

USER EXPERIENCE IN A DIGITAL CLASSROOM: QUALITATIVE INVESTIGATIONS WITH TEACHERS AND STUDENTS

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ABSTRACT

This paper presents a pilot field research on the user experience of students and teachers with a digital classroom in a comprehensive institute (primary and lower secondary school) in Rome, Italy. The investigation was carried out in the framework of the original methodology KidLab Media Research, an innovative approach for field studies on younger users, initially designed for schools. Personal interviews to teachers and focus groups with students are at the core of the first phase of research. Due to the limited size of the considered sample, emphasis is given to the methodology followed, which encompasses the exploration of user experience according to the constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT): *performance expectancy, effort expectancy, facilitating conditions, social influence and behavioural intention*.

KEYWORDS

Children, collective Interview, Digital Classroom, Focus Group, Guided Questionnaire, Information and Communication Technologies, KidLab Media Research, Lower Secondary School, Qualitative and Quantitative Analysis, User Behaviour, User Experience

1. KIDLAB MEDIA RESEARCH AND DIGITAL CLASSROOM

In the framework of Scenario Analysis and in the field of media convergence, the original methodology KidLab Media Research was developed in Fondazione Ugo Bordonì (FUB), focusing on the characterization of the use of video content on multiple platforms by the younger members of the population through experimental investigations. KidLab Media Research, which is related to Scenario Engineering (Nicolò and Sapio, 1999), can be regarded as a multidisciplinary research environment that fosters the study of the behaviour of younger generations related to new technologies.

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The KidLab School Pilot (2011-2015) project was a first step towards the direction of researching about young people in schools. Its main objectives were the exploration of dynamics of adoption and use, attitudes and cultural patterns, user profiles, purchase intentions and consumptions, psychological and social risks. KidLab School Pilot involved the comprehensive institute (primary and lower secondary school) “Giorgio Perlasca” (ICGP) in Rome (Italy) through the interaction with teachers and pupils. A set of specific tools was developed for the field research, taking into consideration the peculiar characteristics of younger audiences and of the school setting. The integration of qualitative and quantitative methods provided greater consistence to results (Giaoutzi and Sapio, 2012). Research tools included focus groups (Sapio et al., 2012a; Sapio et al., 2012a), questionnaires (Mazzolini et al., 2013), longitudinal analysis (Nicolò et al., 2014), text analysis (Mazzoni et al., 2015a; Mazzoni et al., 2015b) and role playing (Nicolò and Sapio, 2016).

At the beginning of 2016 the KidLab opened a new research project about digital classrooms.

In digital classrooms students and teachers can use multimedia devices and schoolrooms are connected to the Internet. The digital classrooms allow the experimentation of advanced teaching methodologies.

Profound changes were introduced in the education sector in Italy by the National Digital School Plan (MIUR, 2015), offering a stimulating research opportunity on the experience of all actors involved in the school context. FUB and ICGP joined their forces again to analyze the user experience of students, teachers and parents with new technologies and learning environments.

The “Cl@ssi 2.0” Italian action (i.e. the digital classroom project carried out by the Italian MIUR – Ministero dell’Istruzione, dell’Università e della Ricerca) aims to transform learning environments through a steady and large use of ICT in the daily teaching practice, according to some trends emerged in the last years (European Commission, 2010; DfES, 2006). The “Cl@ssi 2.0” action started in the 2009-2010 school year and involved 156 classes of the lower secondary school.

Academic discipline

The reference discipline is the set design methodologies centred on end users, Human-Centred Design (HCD), developed as part of Human-Computer Interaction (HCI). These methods consider the user as the recipient of the design process and as the only expert about himself and about his way of living, working and learning.

From usability to user experience

In a user centric approach there are two key concepts: system usability and user experience. System usability is mainly related to pragmatic aspects of the interaction between the technology and user: the achievement of a given objective and the execution of a given task with the technology (Scapin and Berns, 1997; ISO, 2002).

