

# Technology: tool or learning object?

## Travels through two school-work alternation courses

Luigi Traetta<sup>a</sup>

<sup>a</sup> *University of Foggia, Via Arpi, 155/176, Foggia, 71121, Italy*

### Abstract

This paper looks at two school-work alternation courses (ASL, later PCTO) at the University of Foggia's Department of Humanities during the 2016-17 and 2019-20 academic years. Both courses were dedicated to communication technologies and Leonardo da Vinci, respectively. Included among the soft skills to be acquired was an awareness of the use of technologies in everyday life and some learning environments. The courses allowed pupils (aged 15–17 years old) to think about their digital skills by learning to use them to complete the assigned tasks through, for example, the evolution of telecommunications, online searches for sources, or a wooden or digital reconstruction of Leonardo's machines, using specific software. Technology thus assumed a dual role for increasing digital skills (only partially already possessed) and as a fundamental tool (along with technique, as regards Leonardo) for learning. The data that emerged from both the initial questionnaire and the final self-assessment questionnaire given to pupils confirmed the need to combine technology, to improve learning environments with a critical consideration of its real potential, sometimes not yet fully understood by teenagers.

### Keywords 1

Technology, Education, Work-Related Learning, Digital Skills, Discovery Tool

## 1. Introduction

School-work alternation is a methodology based on alternating periods of theoretical training, carried out mainly at a school or training institution, with periods of practical training at one or more companies or organizations [1].

Despite the introduction of courses designed according to the students' interests and the community of practices, the extent of the problematic coexistence of theoretical and practical periods reflects a time characterized by profound changes to the Italian school system. In this sense, alternating work and study is essential to guarantee students flexible and practical courses, giving them the opportunity to fill roles that they feel are "their own" and which also enable them to actively acquire the necessary skills and knowledge for sound personal and professional development, as well as in light of an enterprising future that integrates theory and practice [2].

As of the 2015-2016 school year, school-work alternation became legally required for all third-year high-school students. The 2019 Budget Law (art. 57, paragraph 18) renamed it Soft Skills and Guidance Courses (PCTO) with its total number of hours reassessed.

The PCTO plan for the 2019-2020 academic year implemented by the University of Foggia set up the courses following a detailed, inclusive strategy from a social and educational intercultural perspective in line with the university's general ideas and directives. The PCTO plan has always contained three fundamental elements: curricular, experiential, and indicative. In addition, a results evaluation and description of the modalities and the course's progress were provided via journals and digital portfolios.

---

Proceedings of the Second Workshop on Technology Enhanced Learning Environments for Blended Education, October 5–6, 2021, Foggia, Italy

EMAIL: [luigi.traetta@unifg.it](mailto:luigi.traetta@unifg.it)

ORCID: 0000-0001-7785-9751



© 2021 Copyright for this paper by its authors.

Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

CEUR Workshop Proceedings (CEUR-WS.org)

In the particular field of technology, alternation can also be carried out according to a simulated company model. A student-managed virtual business is set up whose environment is similar to a real one in which skills and previously acquired knowledge are used and explored. Consequently, the relevance of the technologies in the students' lives was highlighted as a useful and profitable asset that, properly managed, is constructive and makes educational experiences with a positive outcome available.

The two courses, "Technologies for Communication: History and research" and "Leonardo da Vinci: Art, science, and technology", were formed on this basis. The latter was organized with the inter-university center "Seminary of the History of Science", of which the University of Foggia is an integral part.

## **2. From technology to technique...and back**

This communication technologies course took its cue from basic theoretical content that refers to the history of technologies and, particularly, to the world of communication means, a fact in the students' daily lives but, very often, little is known in detail.

The ASL course was first developed by distributing a short, open-ended questionnaire to verify initial knowledge of some keywords that should be thoroughly familiar. Instead, the questionnaire results presented surprising data: apart from a very few cases of vague, very superficial knowledge, most students did not correctly understand the meaning of the SAR (Specific Absorption Rate) value as indicated in a smartphone's characteristics— and so, the health risks caused by absorbing electromagnetic waves. Furthermore, they neither realized the potential damage a computer virus could cause nor found their way through the dozens of ads advertising offers for home internet connections.

The course was divided into four modules distributed over five consecutive days. It opened with an overview of the main evolutionary stages of telecommunication technologies. It then focused on the library—a mandatory step in scientific research—where students learned how to consult online databases using research methodologies.

