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A model for defining digital classroom settings

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Abstract

Recent years have seen a steady increase in the number of Italian schools opting to integrate technology into the classroom. Teachers and principals often embark on digitalization projects despite a lack of consolidated theory to guide the process; in many cases, the outcome is a lesson format which remains traditional in style with the implementation of one-to-one computing and use of an electronic whiteboard instead of a chalkboard.Given the lack of a reference framework defining a richer variety of digital classroom settings, in this study we aimed to provide a categorization of digitalization formats to aid in the planning and design of digital classrooms. Our analysis was based on systematic observation of a number of digital classrooms currently being implemented in Northern Italian schools. From the data collected we developed a functional classification of digital classroom settings, described in terms of how digital devices are distributed to students and the specific devices adopted.We identified seven digital classroom settings: one-to-one computing with students seated in traditional rows; paired seating; small group seating; multi-screen classrooms; subject areas; media areas; mobile learning. A further criterion is the type of device provided to students for use at school: handheld screen devices; A5 size screen devices; A4 portable laptop; desktop and large screen devices. This classification may be useful to teachers and principals in the start-up phase of digitalizing their classrooms and schools.

Keywords: Digital Classroom, Setting, didactic, technology;

1. Introduction and problem statement

Recent years have seen a steady increase in the number of Italian schools opting to integrate technology into the classroom. In particular, the Italian Ministry of Education has sponsored a number of ongoing projects aimed at increasing the level of technology in schools and currently about 10% of classrooms are equipped with electronic whiteboards purchased with public funding (Salvia, 2011). Teachers and principals often embark on digitalization projects despite a lack of consolidated theory to guide the process: according to Sandholtz, Ringstaff & Dwyer (1997), in most cases the outcome is a lesson format which remains traditional in style with the implementation of one-to-one computing and use of an electronic whiteboard instead of a chalkboard.

The purpose of this study, arising from the need to provide alternative models to one-to-one computing (which may be seen as a mere replication of a computer lab in a classroom), is to stimulate more sophisticated didactic planning on the part of teachers involved in digital classroom projects. A further aim is to enhance awareness of the

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relationship between setting design and teaching method, enabling teachers to organize lessons in a range of different ways through the implementation of appropriately matched technologies and teaching methodologies (Garavaglia, 2006).

Given the lack of a reference framework defining a richer variety of digital classroom settings, in this study we aimed to provide a categorization of digitalization formats to aid in the planning and design of digital classrooms. Three theoretical assumptions guided the research:

1) the quality of a learning process is 75% dependent on the learner's set of personal skills (motivation, memory, etc.) and 25% dependent on the effects of the physical environment in which it takes place (Hayward, 1995);

2) the physical structure and layout of the environment can communicate values and play a role in motivation (Proshansky & Wolfe, 1974);

3) the effectiveness of education is related to the compatibility between the educational style adopted and the physical environment (Weinstein, 1981).

From the data collected we developed a functional classification of digital classroom settings, described in terms of how digital devices are distributed to students and the specific devices adopted.

2. Method

In order to identify the different settings and their characteristics, the research group conducted systematic observation of 37 digital classrooms (25 primary school and 12 middle school) currently being implemented in Northern Italian schools. Due to differences between the various digital classroom projects and contexts, the research group used three alternative methods to collect data, namely interviews with teachers during project consultancy/review of classroom environment, observation of micro-teaching sessions during lessons and focus groups with students.

From the data collected, a functional classification of digital classroom settings was developed: each setting is defined in terms of four characteristics, that is, classroom layout (arrangement of furniture and technological devices), proxemics (distance between people, furniture and digital school equipment), technological devices (type and physical dimensions) and teaching methodologies.

3. Findings and results: a digital classroom model

We identified seven different digital classroom settings: one-to-one computing; paired seating; small group seating; multi-screen classrooms; subject areas; media areas; mobile learning.

3.1. One to one computing with students seated in traditional rows

In this setting, each student is supplied with a laptop computer for personal use (Penuel, 2006) and the desks are arranged in rows. In terms of proxemics, a traditional classroom model is implemented, with students seated at equal intervals and the teacher tending to stay close to the chalkboard and her desk.

The technologies used consist mainly of one laptop or netbook per student (depending on the budget available) loaded with contemporary productivity software selected by the teachers at the beginning of the school year.

One of the main aims of this setting is to substitute all educational materials/equipment (e.g. book, netbook, workbook) with a single digital device, as is likely to be the case in the course of the children's future lives. The didactic focus is on using electronic devices to complete multiple tasks such as homework assignments, tests and presentations or to access digital content during lessons.

The teacher has access to student PCs via remote access software in order to check individual work and correct it directly on the student's screen; this alters the proxemics coming into play during the discussion of errors (i.e., the teacher does not walk around the classroom standing beside individual students to correct their work but intervenes remotely while remaining seated at her desk).

3.2. Paired seating

This second setting is based on pair work. Technology, teaching support and desktop computer are shared. Learning tasks must be organized and divided between two students: one student uses the computer, while his partner organizes information drawn from other resources (books, paper materials, cards).

Sometimes, this choice of setting is dictated by lack of sufficient funding to provide all students with an individual PC, but in many cases it is chosen to facilitate and activate processes of peer-tutoring. In the latter scenario, teachers tend to pair students with different cognitive levels or different levels of relational skills in order to "bridge the gap", or alternatively to pair students with complementary cognitive profiles or resources in order to enhance productivity, creativity or ability to work together in pairs before moving on to working in larger groups.