User experience is a very broad concept dealing with all the aspects of the user’s interaction with the Information and Communication Technology (ICT): how the system is perceived, learned and used (Norman, 2013). Behind the user experience concept there is an holistic approach aiming for a balance between pragmatic aspects of the user interaction with ICT (mainly related to the execution of a given task) and “non task related” aspects for instance aesthetical, psychological, emotional aspects including beauty, challenge stimulation or self expression (Hassenzahl et al., 2010).

The UTAUT model

User acceptance models are powerful tools to explain individual acceptance and usage of a technological system. In fact, they allow identifying the most relevant factors facilitating/obstructing usage (Van Der Heijden, 2000).

One of the most recognized acceptance models for innovation and emerging new technologies is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). This model comprises different aspects of usage behaviour, including intention to use the system and perceived ease of use and has been extensively used in various application fields (see, for instance, Sapio et al., 2010).

The key dependent variable in the UTAUT model is the intention and/or the use of technology, hence the final purpose of the model is that of understanding and providing an explanation of the phenomenon 'use of information technology', taken as a dependent variable. The role of intention, as an antecedent of behaviour (i.e. of use), is the critical factor of the model. In the formulation of the UTAUT model four constructs are identified, which may play a significant role as direct determinants of user acceptance and usage behaviour: Performance Expectancy is the degree to which an individual believes that using the system will help him/her to attain gains in job performance; Effort Expectancy is the degree of ease associated with the use of the system, which is strongly connected to the degree to which a person believes that using the system would be free of effort; Facilitating Conditions are related to the degree to which an individual believes that an organization or technical infrastructure exists to support the use of the system; Social Influence is the degree to which an individual perceives that important others believe he/she should use the new system. In addition, Age, Gender, Experience and Voluntariness of Use were the original moderators of the model. Income and Education variables were later added as moderators (to be validated in future analysis).

More recently the UTAUT model, initially proposed for organizational contexts, was extended to the consumer context incorporating three additional constructs: Hedonic Motivation, Price Value and Habits (Venkatesh et al., 2012). In the case of payment services and e-health services another important construct is the Perception of Security, including privacy and personal data protection issues (Papa et al., 2010).

In the present study, referring to a learning context, we focus on performance expectancy, effort expectancy, facilitating conditions, social influence, behavioural intention, and use behaviour.

Research in the Digital Classroom

The investigation is aimed at different types of users: students, teachers and parents.

Students

The evaluation of the user experience for students in the digital classroom includes aspects such as:

- perception of the educational atmosphere (friendly, cooperative, participatory, supporting learning);
- satisfaction with the technological system as a whole and with its various components (interactive whiteboard, digital books, Google Drive, email, blog);
- self-assessment of learning in the digital classroom.

In the current international research environment there are no systematic applications of UTAUT models for the specific case digital classrooms and it will therefore be necessary to provide specific tools for data collection.

Some important issues to be considered are:

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- perception of the usefulness of digital technologies in the classroom (e.g. to ask for clarifications, to make observations and give personal contributions, for tests, for group work);
- perception of the usefulness of digital technologies at home (e.g. use of the digital books and e-mail);
- perception of the ease of use and pleasantness of learning in the new technological context;
- perception of the ease of use and pleasantness of the technological system;
- intention to use digital classroom in the future;
- usage of the system (in class and at home) and of the single resources (e-mail, blog, digital books...).

The analysis of these variables, measured through quantitative (such as questionnaires) and qualitative (such as focus groups and individual interviews) tools, will allow to evaluate behaviour of the end users of the technological system and to understand the role of the different components (e.g. user interfaces, support, teaching methodologies) in the overall adoption process.

