DIGITAL LEARNING ENVIRONMENT EMBEDDED IN A LARGER NATIONWIDE ONE: A CASE STUDY OF A HIGH SCHOOL

Cecilia Fissore, Department of Foreign Languages and Literatures and Modern Cultures, Francesco Floris, Marina Marchisio, Italy2Department of Molecular Biotechnology and Health Sciences, Sergio Rabellino, Computer Science Department, University of Torino, Italy

Abstract

The outbreak of COVID-19 and national measures undertaken to tackle the spread of the virus may cause significant disruption to the provision of education opportunities for learners and teachers. In Italy, most schools did not practice online teaching before the emergency, and in a short time head teachers, teachers, students had to face new technological tools and deal with a new type of teaching. The PP&S – "Problem Posing and Solving" – project offered to all Italian teachers and schools, for free, a way of carrying out Online Education through a nationwide integrated Digital Learning Environment (DLE). In this paper we present a case study of a high school that used one DLE for online teaching of the entire school, embedded in a larger DLE at national level. The goal of this research is to present the integrated DLE of the project and the reasons why this case study can represent an effective model for online teaching of a school under different dimensions (technological, human and pedagogical). The results show that the teachers and the school head agree with our point of view. Most teachers are very supportive of using one DLE and think that this facilitates students and collaboration among teachers. Being included in a larger project allows teachers to compare, collaborate and share experiences and materials with teachers from all over Italy, and to have continuous technical and training support.

Introduction

In the spring of 2020, 74% of the world's students, about 1.2 billion children from 186 countries, switched to Distance Learning, without most of the education systems being structured and prepared to support digital education. A survey conducted with 4,859 respondents in 40 countries shows that the majority of teachers (67%) did online teaching for the first time in their careers in the last year (School Education Gateway, 2020). The outbreak of COVID-19 and the necessary national measures undertaken to tackle the spread of the virus may cause significant disruption to the provision of education, training

and mobility opportunities for learners and teachers. A year after the outbreak of the pandemic, there are many studies, research and reports that have been done at European level to try to learn from this crisis, during which technology is used on an unprecedented scale in education and training. The best known example is the Digital Education Action Plan to help ensure continuity in education and training activities and to adapt the related systems to the digital age (European Commission, 2020).

In Italy, the new school year 2020/21 began in September, after the highly emergency educational activities of the months from March to May 2020. Most schools did not practice online teaching before the emergency, and in a short time head teachers, teachers, students (and often their parents) had to learn how to use new technological tools and deal with a new type of teaching (in Italy often called "DaD – Didattica a Distanza" which means Distance Learning). In the design and implementation of Online Education, a decisive factor is the choice of the Digital Learning Environment (DLE) to be used. At the beginning of the pandemic emergency, this aspect was particularly delicate in Italy. Many schools were not digitally equipped and school staff were not sufficiently trained in this field, so each teacher independently chose the tool to be used for online teaching. This choice had the risk of confusing students with multiple different platforms and above all of encountering data privacy issues. In the following months, many platforms and digital tools were proposed by the Ministry of Education to support teachers in Online Education. In June 2020, the Ministry of Education published a decree that provided a reference framework for planning the start of school activities in September, asking schools to equip themselves with a school plan for integrated digital teaching. The Guidelines have provided indications to be adopted in case of need to contain the contagion or if it is necessary to suspend the teaching activities in presence again. One of the indications was precisely "the identification, by each school, of a platform that [...] ensures an easy performance of the synchronous activity and which is usable with any type of device or operating system" (MIUR, 2020). In this new school year, secondary schools are implementing almost exclusively online teaching.

The PP&S project (available at www.progettopps.it), headed by the Italian Ministry of Education, promotes since 2012 the training of teachers of secondary schools on innovative teaching methods through the use of digital technologies (Brancaccio et al., 2014). The PP&S project, intended for teachers of the STEM disciplines but opened in the emergency to teachers of all disciplines, offered for free to all Italian teachers of secondary schools and to all Italian schools the possibility of carrying out Online Education through an integrated DLE (Fissore, Floris, et al., 2020). For all teachers it also offered great support in the transition from face-to-face to online teaching, as well as a wide range of online training activities (Barana et al., 2020; Fissore, Marchisio, et al., 2020b). In March 2020, a high

school in the city of Turin in northern Italy decided to use the PP&S platform for online teaching of the entire school, for all teachers and for all students. After a first positive experience, the choice of the platform was also confirmed for the school year 2020/21. The goal of this research is to present this case study and to answer the following research questions: What are the benefits of using one DLE at school level, embedded in a larger DLE at national level?

