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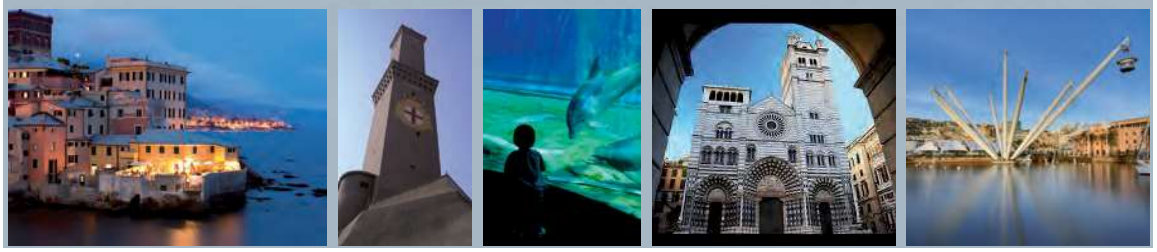

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Needs analysis in classroom digitalization projects

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Abstract
In recent years a growing number of Italian schools have launched digitalization projects, integrating new technologies into their classrooms. Due to underfunding, these schools have accepted grants placing contractual restrictions on project features. The aim of this study was to analyse a number of digital classroom models with a view to identifying how and when needs analysis had been implemented and how this was related to outcomes in terms of problematic aspects, success factors and common/ad hoc project features. The research group conducted systematic observation of four macro-project models encompassing the design of 59 individual digital classrooms (31 primary schools, 20 middle schools and 8 high schools) currently being implemented in Northern Italian schools. Due to differences between the various projects and contexts, three alternative methods were used to collect data, namely project documents, interviews with teachers during project consultancy/review of the classroom environment and quantitative surveys. On the basis of the data analysis, we identified the following digitalization project models shaped by grant-imposed restrictions: *one-to-one models* (Penuel, 2006), *technology-driven models* and *ad hoc models freely designed by the teaching staff*. The results showed overall lack of involvement of the teaching staff, excessively technology-driven training, lack of training and lack of technical assistance to be amongst the critical aspects giving rise to uncertain outcomes. However, the most important factor contributing to classroom management issues was inadequate or inexistent needs analysis (Quaglino & Carrozzi, 1981).

Keywords
digital classroom, design, settings, needs analysis

1. Introduction

In recent years, a growing number of Italian schools have launched digitalization projects, integrating new technologies into their classrooms. Due to underfunding, these schools have accepted grants placing contractual restrictions on project features. The projects that we have analysed in this paper are: Cl@ssi 2.0, Web Generation, Ardesia Tech, Digital Piedmont; all of these were being implemented in Northern Italian schools.

There is a tendency for project leaders to acquire as many technological tools as possible for each classroom, based on the belief that this will significantly enhance the quality of the learning environment (Calvani, 1999). This tendency often goes hand in hand with interest in obtaining large-scale grant-funding, and with a lesser emphasis on needs analysis examining pupils' learning requirements and the need to re-design the classroom environment in line with the new teaching methodologies implemented (Garavaglia, Garzia, & Petti, 2012).

The aim of this study was to analyse a number of digital classroom models with a view to identifying how and when needs analysis had been implemented and how this was related to outcomes in terms of problematic aspects, success factors and common/ad hoc project features.

2. Methodology

The methodology consisted of systematic observation of four macro-project models encompassing the design of 59 individual digital classrooms (31 primary school, 20 middle school and 8 high school) currently being implemented in Northern Italian schools.

The macro-project models analysed were: Classes 2.0, Web Generation, Ardesia Tech and Digital Piedmont. Due to differences between the various projects and contexts, three alternative methods were used to collect data:

- project documents;
- interviews with teachers (Kanizsa, 1993) during project consultancy/review of the classroom environment;
- quantitative surveys (Mantovani, 1998).

3. Theoretical background

According to classical theory, needs analysis may be considered the first step in data collection (Quaglino& Carrozzi, 1981; McKillip, 1987): it is primarily a research activity aimed at gathering data and acquiring reliable information on the basis of which to proceed (or not) with the successive stages of any process (training, planning ...). Arielli (2003) states that «needs are the lack of a desirable state or the presence of a negative state/condition to be overcome». In this definition, needs are considered a sort of lack whose absence is due to an unsatisfactory mode of operating or a malfunction. In any context, action is key to transforming a current situation into a desirable one: procuring food, preparing it, protecting themselves from danger, etc. Needs vary with context: they may be individual or shared by a group; action undertaken to address needs should promote a process of re-motivation and be individualized and personalized as appropriate; actions that do not take these factors into account will contribute to the persistence of demotivation on the part of teachers and students.