Teachers

For teachers, qualitative analysis will be adopted, based on individual or group interviews dealing with issues such as teacher's interaction with the new equipment, methods to plan and deliver lessons in the digital classroom compared to traditional teaching methods, usage of various technological tools available, educational atmosphere, effectiveness of digital classrooms for learning, perception of usefulness and ease of use, pleasantness of use, future intention to use, level of usage.

Parents

For parents, limited quantitative analysis will be adopted, based on questionnaires dealing with issues such as availability and use of technological tools at home, use of technological tools in communication with the school, burdens in terms of monetary costs incurred by families. The analysis will be aimed at the preparation and testing of appropriate questionnaires to be used in subsequent surveys.

The present paper introduces the first qualitative piloting phases of the project: interview to the reference teacher and focus group with students. The following sections will discuss procedures and results.

2. INTERVIEW TO THE TEACHER OF THE DIGITAL CLASSROOM

2.1 Procedure and Setting

In the first phase of the field study the research team decided to interview the Italian literature teacher of a digital classroom, in order to start exploring relevant issues to evaluate user experience. The interview took place in the school library in April 2016, with a main interviewer, an auxiliary interviewer and a person who acted as recorder.

The interviewer informed the teacher about the research to be conducted and asked some general information about her.

She is 54 years old and she teaches literature, history and geography in the digital classroom and Italian language in a traditional classroom. She doesn't have a technological background, but she is curious about technology and met colleagues who stimulated her to use new technologies. She is enthusiastic about the experience with the digital classroom.

2.2 Frequency of Use (Devices and Capabilities)

The interviewer asks what teaching facilities of the digital classroom the teacher uses and how often, and what facilities and devices the students use and how often.

The teacher explains that the classroom has been equipped with the Multimedia Interactive Whiteboard (IWB) since the beginning of the experience. The teachers were trained to use it, especially in the first year, under the guidance of experts from the University of Tor Vergata. This training was not only technological, but it also involved teaching aspects.

She has used the IWB from the beginning, the tablets from the second year. She has also used the PC in the classroom and the PCs in the laboratory, and the blog. Online resources have been mostly exploited through the Web and video images have been shown on the IWB.

There is a class e-mail address used for both homework and communication with families. The students can send their homework to the teacher. They use Google Drive to write shared documents. The communication can be between teacher and student (e.g. correction of a document), but also between student and student (e.g. writing a collective story for a contest).

In the classroom a cooperative text was also written (teacher with PC, students with tablets). The experience was very inspiring for the teacher and she has tried to export it to the traditional classroom. With large groups this tool can be dispersive, with small groups it concentrates the attention.

Also the class e-mail has been exported to the traditional classroom, but with little success due to lack of technological equipment. There was a similar difficulty also in the digital classroom: although the students had chosen to be part of it, at the beginning not all of them possessed the necessary equipment and computer skills.

The tablets (both personal and financed by the project) have always remained at school: students never brought them home. According to the teacher, it would have been useful to have them at home.

There have been considerable advantages for the entire school: for example, now programming activities are carried out with shared documents.

2.3 Teaching activities

This section of the interview dealt with teaching activities in the digital classroom. The teacher was asked how she prepares her teaching activities, what the main changes are with respect to traditional lessons, what teaching methods and tools are used in the digital classroom, how she makes use of the time available, how the teacher's role changes in the digital classroom.

The teacher observes that every class has its own characteristics. This class is particularly vivacious and anarchic, and this characteristic has been strengthened by digital facilities. The face-to-face relationship between teacher and students decreases, because each student has got a tablet, thus the traditional separation collapses.

The students are generally not too creative in the exploration of new technological solutions and they are satisfied with what they already have.

The digital classroom implies a different type of teacher. She imagines an ideal teacher as an organizer, who guides each student according to his/her needs. In this way, the children can work autonomously to a certain extent.

"The Internet has more knowledge than the teacher, but the teacher has a better way of transmitting that knowledge".

Usually, for a third of the time the class works as a digital classroom and for two thirds of the time the class works as a traditional class.