The third module took place at the Department of Humanities' computer lab, with the class divided into working groups. Next, they concentrated on searching for data, information, and bibliographic references for an assigned topic, i.e., the history of one of the communication means presented during the first module, later exhibited as a multimedia presentation. From a learning perspective, the activity helped to understand the importance of doing reliable, objective, and proven—in short, scientific—research through the practical and suitable use of databases; digital catalogs; online directories of specialized journals, periodicals; and other sources (e.g., Wikipedia). Furthermore, as all are available on the Internet, the students learned how to verify the content's source and reliability. Students also had the opportunity for a positive co-planning and job-sharing experience in an open, self-managed learning environment vis-à-vis the timing and methods for carrying out activities. In addition, they learned first-hand the obvious advantages of participation and building up individual accountability—an attitude that empowers individuals in the success of their own as well as the group's work [3]—and the growth experienced by the group by bringing together all the cognitive, social, and affective potential of an individual's talents and skills.

In the fourth and last module, the group's projects were presented to the advisor—who had accompanied the students throughout the course, facilitating their self-learning processes [4]—and the rest of the class for evaluation (and self-assessment) comments on the skills and knowledge acquired.

The distinctive feature here is in terms of "know-how" since different points in the process are a test site for acquiring and consolidating soft skills, including problem-solving, teamwork, listening, communication, creativity, and emotion management.

The experience acquired during the design and implementation of this ASL course was merged, between February and May 2019, into a second one entitled "Leonardo Da Vinci: Art, science, and technology". It was offered to all secondary schools in Puglia, Molise, and Basilicata. It was organized through the inter-university center "History of Science Seminary", of which the University of Foggia

is an integral part. The project involved 218 third- and fourth-year students from institutes with various specializations, primarily scientific high schools.

There were two innovations relating to the communication technologies course. The second and third days were dedicated, respectively, to a guided tour and a workshop whose object was a place, context, or experience related to Da Vinci's activities. For example, the history of hydraulic engineering was brought to life via a mill whose blades have turned in the Cervaro River, on the slopes of the Daunian Mountains, since the 17<sup>th</sup> century. Its present was shown in the dams and pumps that the Capitanata Reclamation Consortium built and managed. On the other hand, the aeronautical company Leonard, with headquarters in Foggia, shed light on the modernity of his aircraft design and construction.

The aims mentioned above are just some of the possible destinations of a guided tour for the project. It was backed up with a planned all-day workshop where the students experimented with constructing machine models, creating a digital support application, or reinterpreting the artistic styles of Da Vinci and that historical period.

In particular, a workshop dedicated to reconstructing models of Da Vinci's machines was very successful, also in terms of training, not easy to predict. Nevertheless, if compared with the complexity of the most recent machines, these simple mechanisms date back more than five hundred years. Scale-model reproductions of means to lift water, build bridges, or storm a fortress were constructed. As a result, the participants became wholly immersed in the Renaissance way of life, experiencing the problems faced by the people of that time first-hand.

However, it was not just a matter of experiencing something.

Alongside the physical reconstruction of some machines, the students also became familiar with virtual reconstructions of some mechanisms during an in-depth study not surprisingly entitled *Leonardo Reloaded*. However, again, then, the entertaining side linked to a remote topic (both in time and deed) won out. The result was the considerable interest sparked that confirmed that learning is encouraged through the "magical effect" of three-dimensional objects [ 5].

### **3. "New" learning environments?**

Identification The Internet could not be forgotten in the overview of an analytical direction in the history of communications media, the most influential slice of the technology population, capable not only of establishing an essential link with education, training, and work but also to directly influence many routine and personal practices.

However, another issue became a genuine emergency during the Covid-19 pandemic [6, 7]. Today, the Internet is available to many but not to everyone, despite the efforts so far. Part of the population does not have digital freedom, finding impediments daily to accessing the simple information typically available to most people. The expression "digital divide" indicates a significant chasm in the diversity that arises between, on one side, those with open access to communication technologies (e.g., the Internet, telephones, computers), thus, a greater possibility to access direct and needed information. On the other side are those denied this possibility because of economic difficulties, social hardship, age, and geographical origin [8]. as the common thread of digital communication", the need to acquire digital skills and "use digital empathy" [9] is becoming more intense in a society with a substantial technological footprint, whose influence given by the Internet and its products at times transcends the boundaries of respect and equality.

In particular, the skills promoted concerned the ability to use the knowledge and technological tools acquired to identify the most appropriate solutions for some specific bibliographic searches, in the case of the communications course. In this way, the students used the library's technology applications, going beyond the merely physical and transforming the library into a nonphysical place that provides its users with equally effective services.