From a systemic perspective on the other hand, need could be viewed as an imbalance (e.g. hunger, thirst), with satisfaction seen as an indicator of balance (i.e. satisfied needs). This is in line with the views of Piaget who defined need as the manifestation of a lack of balance

arising from a change in the individual or in the external context and action as a response to need that ends when balance has been restored between the new circumstance and the mental organization of the individual. (Piaget, 1967).

Piaget's view accommodates both the subjective and objective dimensions of need in line with a systemic approach in which needs are evaluated not only in light of personal values but also in terms of the objective characteristics of the overall system, avoiding interpretations and inferences and recognizing that not all solutions are good for all systems.

In the English-speaking world in particular, the metaphor of design is applied to any context in which there are problems to be solved. Problems are no more than a representation of a set of needs that must be satisfied in order to transform a current state into a desired end state (Munari, 1981). What is the desired state? If the teacher is encouraged to apply for a grant to acquire technology (computers, tablets, netbooks…), is this desired state reduced to technology acquisition? Solving the problem may require action at various levels of detail, involving different skills and different degrees of satisfaction of human needs. All of these make more complex the task of finding where the problem is, in a situation in which there is a perception of dissatisfaction. Understanding where you have to act is in fact a problem in itself (Arielli, 2003). Often in the projects that we assessed difficulty had been encountered in identifying needs, and in monitoring them; this situation helped to create a gap between the teachers' needs and the students' needs as identified by the teachers themselves.

4. Analysis of Grants

We analyzed the grant schemes in terms of 3 main features:

1. didactic model defined by grant;
2. training;
3. needs analysis.

In order to provide a systemic interpretation, we crossed these 3 main features with the four project models analysed.

Cl@ssi 2.0 is a ministerial project targeting all grades of schools. Successful applicants are awarded funding to buy technology for one classroom per school without the provision of training for teachers (the schools applying for a grant were required to state that staff were already skilled in technological teaching methods). The educational model is not defined by the body granting the funding, therefore the teachers in our study were free to choose the technologies they thought most appropriate for their class. Needs analysis was promoted by coaches (expert tutors nominated by the university with responsibility for monitoring the project) during the instructional design phase.

Web Generation, a project currently at the start-up phase, is targeting uptake by a significant number of secondary schools: successful grant applicants receive funding to acquire technology for use in classrooms. Here, too, the educational model is not defined by the grant provider, but may be freely chosen by the grant recipient. Training for teachers is provided, but different ways and schools are free to choose: in some cases training is offered by the education authority directly (e.g. through the University) and in this case the focus is on both technology and teaching methodology; in other cases training is offered by external training agencies (schools are free to choose who to commission with the training). Teachers may conduct needs analysis in order to compile the project submission form for the grant, but this is at the complete discretion of the teaching staff.

Ardesia Tech is a primary school project being piloted at the primary school of a small town near Florence that involves the implementation of technological equipment in three classes. There is a prescribed educational model of one-to-one computing, envisaging one

netbook per child (William, 2000) with the addition of advanced technological tools such as interactive tables. Teacher training is provided but the focus is exclusively on the technological aspect. Finally, needs analysis was not carried out: the teachers adopted the model proposed in the grant scheme.

Digital Piedmont, a project targeting different grades of school, prescribes the teaching model (one-to-one computing); in this case too, teacher training is provided with a focus on how to use the technology. Again, needs analysis is not provided for teachers because they are required to adopt the model envisaged by the grant scheme.

	Model defined by grant	Training	Need analysis
Cl@ssi 2.0	Free design	Not provided	Only if promoted by coach (in different ways)
Web Generation (in start-up phase)	Free design	Provided in different ways: - proposed by the education authority (focus on both technology and methodology); - free to choose	Teachers may conduct needs analysis in order to compile the project form for the grant submission
Ardesia Tech	Defined: one-to-one computing	Provided: focus on technology	Not present. Teachers adopt the model proposed by the grant
Digital Piedmont	Defined: one-to-one computing	Provided: focus on technology	Not present. Teachers adopt the model proposed by the grant

Table 1. Analysis of Grants

In summary, the analysis of four macro-project models in Northern Italian schools conducted by our research group identified the following range of possibilities:

1. Didactic Model
    a. "Free design" model (teachers are free to decide what to do and what technology to acquire)
    b. One-to-one computing (teachers are invited to adopt this model)
2. Training
    a. Provided and focused on how technology works
    b. Provided and focused on the school's choices
    c. Not provided
3. Needs analysis
    a. Teachers may conduct needs analysis (the grant form is based on a project proposal)
    b. Impossible (teachers must adopt the model defined by the grant)

On the basis of the results presented in Table 1 above, we identified the following digitalization project models shaped by grant-imposed restrictions: one-to-one models (Penuel, 2006), technology-driven models and ad hoc models freely designed by teaching staff.