The electronic school register is complementary. It contains homework, presences, notes and scores.

It is difficult to find websites and software for lesson management. *"In the Internet everything can be found, but not always the teacher is able to do it".*

There were some attempts at flipped classroom, with various results. *"Time management is one of the biggest problems in a digital classroom".*

In two hours the students carry out an assignment, but it takes much more time with shared text writing.

2.4 Performance Expectancy

In order to evaluate user experience within the context of a consolidated theoretical framework, we used the UTAUT constructs: *performance expectancy, effort expectancy, facilitating conditions, social influence and behavioural intention*.

The utility perception in the digital classroom is evaluated by asking how the teacher assesses the educational climate (friendly, collaborative, favourable to learning, participatory) and what the changes are in comparison with traditional lessons, if the digital classroom is useful and effective for teaching and learning (in which cases, for which categories of students, in which disciplines. The interviewer also asked to what extent she positively assesses the various devices and functions (IWB, tablets, digital books, document sharing on Google Drive, e-mail, blog, access to the Internet) and if there are any missing functions.

The teacher explains that a digital classroom cannot guarantee improvements. *"A good teacher should have trust and desire to use these technologies, which cannot be imposed by law".* However, even teachers can be educated and trained.

She would like to keep on using technology, but technology is not a value in itself. Training is very important and governments should invest much in it.

In her opinion, tablets seem to be very useful, mainly for shared writing. On the contrary, she has not found a specific use of these tools for history and geography.

The digital classroom should make all subjects easier. An online multimedia workstation, ready to be used in every classroom, is a fundamental tool.

The students use digital books with some teachers, but not with the interviewed teacher. Electronic books integrate traditional books, but they do not substitute them.

It would be useful to have more than one PC in the classroom because the tablets are small (7"). It would also be better to have other workstations for the students, that is multimedia islands for customized and differentiated teaching.

The blog has been a good experience, but it has faded off due to difficulties related to the need of continuous updating. The classroom has not succeeded in managing the blog autonomously.

2.5 Effort Expectancy

Effort expectancy was assessed by asking the teacher if she learn to use the equipment easily, if she, her colleagues and the students find the system easy to use, if there were any have any difficulties to face the changes stemming from the introduction of the digital classroom, if there was there any change as to the layout of the schoolroom (furniture, lights, space), if she experienced issues with the access to the equipment and shared resources or due to the prolonged use of the PC or other devices (e.g. eye issues). The pleasantness of the experience was also enquired about.

The teacher replies that technology must be effective and ready to use: "*I want to press a key and have everything ready*".

The IWB is basically used as a projector, without the most advanced features (e.g. touch screen). Even if the training course was detailed, some features are too complicated and eventually not used.

There are difficulties to recharge all the tablets.

In the beginning various arrangements of the classroom were tested, but they did not favour discipline, thus the traditional arrangement has been kept. The teacher would like to test the American way, with a teacher's schoolroom instead of a students' schoolroom.

Change in the mentality of the teachers are little, yet visible.

Even if she loves "*the smell of books and notebooks*", the teacher has found the experience with the digital system very pleasant. Other teachers have not appreciated the change and have not used new technologies at all (except for the IWB, regarded as a projector, which is used more or less by all).

Generally, the teachers who are reluctant to adopt new technologies are elderly, but there are some young teachers who are averse as well.

2.6 Facilitating Conditions

Facilitating conditions include financial and technical support. These were enquired about, together with the role of manuals, training courses, support by colleagues.

The teacher mentions that she bought an iPad at her own expense. "*It was a good investment*". A financial bonus was given to teachers.

In the school there is a teacher who is responsible for the information laboratory: he tries his best, but does not succeed in satisfying all the needs of technical support.

Sometimes the parents of the students give their support for the equipment in the classroom.

The bottom line is that "*there was great mutual education, with considerable help from some colleagues*".