The various services offered are divided into access, reference, information, and basic or specialist bibliographic searches. Local book borrowing is not limited to university users only but is also open to authorized external users. The students were shown how interlibrary loan (ILL) permits borrowing

books from other libraries that their local library does not hold. In addition, they learned how document delivery (DD) lets them receive copies of articles, magazines, parts of books unavailable in their local library's collections. The training courses organized by the library on its primary services and the continuously updated resources available are indicative of continuing education in knowledge. It is essential to highlight a library's Wi-Fi networks to understand its adaptability in searches in these cases. The students were introduced to the library's resources in IT terms and on how to obtain correct, verifiable information in the library with the help of OPACs (Online Public Access Catalog).

To avoid sailing without a compass and know how to get the required documents in the shortest time possible, the students were taught the importance of search criteria. Using English-speaking journalism's Five Ws rule (who, what, where, when, why) encourages giving as complete an explanation as possible of the direction one wishes to take. These interrogative words structure questions that prove to be foundational for the questions to be asked [10, 11]. The phases of the research process involve implementing a multi-part research strategy with several steps: resource identification and retrieval, resource evaluation and use, and research formulation. To give a semi-formal picture of bibliographic information, FRBR (Functional Requirements for Bibliographic Records) users perform such activities as finding, locating, identifying, selecting, and connecting resources; gaining access to or browsing the Internet [12]. Search strategies are also determined by the use of search keys.

The students were also given information on how the University of Foggia's paper heritage could be searched using such online tools as catalogs and the Discovery Tool. Later, databases are shown. these electronic bibliographic reference files can be queried dynamically, whose knowledge and optimization of the level of information retrieval strategies allowing for an improved qualitative level of searches.

The third laboratory-based module had the students focus on looking for data, information, and bibliographic references on their assigned topic, diving into their role as investigators eager to carry out serious, reliable, and verifiable research. The students' research topic was mass media and digital communication, and the students were interested and involved in the assignment.

#### **4. The results**

At the end of the ASL telecommunications course, the pupils were given a questionnaire. One interesting data set emerged, especially compared to the answers from the beginning-of-course questionnaire. Although not particularly significant (154 questionnaires completed), the sample allows for considering the connection of 16- and 17-year-old adolescents to technology. Moreover, the results seem to generally confirm the classic considerations that de Vries [13] identified as the cause of young people's particular relationship with technology.

For example, given their evident confidence as "users", most students showed a total lack of information regarding electromagnetic waves' potentially negative impacts on health (97%) and the associated risks of spyware and computer viruses (88%). Both issues were addressed during the course. Under the guise of introducing basic bibliographic research, sources were examined broadly. Again, in this case, severe limitations emerged in knowing how to use the technologies. Nevertheless, 94 % declared that they had never questioned the reliability of the sources found on the net. In contrast, with the data appearing positive this time, 72% believe that the advantage of the Internet is linked solely to its speedy access to information compared to books.

The highly positive feedback on the course makes it possible to recognize a real educational emergency in the demand for adequate training in the various contemporary technologies. If one of the ASL courses' primary objectives is to train individuals and consumers, an inability to identify a computer's main hardware characteristics (81%) for their intended use or a fundamental ignorance of the Internet's practical features of the offers from Internet providers' is clearly another genuine educational emergency. For example, 100% of the students identified the connection speed differences between 4G and 5G technologies (regarding mobile networks) and between traditional copper and optical-fiber networks. In this case, as in the example of the risks associated with electromagnetic waves, scientific knowledge (particularly physics) for interpreting the phenomena correctly was by no means lacking. However, the ability to apply this knowledge to technology was lacking, with its

instrumental and applied aspects overly considered but under-considered from an epistemological perspective [14]. As regards the final questionnaire, 40% of the students involved in the various editions of the course, say that their motivations and initial objectives were “very satisfied”, and this data is accompanied by the numbers relating to the “satisfied” answer. (36%) and “very satisfied” (3%). To the open-ended question that asked what was the most popular aspect or activity within the path, the numerically most consistent answers can be traced back to two dimensions of meaning: on the one hand, the possibility of learning content on technologies of communication; on the other hand, the experience of working in a group.