Needs analysis, even when provided for at the grant application stage is never carried out in depth. The lack of needs analysis leads to technology-driven effects.

We identified some of the factors implicated in the failure to conduct needs analysis:

- lack of training in needs analysis processes for planning/design;

- lack of rigorous evaluation of quality as a project step: evaluation would naturally bring a focus on the match between project objectives and outcomes

A further distorting factor is the current economic recession, which makes securing grant-funding an objective in itself, as opposed to the solution of a problem / fulfilment of a need.

5. Steps involved in the needs analysis process

The training consultant Robyn Peterson (1992) suggested an approach to defining performance issues in organizations that seems may be used to analyze the context of the teachers involved in digitalization projects. The diagram shown at Figure 1 illustrates the total approach to examining human performance problems in a fully professional fashion. According to Peterson, it is possible to identify some of the causes of the perceived performance discrepancy that teachers aim to solve through the introduction of technology in the classroom. Many of these causes were reported by the teachers in our study who hoped that participation in the digitalization project would lead to improved outcomes. Unfortunately, only some of these causes may be addressed in this way, for example inappropriate, limited or poorly-maintained equipment. Other issues such as inadequate pay scales or benefits cannot be resolved by introducing technology (and in general are difficult to address in Italy as they are fixed by national wage agreements for the public sector). Similarly, within the current school system, participation in digitalization projects does not influence career path opportunities. Still other issues are unrelated to technology but may be addressed by other means; these include lack of experience, poorly-designed work areas, poor physical environment, peer pressure, lack of information or poor delegation. Finally, the issue of inadequate training is addressed in a variety of different ways across the projects discussed in this paper, but in most cases without effectively solving the problem given that the training provided generally lacks a focus on design and methodological aspects.

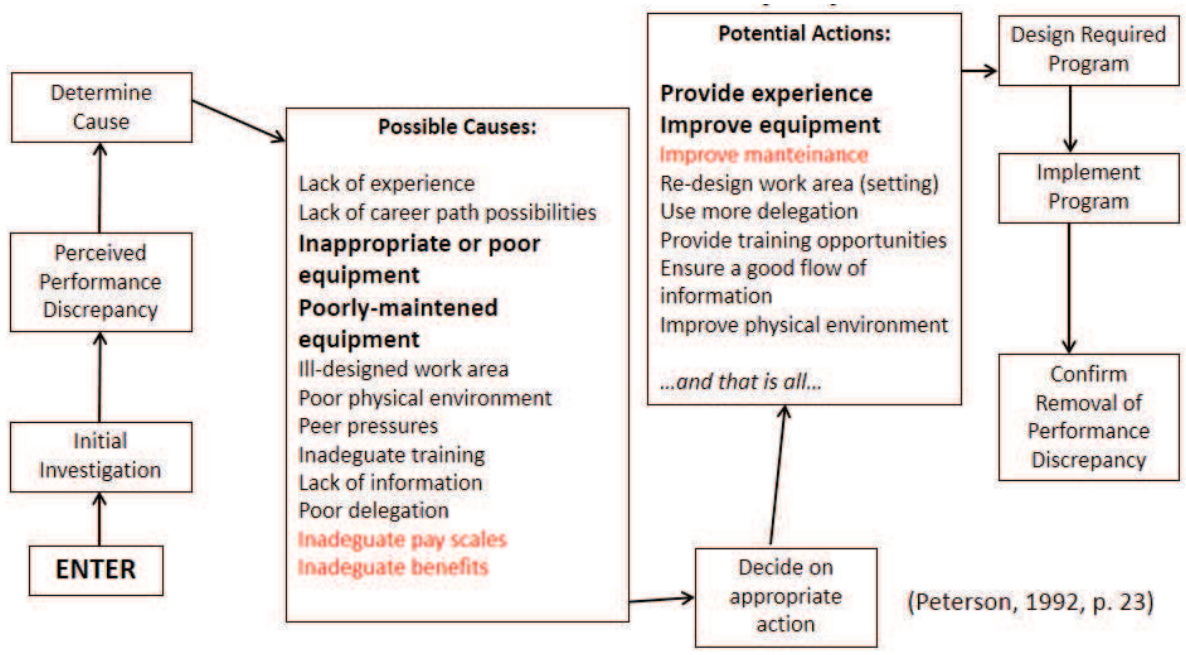

Figure 1. Basic ideas of the course "Educational Technology"

The implementation of a digital classroom project leads to gains in experience and improvements in equipment: these seem to be the main benefits to be obtained. This means that it is improbable that digitalization of the classroom with significantly alleviate the identified performance discrepancy recognized.

