also be implemented.

Technologies can be a support to set up activities in which the class is organized as a community of people who solve problems and build knowledge (Scardamalia and Bereiter, 2006), using educational platforms to discuss together, design common works with students from other schools, connect with experts who can answer to specific questions; they also allow you to open up to diversity through contacts with other languages, cultures, and ages, such as in the case of collaborations between different generations (primary school children and the elderly who exchange and share life experiences;

Kindergarten children who imagine stories that are then illustrated by students of Art schools, and so on).

So, technologies at the service of daily teaching practices, not confined to a "computer lab" use, to visit once a month, but placed in the classroom for daily use, as the movable type box for printing and other technologies of the time were present in classes inspired by Freinet techniques (1969).

In primary and secondary school classes it will therefore be essential to have a technology station equipped with a PC, projector, printer/scanner, and possibly a few tablets for small group activities among students.

Even in kindergarten, "technology areas" equipped with technological tools to be used creatively can be organized. For example, there may be tablets with apps that can stimulate logic and creativity, or small programmable robots like Bee-Bot. But above all, tablets can contain applications to build stories together, recording voice and images, scanning designs and inserting them into history, briefly, becoming tools for the creative production of artifacts.

13.3. The Trialogical Learning Approach to fruitfully integrate technologies in Secondary Schools

In the first paragraph we already claimed that nowadays, among its main tasks, school has that of educating youngsters to a conscious and constructive use of technologies. To this aim teachers should be prepared to set up significant learning contexts, within which the technologies are used to access and build shared knowledge, to solve real problems, and to broaden the dialogic base of the group. The trialogical approach, above mentioned, helps us by conceiving technology as a mediation tool able to sustain the discourse within the community, as a possible extension of the knowledge of the community itself and as a support for the collaborative construction of artifacts. These objects are not merely conceived for evaluation purposes, rather they are meant to be concretely used, both inside and outside the learning community which created them. In this approach, therefore, the acquisition and participation metaphors of learning (Sfard, 1998) are embedded in the knowledge creation metaphor, going beyond two traditional dichotomies: individual

versus social processes, and conceptual knowledge versus the social practices needed to foster collaborative creativity (Paavola, Engestrom, and Hakkarainen, 2010).

The Trialogical Approach is applied through six Design Principles (DPs) (Hakkarainen and Paavola, 2009) which guide the planning of technology-based teaching and learning activities to facilitate the shared efforts of working with knowledge artifacts. In the following table, the DP are presented and accompanied by practical examples taken from European project[1], to which several Italian secondary schools participated to experience the effectiveness of the TLA.

TLA DESIGN PRINCIPLES	DEFINITION	EXAMPLES
DP1 Organizing activities around shared "objects"	*Formative action must converge towards the realization of shared objects recognized as important and intended for actual use*	*A videogame about a famous Italian novel* *A guide for the correct use of a professional oven* *A website about II World War* *A tool to test the acquisition of Math knowledge*
DP2 Supporting interaction between personal and social levels	*It is necessary to fruitfully combine individual work with that of a team, considering individual needs and exploiting inclinations and interests*	*Workgroups of 6-8 members* *Assignation of specific Roles: the group coordinator, the researcher, the process observer* *Formative assessment considering both the individual and the group*

[1] KNORK http://knork.info/website – Promoting *Knowledge work* Practices in Education –is a project funded by the European Community within the Lifelong Learning Program in the years 2014-2016. The project was promoted by the Technology in Education Research Group (TEdu) of the University of Helsinki and was attended by various institutions, schools and universities from four European countries: Finland, Bulgaria, Sweden and Italy.