2.7 Social Influence

We looked into the social influence by asking the role of the government, the role of the school director and the role of other teachers.

The teacher explains that the school received a budget to purchase equipment. The initiatives of the government were indeed effective, yet the problem is the lack of an evaluation phase. However, a school report will be produced to understand if the experimentation can be exported to other classes.

The school director promoted the new technologies and the digital classroom. The teachers readily accepted the electronic school register, appreciating its usefulness. *"Even the most reluctant teacher may become interested in the new technologies if she sees an advantage"*.

2.8 Behavioural Intention

In the end, the interviewer asked about the overall satisfaction with the experience, if intends to use the digital classroom again in the future, what the strengths and weaknesses of the digital classroom are, what potentialities of are there for teaching and learning, if she has any suggestions or proposal for improvements.

The teacher mentions that the experience has not been complete: something more could be made. There was an initial strong effort, then the traditional status has been gradually re-adopted, especially in the third year.

There is a great percentage of students with dysorthographia. They appreciated the possibility of writing with the computer very much, anyway they must also use pen and paper, because the final examination is carried out in a traditional way.

The strengths of the experience are the experimental nature, the many possibilities (differentiation in teaching with reference to different people, boost of creativity for both teachers and students), the help to children with difficulties (absence of evaluation of the students with dysorthographia, orthographic corrector).

The weaknesses include time management, classroom discipline management, lack of room, and lack of greater economic resources.

The idea of experimentation is stimulating, but in the meantime it may be also a limitation: children's and parents' expectations may be exaggerated. *"Digital technologies do not solve all the problems and it is not possible to rely only on technological tools"*.

3. FOCUS GROUP

3.1 Procedure

In the second phase of the field study the research team adopted a qualitative methodological approach in order to explore the digital classroom, while building hypotheses to understand the point of view of the young users, their behaviours, their experience and their needs. A focus group was held, which involved the pupils of a third year class of the lower secondary school in May 2016 (Sapio et al., 2017).

3.2 Setting

The focus group was held in the Comprehensive Institute "Giorgio Perlasca" of Rome and involved the pupils of class III C (lower secondary school) in the morning of May 12, 2016.

It was attended by twenty-two students (12 males and 9 females; mean age 13 years) sitting at their desks, a teacher, an interviewer, a recorder and an auxiliary interviewer.

The collective interview lasted about two hours.

The discussion guide was structured in order to investigate the experiences of children with the digital classroom. These students had been members of an experimental digital class since sixth grade, for a total of three years. Some students had been involved by their primary school teachers and voluntarily agreed to participate in this experience, others were added at a later stage.

3.3 Personal Experience with the Internet and Other Technologies

The interviewer introduces the focus group (motivations, objectives, tools) and invites children to participate freely in the discussion. He invites them to a first speaking round: they can talk about their hobbies. The students mention reading books (especially fantasy) and comics, writing, playing sports (football, basketball, gymnastics, fishing), music (listening to music, playing an instrument, singing), personal computer (especially for games), watching movies (especially horror), astronomy. The atmosphere is immediately relaxed and the children overcome their hesitations, with some exceptions (*"I have no hobbies"*).

The participants are asked what they do on the Internet and the responses explore different fields: playing online, shopping on eBay, watching videos on YouTube, reading comics and online stories, surfing learning websites, using social networks.

SOCIAL NETWORK	USERS
Facebook	59%
Twitter	23%
Instagram	86%
WhatsApp	100%

The discussions shifts towards personal computers. The PC and the Internet play an important role in their lives: *"70% of life takes place using the PC and the Internet (including assignments)"*. Their enthusiasm towards technology clearly shines, together with and undisguised pride of mastering it: they are digital natives and they want adults to acknowledge that.

They easily use Microsoft Word and Microsoft PowerPoint (the teacher often asks them to prepare presentations), but only a few can use Microsoft Excel.