6. The short-circuit in the design model caused by grant restrictions.

The discrepancy just defined can also involve the inability to complete an ideal design process. In this paper, we draw on Munari's model of design (1981) to explain the mechanism underlying the failure to design satisfactory digital classroom projects. This model consists of three key steps: the Problem (P), Creativity (C) and the Solution (S). The sub-steps between the first two (from Problem to Creativity) comprise the Problem Description (DP), definition of Problem Elements (CP), Data Collection (DC) and finally Data Analysis (AD). Once the Problem has been defined in detail, the designer goes through the Creativity steps in the process and produces a first draft outline of a solution. This outline needs to be piloted and the first step in the testing process is to acquire technologies (MT). However, it is not possible for schools to complete this step because they generally do not have enough funding. In other words, a paradoxical and difficult to manage situation arises because the grant schemes do not provide for completion of the final sub-steps (experimentation SP, Model M and Validation) required to validate the optimum solution (S) to be applied by means of the grant. This may explain why many schools opt for solutions that do not match the issues flagged in their needs analyses.

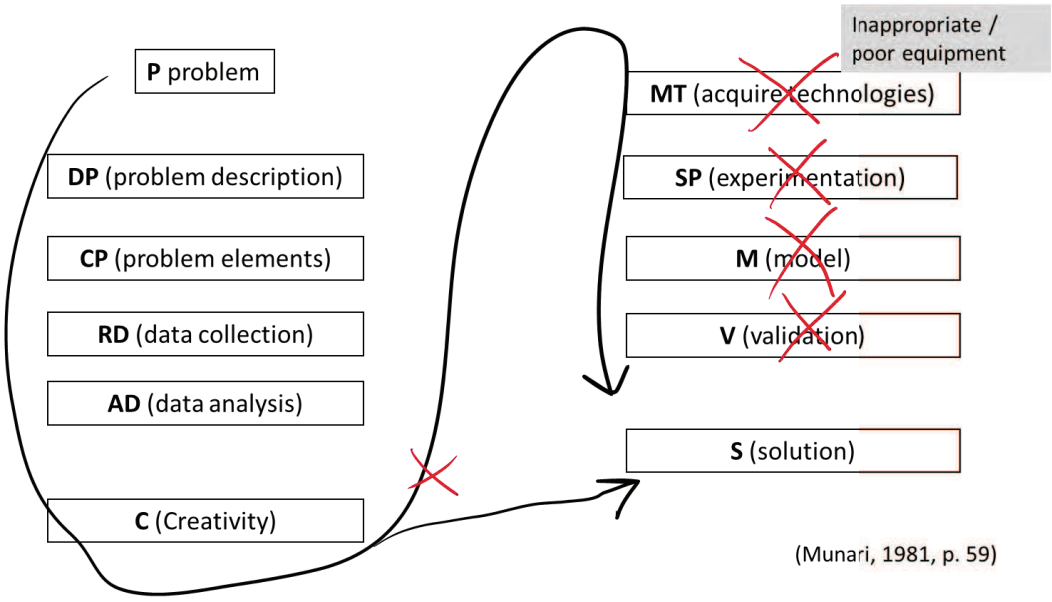

Figure 2. The short circuit in the design model caused by grant restrictions

7. The design approach used by teachers.

In order to gain insight into the processes teachers had followed to design their digital classroom projects, we conducted some interviews. Most of the teachers interviewed did not report having engaged in a step-by-step design process as recommended by Munari, but seemed more interested in acquiring technologies rather than in solving problems thanks to

in-depth analysis. It followed that their failure to conduct needs analysis at the outset had led to technology-driven effects. As outlined above, this tendency is related to a serious lack of funding leading schools to target grant-funding at all costs, as opposed to setting out to solve a problem based on a need.

Again, needs analysis was frequently not carried out due to lack of training focused on "needs analysis processes for project-planning": it emerged that there were very significant variations in the type of training previously attended by teachers, mostly determined by differences in personal interests. Lack of rigorous evaluation of quality as a project step also played a part, as previously mentioned, as evaluation would demand a match between the results and the objectives of the project, forcing teachers to bring a more timely focus to bear on needs analysis.