DP3 Fostering long-term processes of knowledge advancement	*Learners should be provided with enough time for iterative inquiry cycles and with supporting environments to let long-term processes take place*	*Course divided into modules with repeated activities* *Students performing peer-assessment* *Group products to be continuously improved*
DP4 Emphasizing development through various forms of knowledge and practices	*New ideas and practices can easily emerge when learning involves various forms of knowledge and practices: declarative, procedural, visual, as well as tacit*	*Handbook, movies, experts' interviews help build the videogames around the novel* *The guide for the oven was realized both in a textual and multimedia support* *Students wrote a Learning Diary while realizing the II World War Diary*
DP5 Cross fertilization of knowledge practices across communities and institutions	*Creating connections within other contexts promotes the acquisition of novel modes of interaction, ways of thinking and languages typical of contexts with which students interact*	*Videogames experts helping students to project and realize their own product* *Oven producers revising the guide and providing improvement feedback* *Professional software used by students to build their "Math exercises tool"*
DP6 Providing flexible tool mediation	*Learning paths should be supported by adequate and diversified technologies, suited to mediate collaborative activities and able to enhance the aspects highlighted in the other design principles*	*Google Drive to collect storyboard and learning diaries* *Padlet to stimulate a brainstorming about the website graphic* *Geogebra to build the Math tool* *Webforum to stimulate discussion around the main actors of II World War*

Table 13.1. The six design principles and their application in secondary schools.

Together, the six principles synthesise the main pillars of the TLA: designing object-based learning activities through which enhance both individual and collaborative work strategies, creative processes, and an effective use of educational technologies. In this sense, the trialogical approach is not new. However, it provides teachers and researchers with precise guidelines that enable them to innovate their

pedagogical practices and inspire the use of broader and consolidated theoretical frameworks such as Learning by Doing (Dewey, 1900), the Cultural Historical Activity Theory (Engeström, 1987) and the Knowledge Building Theory (Scardamalia & Bereiter, 2006).

Modern digital technologies are well placed within and in support of a trialogical learning thanks to their ability to integrate different types of mediation processes (Rabardel & Bourmaud, 2003). But it is only conceiving them in a theoretically anchored educational design that they can lead young people to use them in a "wise" way, freeing the teacher from the belief that they are an element of distraction to be kept out of the classroom. They should rather be used as work tools, according to a BYOD (Bring Your Own Device) logic, i.e. the possibility of using the devices students already bring with themselves (tablets, smartphones, laptops). With smartphones or tablets, for example, it is possible to participate in collective brainstorming in the classroom, to contribute to a learning discussion, to keep track of the work the workgroups are doing, to build the shared final object. This is the case of the above mentioned examples taken from the secondary schools participating in the KNORK project: personal devices, for instance, were used for the initial brainstorming needed to define the phases and roles of the activity leading to the novel-inspired videogame, as well as to write the learning diary of the workgroups involved in designing the oven guide, and so on.

The BYOD logic focuses on students using their digital devices in classrooms, but technology can also play an important role outside the classroom, at home. In flipped classrooms, students review lecture materials before class, as homework. In-class time is dedicated to discussions, interactive exercises, and independent work that would have previously been completed at home. The materials reviewed before class can take the form of recorded lectures, curated videos, reading assignments, video broadcasts — any material that the teacher dispenses as relevant to the topic at hand. This is how the students building the II World War website prepare some short talk about the world main actors to be presented to their classmates and then stimulate a collective discussion. And this is just the sense of flipped classroom activities, that is to mix face-to-face interaction

with independent study via technology, in which students come to school to do their work armed with questions and at least some background knowledge.

13.4. Technology to renew university teaching

The renewal of university teaching is a complex path, started at European level about fifteen years ago and, however, not yet fully implemented at a practical level in Italian universities. The great issue remains the poor ability to prepare young people for the world of work, providing them with an adequate knowledge base, but also professional skills. One of the main goals of higher education, in fact, is to ensure that students acquire useful skills to achieve success not only in their studies, but also in their future career and in life in general. In every age, the "useful skills" are defined according to the context in which those skills should be mobilized (Le Boterf, 1994). The context where today's students live and work is that of a highly technological impacted knowledge work society. In other words, it is a society where knowledge and technology represent two "inextricably linked" factors in any educational and professional context (Scardamalia, Bransford, Kozma, & Quellmalz, 2012, p. 234). To be successful in such a society, students should learn to act and work intentionally and effectively, individually or together with others, in authentic contexts, solving complex problems and creating new solutions and new knowledge. Based on these aspects, the knowledge work skills that students should master can be grouped into three categories (Ilomäki, Lakkala, & Kosonen, 2013): individual (e.g., metacognitive skills, creativity, and ICT skills), social (e.g., networking and communications) and epistemic (e.g., critical thinking, information management and networking).