The mobile phone is extremely popular, although parents often prevent their use for punishment. A student says that he had to stay for an entire month without being able to use his phone as consequence of castigation. The discussion decidedly shows that staying without a mobile phone brings great pain, but they can survive (with difficulty), perhaps spending time doing outdoor activities.

3.4 Frequency of Use (Devices and Capabilities)

The digital classroom includes several devices and functionalities: Multimedia Interactive Whiteboard (IWB) in the classroom, personal tablet to each student, digital textbooks, sharing files on Google Drive, e-mail, class blog.

This section of the focus group deals with modalities and frequency of use.

IWB

The IWB is widely used for some subjects (English, Italian, mathematics and French). The boys find it very useful especially for Italian (e.g. to search for poems on the web), for mathematics, for English (especially for pronunciation), for sciences (e.g. to watch videos of the solar system planets). Yet they believe it can be useful for all subjects, including physical education. During school hours the IWB is used for 60-70% of the time, but not all professors adopt it.

Whenever the science teacher cannot explain the lesson, she e-mails video lessons.

The other professors use video lessons as well. For example, the math teacher used a video to explain the Pythagorean theorem. The video lessons are usually found ready on the Internet, but, in some cases, are also prepared by the teachers themselves. The professors also show PowerPoint presentations prepared by them.

The video lessons are considered to be effective by the students (for example the one to explain the Pythagorean theorem), mainly as integration to the lesson ("*if you do not understand something in class, you can re-watch to the video*").

Students can also ask questions to professors by e-mail. The teacher always responds in a timely manner ("*even on Sundays!*"), so there is no excuse for not doing homework.

During religion hours, they use the IWB to watch movies. During this time mobile phones are allowed, whereas they are prohibited at other times. When someone is caught using a mobile phone, "*the professor confiscates it*".

E-MAIL

If they make requests to the teachers by e-mail, the teacher responds immediately. Usually these requests to teachers involve clarifications about assigned homework, which should be duly noted on the electronic register, which is often not updated. In this case students need to turn to e-mail. In some cases the explanations also cover topics to be covered during school tests.

E-mail is sometimes used by teachers to communicate with parents, for example to let them know about any behavioural issues with their children. In turn, parents write e-mail messages to professors, for example to make an appointment for a meeting. In some cases "*parents are hopeless*" at technologies and their children help them.

WHATSAPP

Communication among classmates occurs mainly via WhatsApp. In general, "*it is better to talk to friends in presence rather than on WhatsApp*". But someone is more comfortable writing than speaking and believes that on WhatsApp "*you can beat shyness*".

In any case, the children admit that there are also drawbacks with WhatsApp:

- you cannot understand other people's state of mind: "*the others basically do not know you*", "*listening to voices is way better*", "*it is like an empty talk*";
- there are too many abbreviations and misunderstandings often occur: "*serious things... better to say them in person*";
- on the other side there could be a person with a different identity from what you expect: "*it is not the friend who is writing, but his brother playing a prank*";
- you can organize class dinners, but then "*too many stupid and unnecessary videos and pictures that clog up your cell phone*" are produced.

Many would be happy if WhatsApp was incorporated more formally into the digital classroom. Others prefer the use of e-mail, as it is not synchronous and does not require online presence.

The teacher warns about the use of WhatsApp in the digital classroom and reports that, in eighth grade, she received a photo of some students who had skipped school (they were at Circo Massimo during school hours instead of being in the classroom) because her address had been mistakenly included in the list of recipients of the picture!

ELECTRONIC REGISTER

Communication between teachers and parents should be made through the electronic register, which is not always updated. Hence they often resort to alternative means, such as e-mail.

DIGITAL TEXTBOOKS

The students are provided with textbooks in electronic format (the same books they have in paper form). When they buy the book, it is also provided on a CD, which, in addition to the electronic version of the book, also contains extras (e.g. videos). The books can be downloaded or viewed by connecting to a website.