## 5. Conclusions

If technology as a learning tool is currently the subject covered extensively by scientific literature [15, 16], much less research has been carried out on it and its relationship to a specific range of users (adolescents, in particular). Naturally, there is no reference to the psychological aspects—again, with a significant number of publications on the subject, starting with addiction issues—rather than to the epistemology of technology itself. This is especially true in the field of digital technologies, whose influences on “educational success” and “being in the classroom” [17] are now a confirmed fact.

One of the answers given on the ASL end-of-the-course questionnaire mentioned above is illustrative. The only open-ended question regarded the risks associated with using communication technologies. The response stated, “These deep-rooted habits are difficult to change if you are unaware of them. Often, we do not know; more often, we wish to remain blind and pretend nothing has happened. Nevertheless, the increasing number of risks no longer instead seem so unlikely, with the current use of technologies.”

The need for technology has become increasingly an educational subject able to engage “many different types of learning” [18]. The actual difficulty of valuing technology as a subject in a school’s curriculum, on the other hand, is indicated as one of the chief determining causes of the students’ attitude towards technology itself [19].

## 6. References

- [1] G. Bertagna, *Fare laboratorio. Scenari culturali ed esperienze di ricerca nelle scuole del secondo ciclo*, La Scuola, Brescia, 2012
- [2] C. Zadra, *Il tutor esterno nei PCTO (Percorsi per le Competenze Trasversali e l’Orientamento): maestro invisibile alla ricerca di circolarità fra teoria e prassi*, *Excellence and Innovation in Learning and Teaching-Open Access*, 5. 1 (2020).
- [3] M. Laal, L. Geranpaye, and M. Daemi, *Individual accountability in collaborative learning*, *Procedia - Social and Behavioral Sciences*, 93, (2013): 286-289.
- [4] G. Toto, and P. Limone, *Research on a massive open online course (MOOC): a Rapid Evidence Assessment of online courses in physical education and sport*, *Journal of Physical Education and Sport*, 19, (2019): 2328-2333.
- [5] L. T. De Paolis, V. De Luca, and G. D’Errico, *Augmented reality to understand the Leonardo’s Machines*, in *International Conference on Augmented Reality, Virtual Reality and Computer Graphics*, Springer, Cham, 2018, pp. 320-331.
- [6] J. Lai, and N. O. Widmar, *Revisiting the Digital Divide in the COVID-19 Era*, *Applied economic perspectives and policy*, 43.1, (2021): 458-464.
- [7] G. A. Toto, and P. Limone, (2021a). *From Resistance to Digital Technologies in the Context of the Reaction to Distance Learning in the School Context during COVID-19*, *Education Sciences*, 11.4, 163 (2021).
- [8] E. De Marco, (2008). *Percorsi del nuovo costituzionalismo*, Giuffrè Editore, Milano, 2008.
- [9] F. Derchi, and G. Xhaet, *Digital skills: capire, sviluppare e gestire le competenze*, Hoepli Editore, Milano, 2018.
- [10] P. Meyer, *Giornalismo e metodo scientifico*, Armando Editore, Roma, 2006.

- [11] K. T. Kukiolczynski, and Y. Q. Liu, Public Library Events: Who, What, Where, When, and Why?, *Public Library Quarterly*, (2021): 1-22.
- [12] E. T. O'Neill, Frbr: Functional requirements for bibliographic records, *Library resources & technical services*, 46.4, (2011): 150-159
- [13] M. J. De Vries, Proefschrift: Techniek in het natuurkunde-onderwijs, Technische Universiteit Eindhoven, Eindhoven, 1988.
- [14] P. C. Rivoltella, and P. G. Rossi, *Il corpo e la macchina. Tecnologia, cultura, educazione*, Scholé, Brescia, 2019.
- [15] D. Henriksen, E. Creely, M. Henderson, and P. Mishra, Creativity and technology in teaching and learning: a literature review of the uneasy space of implementation, *Educational Technology Research and Development*, (2021): 1-18.
- [16] M. McLain, M. Developing perspectives on 'the demonstration' as a signature pedagogy in design and technology education, *International Journal of Technology and Design Education*, 31.1, (2021): 3-26.
- [17] G. A. Toto, and P. Limone, Motivation, Stress and Impact of Online Teaching on Italian Teachers during COVID-19, *Computers*, 10.6, (2021): 75.
- [18] N. Rosenberg, *Dentro la scatola nera. Tecnologia ed economia*, Il Mulino, Bologna, 2001.
- [19] J. Ardies, S. De Maeyer, D. Gijbels, and H. van Keulen, H., (2015) Students attitudes towards technology, *International Journal of Technology and Design Education*, 25.1, (2015), 43-65.