In this regard, an important role can be played by digital technologies that, provided a theoretically founded implementation, can enhance students' participation, professionalization process and the teaching strategies that aim to support the sense of community, the creation of knowledge and the production of ideas. What are the appropriate technologies for this? There is no unambiguous indication; the teacher must use the most useful technology (hardware and software) for a specific goal and task. The activities of

a class that adopts, for example, a trialogical approach may require the use of articulated learning platforms (Learning Management System, LMS), where to organize all the activities of the course. One of the most popular LMS is undoubtedly Moodle (Modular Object-Oriented Dynamic Learning Environment), a free and open source educational platform where teachers can "build" their own learning environment by selecting the most useful functions for their own purposes: insert folders to share files; open forum for group discussions; propose tasks and define delivery methods and deadlines; open wiki spaces for collaborative writing; open polls or administer quizzes; manage and share a calendar. Beyond the platforms, there are numerous tools that can support the development of professional skills, such as continuous improvement, creativity and collaboration. From this point of view, the possibility of intervening several times on a text or on an artifact to improve it, being able to post comments and responding to them to clarify certain aspects are functions that make technologies a fundamental tool for the continuous improvement of the objects of knowledge. In this sense, so-called cloud services such as Google Drive (www.google.it) are useful, since they allow students and teachers to organize all types of documents in folders to be shared with defined groups, inside and outside the classroom. The relevant aspect of Google Drive is, in fact, the offer of a series of Apps for collaborative work to directly edit documents online (Google Documents), drawings and maps (Google Drawings), presentations (Google Presentations), facilitating collaborative distance writing, which is furthermore enhanced by discussion tools such as chats. Technologies can also support spontaneous production and exchange of ideas, as well as defining the steps of a project. A certainly interesting tool for this specific action is Padlet (www.padlet.com), a shared bulletin board on which all students can write, even via their own mobile phones. The ideas generated become visible to everyone and easily shared, making the discussion on them more functional and productive. The teacher can organize the comments spatially, moving and grouping them according to the choices of the class.

Here follows an example of university course inspired by the trialogical approach, in which the different technologies above listed were used to promote knowledge work skills, also reporting a good

result, as shown in the study briefly described. One-hundred and nine Psychology students (27 male, 82 females, aged 20-23 years) voluntarily participated in an undergraduate course titled "Experimental Pedagogy", offered at Sapienza University of Rome (Italy). The aim of the course was to provide fundamental knowledge about main learning theories and authors, and to let students experience specific collaborative techniques and an educational use of modern technologies. Students were divided into eleven learning groups with a minimum of nine and a maximum of eleven participants in each. In each module the learning groups had to analyze and discuss issues raised during face-to-face meetings, study the learning material provided by the teachers, reflect upon the various topics, search and share theoretical insights connected to the course content, build collaborative products, and reciprocally comment on them by providing formative feedback. As the architecture of the course was inspired by the Trialogical Approach, each of the six Design Principles inspired specific course activities and, viceversa, each activity followed a specific principle. The general aim of the study shortly reported here, was to understand the impact of the course on students' perceptions of their acquisition of knowledge work skills. The data collection was informed by the trialogical design principles that inspired the course and defined the knowledge work skills to be observed, i.e. collaboration, continuous improvement, digital skills. A self-report anonymous questionnaire was administered at the end of the course, the Contextual Knowledge Practice questionnaire (CKP, Muukkonen et al., 2017), comprising 27 Likert-scale items, organized into seven scales built around TLA design principles. The data collected included 100 CKP-questionnaire responses (91.7% of the 109 participants registered on the course); SPSS was used to perform significance tests (ANOVA). When looking at the scales from top mean score to bottom, we can see that development through feedback is the skill perceived as the most acquired (mean = 4.2), immediately followed by Learning to collaborate on shared objects (mean = 4.2). The last three scales are slightly under the average score of 4 – though, this is still to be considered as highly acquired − with the last one referring to the Interdisciplinary collaboration and communication (mean = 3.5). When considering students' perceptions about their skills

development, it would appear that the Trialogical design effectively promoted the targeted knowledge work skills, notably the capability to use feedback to improve the objects under construction. This skill is connected to the capability to work together in a very concrete way, going beyond the simple group dimension and focusing on object development through the means of a constructive use of modern digital technologies. Altogether considered, these abilities constitute the crucial skill set to promote students' transition towards their professional career.