Online Education and the situation in Italy

In Italy, not many national reports have been made on the development of Online Education during the Covid-19 pandemic. Most of the investigations focused on the technological availability (PCs, mobile devices and internet connection) of teachers and students in order to investigate the worrying school dropout. In December 2020, the National Institute for Documentation, Innovation, Educational Research published a report on the teaching practices of teachers during the months of emergency teaching (INDIRE, 2020). Some of the topics covered in the survey were: Didactic strategies, Quality of the DaD and Training. According to this report, the teaching strategies most practiced by Italian teachers can be considered the transposition of traditional frontal teaching into distance teaching. Most of the teachers carried out "videoconferencing lessons" and "making resources available for study and exercises" to be carried out independently. A minority of teachers have experimented with laboratory practices. The teachers more inclined to a laboratory type teaching found higher levels of satisfaction than the other teachers. Teachers who had online training experiences during the lockdown underlined the need for training on digital skills and their willingness to bridge the technological gap to support learning processes.

In our opinion, distance learning and online teaching are not the same thing. Online teaching should not be a mere transfer of face-to-face lessons in synchronous online mode via web conference, and it cannot consist of a simple transmission of materials and tasks and exercises (Hodges et al., 2020). Online teaching is a form of teaching that consists of resources but also and above all asynchronous activities that are always available, which students can carry out when they can and when they prefer. In fact, online learning allows students to study from home respecting their own times and independently organizing the time schedule of the study. Resources and activities can be the result of the integration of different media to facilitate students' understanding and personalization based on each person's characteristics. The peculiarities of online teaching are: multimedia (use and integration of different techniques and tools); multimodality (presentation of a concept or carrying out an activity in different ways); granularity (design and development of content for micro topics); non-linearity (alternation of different tools and contents in a non-linear way); and interactivity. These characteristics require a rethinking in the choice of contents

and materials to be used, which cannot always be replicated in the same way of face-to-face teaching.

An embedded DLE for online teaching

A fundamental ingredient for Online Teaching is the DLE, a virtual space useful for teaching, learning, developing digital skills, online activities in classroom-based, remote or blended settings. It comprises a human component, a technological component, and the interrelations between the two. The human component consists of one or more learning communities, whose members can be: teachers or tutors, students or learners together with their peers, the administrators of the online environment. The technological component includes a Learning Management System integrated with different tools. Within it, students can be provided with multiple resources and numerous synchronous and asynchronous online activities. The activities carried out by students can be evaluated, alone or in a group, and it is possible to monitor the students' actions on the platform and the learning objectives achieved. The DLE of the PP&S is based on a Virtual Learning Environment, VLE, a Moodle-learning platform, integrated with an Advanced Computing Environment, an Automatic Assessment System and a web conference system (Fissore, Marchisio, et al., 2020a). In the case study we study, the school had the opportunity to have a dedicated DLE for the whole school embedded in the larger nationwide one. In it, the following courses were created: courses for each teacher (of any discipline) for each class of students in which they teach; a course with all students for school communications and activities; and the courses of the departments for each discipline. This design was intended to recreate the school environment as much as possible, to facilitate the organization of activities and communications between teachers, students and between teachers and students, and to encourage collaborative teaching and learning. At the same time, the school's DLE joined the much larger DLE of the PP&S Project, shared by secondary school teachers from all over Italy. This allows the school to maintain its own entity but at the same time to be in contact with teachers from other schools, who have experience within the Project. Within the Teacher Community, where synchronous online training activities also take place, there are many materials for self-training, forums and database of materials for sharing between teachers. For this reason, in answering the research question we will alternate two dimensions: the school level (level 1) and the national level of the PP&S project (level 2). We believe that the use of one DLE for the school embedded in a larger nationwide DLE represents an effective model for online teaching of a school because it presents many benefits under different dimensions.

Technological dimension

In this case, level 1 and level 2 coincide because the school's DLE is embedded in the larger one of the PP&S and acquires all its characteristics. In particular, the following aspects are guaranteed.

- *System reliability*: Guarantee of the functioning of the platform even with large numbers of teachers and students connected at the same time. In addition, the head teacher and individual teachers do not have to worry about technical aspects related to setting up and maintaining the platform because they are guaranteed by the PP&S' technical staff.
- *Interoperability among various systems*: Use of the various integrations of the platform for educational activities.
- *Efficiency with respect to the resources invested*: The possibility of having a dedicated DLE available free of charge and the continuous advice of technical support, thanks to the fact that the project is promoted by the Ministry of Education.
- *Activated services*: E-mail assistance for the school (design of the DLE and for the resolution of problems in which the school acts as an intermediary between students/parents and technical support); assistance for teachers through the helpdesk and forum of the Teachers' Community (resolution of technical problems and support on the use of proposed technologies); assistance for the student (support in access problems and in using the platform).