Our analysis identified two main approaches generally used by teachers: in the first, which we have termed *in-depth design*, teachers reported that they had aimed to improve the quality of their teaching through the acquisition of new technology, and to address some of the issues identified in the needs analysis. As mentioned before, this was the less common approach. It is represented in Figure 3.

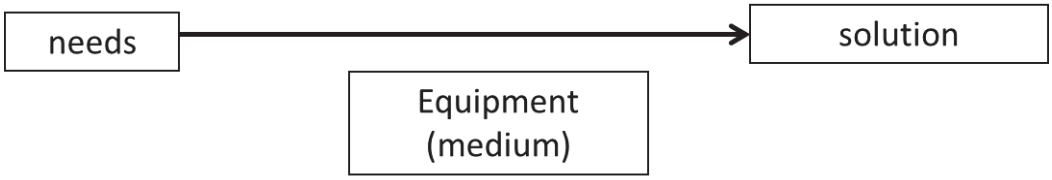

Figure 3. The"in-depth design" approach

Alternatively, in the second and more common approach defined here, termed *Instrumental*, teachers reported the need to improve the quality of their teaching through the acquisition of new technology, but only by virtue of the technical innovation and not on account of any improvement in methodology. In other words, if technology is the goal, the medium becomes the solution (figure 4).

Figure 4. The instrumental approach. In this case, the acquisition of equipment becomes the solution.

8. Conclusion: some suggested feasible solutions

It's not easy to address the lack of design using needs analysis. The complexity of the problem is increased by a general lack of involvement of the teaching staff as a group, high turn-over of teaching staff and little real opportunity to re-design work areas. These aspects are critically influenced by an excessively bureaucratic system and lack of government funding, so teachers and school principals tend to overlook them and focus on more manageable issues.

Notwithstanding this complexity, our study suggested some feasible solutions that we recommend to schools planning to implement one or more digital classrooms. Our key recommendation is to focus on competences that teachers can realistically acquire: this means that it is necessary to take a benchmark measure of teachers' existing competencies at the

outset of the process.

A second recommendation is to choose general-level solutions that may be easily applied again in future years with other groups of students, i.e., specific solutions for specific students are to be discouraged..

In addition, it is fundamental to focus on "neutral" technology that allows use of a range of software and hardware devices: neutral technology is a device with multiple uses that is compatible with most standard files and applications. For example, if an e-reader that is incompatible with the most common open standard such as e-pub is chosen this will generate technical difficulties that will distract both students and teacherùs from a healthy focus on teaching and learning.

Finally, it is very important that everybody at the school views "digital literacy" as a key skill, otherwise the climate would be less than conducive to significant positive change arising from digitalization. .

These recommendations are to be viewed as a pragmatic guide to schools seeking to optimize their participation in digitalization projects that can help teachers and headmasters to carry out their own needs analysis process before defining the final project proposal. However, we would like also to suggest that grant-schemes be set up with preliminary needs analysis as a mandatory project phase. A further improvement would be to make a portion of the grant capital available in advance to allow the proposed solution to be pilot tested, with release of the remaining funding contingent on its successful validation.

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DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONE E DI ATTO DI NOTORIETA'

(Art. 46 e 47 del D.P.R. 28 dicembre 2000, n.445 – Testo Unico delle disposizioni legislative e regolamentari in materia di documentazione amministrativa)

Il sottoscritto Andrea Garavaglia nato a Cuggiono (MI) il 04/08/1973 residente a Lentate Sul Seveso (MB) in Via Puccini 3/G,
consapevole delle sanzioni penali e civili, nel caso di dichiarazioni mendaci, di formazione o uso di atti falsi, richiamate dall'art. 76 del DPR n. 445 del 28/12/2000, sotto la propria responsabilità

Dichiara

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editato e pubblicato senza le specifiche attribuzioni delle parti scritte dai distinti autori, è stato elaborato sulla base della seguente ripartizione:

Il capitolo nasce dall'ideazione comune degli autori che ne condividono l'impianto, i contenuti e i risultati. Nello specifico, ad Andrea Garavaglia devono essere attribuite le seguenti parti:
5. Steps involved in the needs analysis process
6. The short-circuit in the design model caused by grant restrictions
7. The design approach used by teachers
I seguenti paragrafi sono invece da attribuire ad entrambi gli autori
1. Introduction
8. Conclusion: some suggested feasible solutions

Milano, 30/03/2018

IL DICHIARANTE