Eighteen of the twenty-two students prefer to use paper books at home, so they don't get eye fatigue. Others use both formats. Some people prefer the electronic book and believe that "*there is no eyestrain since you can enlarge the font*".

The math teacher uses the paper book in the classroom, but she displays it with the IWB and explains in a different way than a traditional lecture.

Some students use their mobile phones to read e-books, since they are often outdoors.

TABLET

The professors recommend a series of educational applications and students download them to their tablets. For example, following one teacher's advice, they use CmapTools to create conceptual maps.

The tablet is used only at school. If computing needs arise at home (e.g. the need to listen to a poem), the alternative is to use a personal computer.

In class tablets they are only used in some hours and following a fairly lengthy procedure. Two students in charge take them from the closet containing them and distribute them around. Often the tablets are out of charge and must be recharged and "*it is a mess*". Obviously there are not twenty-two power outlets in the classroom, therefore some students bring their personal charger from home.

For these reasons, in the last year the tablets were used less than in the previous year. Another issue is their relatively small screen (7"): some children claim that it would be better to have a larger screen (10"). In addition, the tablet cannot be connected to the IWB: if you want to show content from the tablet to everybody else, you have to send it by e-mail to the class computer connected to the IWB.

At school, the tablet is used in various subjects, especially for group work, and also during tests (for example, they were once requested to prepare a contribution and add it to the class blog).

GOOGLE DRIVE

Google Drive is used on the tablet for group work, which is performed for all subjects (except religion). For group work, everyday a helper is designated to assist all professors in that day.

The math teacher uses group work in a systematic way, the Italian teacher on a more occasional basis. Depending on the work to be done, the teacher defines the number of groups

and their composition, the roles within the group and the roles of the groups themselves. Examples of roles are the *"voice controller"* ensuring that nobody gets too loud, or the *"logbook writer"* compiling the group diary. Each group has a task and then, at the end, they put the results together.

Google Drive is easy to use and convenient (*"I did my homework even when I was on the train getting online with my mobile phone"*).

There are however some drawbacks. The connection is often slow and insufficient: when using it in the classroom, *"the last ones fail to connect"*. When they use to for the class tests, sometimes *"you cannot complete them"*.

CLASS BLOG

They add texts with images to the class blog. Sometimes the homework is to prepare a report to be uploaded to the blog. Reports about school trips are also posted.

Both children and parents can access the class blog. It often happens that those accessing also leave comments.

However, the blog is not constantly updated. There is little time to attend to it, because priority is given to schoolwork: *"the report is the school assignment which is then uploaded to the blog"*, *"writing the blog is fun"* and *"it is nice that others read what is being done in class"*.

3.5 Learners' Experience with the Digital Classroom

In this section of the focus group the learners' experience with the digital classroom is evaluated considering the modalities in which the lesson is conducted, the perception of the learning climate (friendly, cooperative, promoting learning, participative) (Rogers, 1969; Gnisci et al., 1999) and the main perceived advantages/disadvantages of the digital classroom for learning.

The results emerging from the discussion are summarised in the following table:

ADVANTAGES	DISADVANTAGES
Learners having problems with handwriting work more easily with a computer.	Tablets sometimes <i>"do not work as a tool"</i> and <i>"generate a waste of time"</i> . <i>"Often it is not possible to complete the work at school and it is necessary to finish it at home using different tools"</i> .
There is the opportunity to learn the use of new computer programs (Microsoft Word, Microsoft PowerPoint, etc.): <i>"I learned how to use Google Drive"</i> .	Teachers are not able to master computer programs: <i>"Training with computer programs should be compulsory for teachers"</i> , <i>"Teachers need to be more skilled if they want to produce beautiful PowerPoint presentations"</i> .
Video lessons, in depth information included in CDs, photos are helpful tools for learning: <i>"I had trouble with learning... video lessons helped me"</i> , <i>"When I don't understand something, I just take a photo of the blackboard"</i> .	The digital classroom is generally preferred to the traditional one, but <i>"sometimes equipment doesn't work and, in those cases, the traditional classroom is better"</i> .