Human dimension

- *Community of Teachers*: At level 2, teachers can: participate in multiple activities of continuous professional development (synchronous and asynchronous); improve digital skills; confront and collaborate with teachers from all over Italy and with trainers; and have a repository of materials and activities ready to use in their teaching. At level 1, teachers can easily interact and compare remotely with their colleagues, collaborate in the creation of activities and resources and exchange experiences and advice. In general, being part of a community helps teachers not to feel alone in the difficult task of learning new teaching tools and methodologies and the constant support of colleagues and trainers supports lifelong learning.
- *Community of students*: At level 1, the identity of students as belonging to the school does not fail. Students, being all placed in a unique virtual environment, feel part of a community, share the same experiences of using the platform and can discuss didactic activities and easily interact with each other and with the teacher. They can also develop digital skills and collaborate with their peers on the platform. In general, interactions and communications are safeguarded at the level of the individual student, at the class level and at the school level. For the moment, level 2

is not contemplated for this sub-dimension, but in the future interactions between students from different schools throughout Italy could be planned.

Pedagogical dimension

- *Environment born for collaborative teaching* (level 1 and 2 coincide): The design and development of Moodle are guided by the socio-constructivist teaching philosophy based on the concepts of constructivism, constructionism and social constructionism. Dual aspect of the role of the teacher: At level 2, the teacher within a community learns and collaborates with other teachers, experimenting with the use of the platform from a student's point of view. At level 1, teachers manage the DLE and make their students collaborate and learn by creating a learning community.

- *Interdisciplinarity* (level 1): the use of one DLE for all teaching subjects favours the conduct of interdisciplinary activities and the connection among different disciplines.

- *Automatic formative assessment in the various disciplines* (level 1 and 2 coincide): the didactic methodology of automatic formative assessment supports the learning process and the involvement of students, through immediate and interactive feedback (Barana et al., 2019).

- *Inclusion* (level 1 and 2 coincide): Thanks to the integration of the DLE with the highly accessible EasyReading font and the customization of activities and resources, the platform is accessible for all users (even those with specific learning disabilities).

- *Vertical curriculum* (level 2): The project includes first and second grade secondary school teachers who can exchange views with each other in order to encourage the development of a vertical curriculum.

Data and methodology

To answer the research question, the following data were used: data from the platform (number of teachers and students involved, number of courses created for the school); questionnaire to all teachers of the school; and interview with the school head teacher. The questionnaire submitted to the teachers was divided into three parts: general data of the teacher and involvement within the project; reflections on online teaching (characteristics of online teaching, types of teaching activities and tools used); use of DLE PP&S for the whole school (possibilities offered by the platform to students, teachers and the school; technical support and open questions on significant teaching experiences and comments). The interview with the school head instead analysed the motivations and strengths in the choice of adopting one DLE for the whole school (in particular that of the PP&S) and particularly significant aspects (satisfactions, difficulties encountered, appreciation, etc.)

reported by teachers and students. After extracting the data from the platform, the questionnaires were analysed according to the model proposed in the previous paragraph and extracts from the interview were reported to the school header.

Results

The numbers of the high school within the PP&S Project are: 117 teachers of different subjects (some of them enrolled in the project since before the pandemic); 1604 students (from grade 9 to grade 13); 590 courses (1 course for the student community, 8 courses for departments and 581 courses for teaching activities). The departments of the school are natural sciences, physical education, religion, foreign languages, literature, mathematics and physics, philosophy and history, drawing and art history. 55 teachers from different subjects answered the questionnaire: natural sciences (11%), religion (5%), foreign languages (11%), literature (25%), mathematics and physics (32%), philosophy and history (11%), drawing and art history (5%). 79% of the teachers who answered were female. The average age of the teachers is 54 and on average they have been teaching for 25 years. 25% of the school teachers were enrolled in the PP&S project even before the pandemic emergency, all of them from scientific disciplines. Of these, the majority (71%) have been enrolled in the project for more than three years. As also emerged from the INDIRE report, the teachers who answered the questionnaire organized the teaching activities in a mainly synchronous mode (18% in completely synchronous mode and 62% mainly in synchronous). 14% of teachers in equal mode between synchronous and asynchronous and 4% in completely asynchronous mode. This result may be due to the fact that most of the teachers used the DLE for online teaching for the first time. The teachers evaluated the support received to facilitate online teaching (on a scale from 1 = *not at all* to 5 = *very much*) with the following average scores: from the technical staff via email (3.3), from the technical staff via HelpDesk (3.0), from tutors through forums (3.2), from tutors through online synchronous training meetings (3.2), from other teachers through forums (2.9) and from other teachers through the sharing of material (2.8). They positively assessed the aspects concerning the technological dimension, slightly less those relating to the human component. This may be due to the fact that becoming part of a community of teachers in a period of strong emergency has not been easy for some teachers, especially those of non-scientific disciplines that are less represented within the community. Using the same scale, the teachers evaluated the support received to facilitate online teaching in terms of: search for innovative solutions to better achieve the educational objectives (2.8), customization of the virtual learning environment (2.7), creation of resources and activities (3.0), resolution of problems related to use and access to the platform (3.0). The teachers reflected on the human dimension of the community of teachers and students, and they assessed with the same scale as before how much the DLE allows for different aspects for both communities (Table 1).