With regard to working with others, some learners prefer to learn alone or with one partner (Burke & Burke-Samide, 2004) and require experience of pair work before progressing to group work with a higher number of peers (Spaltro, 2005). Initially the pair work is organized by the teacher; subsequently this function is delegated to students.

Technology is shared and distributed; it is used on an everyday basis as a function of the didactic activities and is integrated with other teaching aids.

3.3. Small group seating

This setting is organized around work stations, each equipped with technological devices to support group work. Specific school furniture is used: a large round or a hexagonal/octagonal table is at the centre of each station with students' chairs placed around it. The classroom is composed of four/five work stations and the students are divided into four/five working groups. The teacher moves from group to group to supervise the work, and to provide support and advice in line with specific needs. Explanations no longer take the form of a one-way lecture: the teacher changes position continuously so as not to turn her back to certain students and also to move close to groups requiring specific input or information.

Each work station is equipped with a number of technologies (notebooks and other devices) and is connected to both classroom and teacher tools (interactive whiteboard, teacher's notebook, internet, intranet, etc.). The teacher manages levels and timing of access to shared resources and directs the students' attention to the various devices as appropriate.

Learning activities are organized on the principle of teamwork: in an initial phase, the teacher guides and structures group work; subsequently the group learns to work independently as a team.

Workstations integrate multiple learning resources used to carry out a range of tasks promoting and developing active learning processes.

3.4. Multi-screen classrooms

This is a variation of the previous three settings, characterized by the presence of more than one large screen on one or more walls. Such a setting can modify classroom proxemics in different ways: if the screens are used to deliver a number of multimedia objects during a lesson, then students need to change the direction of their gaze in order to follow the teacher's presentation and the seating arrangement should be designed so to provide all students with a good view of all screens; in addition, students should preferably be supplied with mobile chairs. Alternatively, if the screens are used for group work, then it is important to leave enough space between them to facilitate a positive working atmosphere with lower noise levels.

The technology implemented can vary from situation to situation: it is possible to use multiple electronic whiteboards, projectors or large screen monitors, each of which can be viewed easily by at least four-five students (small group). This kind of setting can be useful in implementing teaching methods based on group work: the students use the large screen initially as a board during their joint work activities and subsequently to share their

output with the other groups; simultaneous use of multiple screens and devices allows the groups to alternate flexibly and interact with one another when presenting their work.

3.5. Subject areas

In this setting the choice of technology is linked to the specific discipline. Hardware and software are planned as a function of the learning content and the specific tasks to be carried out: dedicated science labs at specific locations, specialized software for mathematics, word processing stations, etc. Stations are placed around the edge of the classroom (like peninsulas) or at the back and students move from one work area to another according to the type of activity they need to carry out. Students come back and sit at their desks when teaching requires explanation, individual study or assessment. The teacher shifts between delivering traditional teaching methods, providing individual support, fostering collaborative learning and mentoring group work/peer tutoring.

In this setting, the technology is designed to cater for specific needs within specific subject areas and is only accessible to a few students at a time. If the teacher wants to assign the same learning activities to the entire class, this can only be done by rotating small groups around the different technologies.

3.6. Media areas

In this setting, the technology is designed to support activities that cut across disciplines, typically involving implementation of educational projects such as school web radio, school newspaper office, TV channel.

Depending on the space available, dedicated work areas may be located inside or outside the classroom (in the latter case, the setting design requires students to move outside the boundaries of the classroom). Specific areas are purpose-designed and equipped: for example, cameras and lights for making film footage placed next to a computer for editing and post production, rooms with special lighting for photography, classrooms in which the walls are painted specifically to enhance the effects of pictures displayed or to mark out dedicated environments.

The teacher supports the work groups in planning work schedules and provides technical support, while the students are free to organize their team work independently. This setting is an application of Freinet's principles for the physical arrangement of schools in terms of availability of a rich and appropriate stock of tools (1967).

3.7. Mobile learning

It is difficult to define a layout for this classroom setting because its key characteristic is that students are free to move outside the classroom although remaining connected by handheld mobile devices. This kind of setting is not to be seen as merely a mobile device-based audience response system (Tremblay, 2010), because it allows students to freely enter and exit the classroom, using their personal devices to gather and graphically represent data from in situ observation and live experiments (Roschelle, 2003).

This setting has a major impact on proxemics because communication between teacher and students can be maintained via mobile devices even when they are not in together in the classroom or at the same location; the desk no longer determines the relative positions of students and teacher.

The technology used for this setting has shifted over the past few years from PDAs (Personal Digital Assistant) to Smartphones or handheld tablets. These devices are designed to work without a keyboard and are usually equipped with a touchscreen or pen-based input system; furthermore, developers have significantly improved user interface by introducing features such as motion feedback, making this kind of device more user-friendly (Doyun, Ji-Hyun, & Sangtae, 2011). Such devices have the potential to enhance many forms of learning by experience and field learning, for example in the area of environmental education.

4. Conclusions and Recommendations

This classification is designed be useful to teachers and principals in the start-up phase of digitalizing their classrooms and schools. Firstly, it may constitute a valuable resource in identifying alternatives to one-to-one computing models so as to avoid reducing the digital classroom to "a computer laboratory"; secondly, it provides guidelines to assist teachers in redesigning their classroom setting in such a way as to obtain significant didactic improvement. Teachers should be helped to acquire greater awareness of their didactic methodology, so as to identify the most appropriate technological setting for their classroom that could make a real difference to students. It is also critical to implement a participatory design process by involving students in the transformation of the classroom: this will further assist the teacher in making a significant departure from classical setting models.

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