In conclusion, we claim that, whichever the school level, it is necessary that teachers know how to set up meaningful learning contexts within which students are invited to use the artifacts of our culture, and in particular digital technologies, to access shared knowledge, to build real knowledge and solve real problems, to broaden the dialogic basis of the group and to direct one's effort towards the construction of a product.

References

BENITTI, F.B.V. (2012). Exploring the educational potential of robotics in schools: A systematic review. *Computers and Education*, 58 (2), 978-988.

BRUNER, J. (1996). *The Culture of Education*. Cambridge: Harvard University Press.

DEWEY, J. (1938). *Experience and Education*. New York: Mc Millan.

DEWEY, J. (1900). *The School and Society*. Chicago: University of Chicago Press, (trad. it. *Scuola e società*, Firenze: La Nuova Scuola Editrice, 1969).

ENGESTRÖM, Y. (1987). *Learning by expanding: an activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit Oy.

FREINET, E. (1969). *Nassaince d'une pédagogie Populaire*. Paris: Maspero 1969.

HAKKARAINEN, K. (2009). A knowledge-practice perspective on technology-mediated learning. *International Journal of Computer Supported Collaborative Learning*, 4, 213-231.

HAKKARAINEN, K., & PAAVOLA, S. (2009). Toward a trialogical approach to learning. In Schwarz B., Dreyfus T. & Hershkowitz R. (Eds.), *Transformation of knowledge through classroom interaction* (65-80), London: Routledge.

LE BOTERF, G. (1994). *De la compétence: Essai sur un attracteur étrange*. Les Ed. de l'Organisation.

ONG, W. (1982). *Orality and Literacy: The Technologizing of the word.* London: Methuen.

PAAVOLA, S., ENGESTRÖM, R., & HAKKARAINEN, K. (2010). Trialogical approach as a new form of mediation. In A. Morsh, A. Moen & S. Paavola (Eds.), *Collaborative knowledge creation: Practices, tools, and concepts* (9-23), Rotterdam, Boston, Taipei: Sense Publishers.

PAPERT, S. (1980). *Mindstorms: Children, Computers and powerful ideas*. London: Harvester Press.

PRENSKY, M. (2001). Digital Natives, Digital Immigrants Part 1. *On the Horizon* 9 (5), 1-6.

PRENSKY, M. (2009). H. Sapiens Digital: From Digital Immigrants and Digital Natives to Digital Wisdom. *Innovate,* 5 (3).

RABARDEL, P., & BOURMAUD, G. (2003). From computer to instrument system: A developmental perspective. *Interacting with Computers*, 15, 665-691.

RESNICK, M. (2013). *Learn to Code, Code to Learn*. Ed Surge, May, https://www.edsurge.com/news/2013-05-08-learn-to-code-code-to-learn.

SCARDAMALIA, M., & BEREITER, C. (2006). Knowledge Building: Theory, pedagogy, and technology. In Sawyer K. (Ed.), *Cambridge Handbook of the Learning Sciences*, 97-118. New York: Cambridge University Press.

SCARDAMALIA, M., BRANSFORD, J., KOZMA, B., & QUELLMALZ, E. (2012). New assessment and environments for knowledge building. In Griffin P., McGaw B., & Care E. (Eds.), *Assessment and teaching of 21st century skills*, 231-300. Dordrecht: Springer.

SFARD, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27* (2) 4-13.

TAYLOR, R.P. (1980). *The computer in the School: Tutor, Tool, Tutee*. New York: Teacher College Press, Columbia University.

VYGOTSKIJ, L.S. (1934). *Myšlenie i reč. Psichologičeskie issledovanija*. (trad. It., *Pensiero e linguaggio. Ricerche Psicologiche*. Bari: Laterza 1990).