Table 1: Reflections of teachers on the human dimension a level 1 of the community of teachers and students

DLE allows students to:	Mean	Dev.St.	DLE allows teachers to:	Mean	Dev.St.
Easily have all teaching materials available	3.9	1.0	Participate together with colleagues in training activities	2.6	1.0
Be part of a learning community	3.0	1.1	Develop digital skills	3.2	0.9
Carry out different types of synchronous and asynchronous activities	3.5	1.0	Collaborate in the creation of activities and resources	3.1	1.0
Having a learning environment that recreates the school environment	2.6	1.0	Discuss the activities carried out with students	2.9	1.1
Interact with your peers	2.4	0.9	Share activities and resources	3.2	1.0
Interact with the teacher	2.7	0.9	Sharing reflections and ideas	2.8	1.1

As for the students, teachers agree that the platform contributes to the creation of a learning community and that it is easy for students to find teaching materials and carry out different types of activities. Surely the DLE will never be able to recreate the school environment and the interactions that teachers and students are used to in face-to-face teaching. This may explain the slightly lower scores in the latter aspects. As for the Community of Teachers, the teachers agree that the DLE allows to: collaborate in the creation of activities and resources; sharing activities and resources and considerations, experiences, ideas on teaching activities; discuss the activities conducted with students and develop digital skills together. 82% of teachers answered yes to the question: "Is the use of a unique platform for the whole school a strength?". Some of the most significant reasons were: "Because the use of multiple platforms is very dispersive", "Yes, because it is easier for students to use the same mode with different subjects", "It gives students and teachers an idea of school as a community and allows support between colleagues", "Facilitates interactivity between teachers and students". Some of the motivations of the teachers who answered no were: "It is necessary to be able to use different platforms, in order to choose the ones that have the greatest potential", "Different teaching subjects need different tools". The most significant impressions and opinions of students on the use of the platform for online teaching reported by the teachers were: "Some students use the platform without problems. Other students ask to return to "traditional" lessons", "Learners find the platform very useful for practicing tests with formative assessment or for repeating the tests even an unlimited number of times", "In the beginning there was concern about the possibility of overloading tasks, now they consider it a valid subsidy". Finally, some of the difficulties in using the platform reported by the teachers were: "Initially, it is necessary to be available for training and experimentation, also through trial, error and other attempts.", "At the beginning, due to my lack of knowledge of the platform". 25% of the

teachers said there were no difficulties. According to the school head, the choice of one digital environment allows the development of knowledge and use of multimedia technologies and facilitates the transition from a more transmissive traditional teaching to experimentation with different and innovative teaching methods. It also allows the school to invest in teacher training in a homogeneous way and aimed at the shared use of the digital tool and to provide a "common ground" for comparison, support and exchange of experiences and materials. A number of teachers highlighted various initial difficulties with regard to the new technologies proposed. In this sense, online training and tutoring were highly appreciated and favoured the use of the platform. The school head would advise all colleagues to use one platform, presenting it to the school as a precious opportunity and not as an obligation. It involves investing in technical and professional resources and in the training of teachers to support the development of innovation in teaching methodologies through the use of new technologies that are best suited to support teaching paths that offer the best learning opportunities of disciplinary, transversal, digital and inclusive skills for all students.

Conclusions

A case study of the use of one DLE by the whole school embedded in the PP&S nationwide DLE was presented. We discussed the integrated DLE of the project and the reasons why this case study can represent an effective model for online teaching of a school under different dimensions (technological, human and pedagogical). The results show that the teachers and the school head agree with our point of view, especially for the first two dimensions. Most teachers are very supportive of using one DLE and think that this facilitates students and collaboration among teachers. Being included in a larger project allows teachers to exchange views, collaborate and share experiences and materials with teachers from all over Italy, without feeling alone in the learning process. In this context, the teachers greatly appreciated the technical support guaranteed by the project and the various training opportunities offered. Most of the teachers joined the project after the start of the pandemic, in an emergency period. Probably for this reason they have not fully understood the potential of DLE. The analysis presented will be deepened by dividing the teachers between humanities and scientific subjects to study teaching strategies and compare them. Doing online teaching now definitely allows teachers to acquire new skills and to prepare teaching materials that can be used in future teaching. Online teaching should be understood as an additive and not a substitute paradigm for classroom teaching.

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