Students often help their unskilled parents with computers. In some cases parents help students with learning specific software tools.	The pleasantness of the digital classroom use depends on the school subject (not on the teacher).
Learning is easier using Microsoft PowerPoint <i>"than when the book is used"</i> , <i>"PowerPoint is helpful to summarize and to highlight the most important issues"</i> .	There are problems with the consultation of digital books in the website: <i>"I often do my homework connecting to the website by phone, but there are problems in accessing it... paper books are better"</i> .
The use of different computer programs (Microsoft PowerPoint, Word, Excel) is important for future job careers: <i>"Many jobs need information technology"</i> .	Fights among students when the student in charge forgot to include the list of homework for the next day in Google Drive. Students who were absent from school that day did not complete homework. The teacher punished them and an animated discussion followed.
	Issues often arise in the WhatsApp class group: <i>"There are pranks among students, but there no bullying messages"</i> .

3.6 Performance Expectancy

In order to evaluate experience with and acceptance of the digital classroom, the following constructs of the UTAUT model are considered in depth: *performance expectancy*, *effort expectancy*, *facilitating conditions*, *social influence* and *behavioural intention*.

Performance expectancy is related to perceived usefulness of the digital classroom. This aspect is investigated by asking to learners if they think that devices available in the digital classroom are useful, which of them are believed more useful, if there are any relevant activities which are not possible with the available technology, if the use of digital classroom technology is perceived effectively useful for learning.

All of the twenty-two students believe that the digital classroom is useful. The detail of perceived usefulness for each functionality is summarised in the following table.

Functionality	Number of learners
IWB	22
Google Drive	22
Tablet	14
Digital textbooks	10
E-mail	22
Class blog	17

3.7 Effort Expectancy

Effort expectancy evaluates the ease and the pleasantness of use of the digital classroom. Students are asked how easy to use are the different devices, how easy it was to learn to use the technological system, if there were problems with technology at school (for instance due to an inadequate layout of the classroom, difficulties with accessing tablets, slowness and

difficulties with the Internet connection...), if they had problems with technology at home (for instance due to lack of equipment, slowness and difficulties with the Internet connection...), if they think it is pleasant to learn in the digital classroom and why, if sometimes (at home or at school) they experienced visual fatigue or any other kind of discomfort due to the prolonged use of electronic devices.

Learners report that it was difficult to learn how to use some computer programs. They often learned on their own, since parents *"don't know anything about computers"* and are not able to help them. Someone mentions to have learnt *"breaking the computer"*. When parents are unable, siblings and friends often help.

Many students maintain that *"a video is more helpful than a written manual"* for learning, but someone affirms: *"I prefer a person"*.

Using video they can learn more quickly, because they can review over and over when concepts are hard to grasp: *"At the beginning it is critical, but then it is possible to go beyond difficulties"*, *"at the beginning I didn't use it very much, later I became addicted"*.

No particular visual fatigue problems are observed, since *"you can comfortably look at the IWB"*. Problems can arise when the *"the teacher writes on the blackboard during the lesson and at the same time shows digital book on the IWB"*. Someone reports difficulties in accessing the technological equipment at home, since the home computer is often kept busy by parents. Furthermore, *"the computer often doesn't work"* or *"the parents' PC breaks down and they are forced to use mine"*. Sometimes at home they have difficulties with the Internet connection.

In general, learners are not obliged to send homework to teachers via e-mail, except in particular cases. However, some students regularly send homework via e-mail. Others do not do that because *"it is easier to do homework using paper and pen"*. A learner tells that once he had to do his homework again since *"it got lost"* and from that time *"I do my homework using paper"*.

Nine learners think is better to do homework using paper. Someone thinks that the choice between paper and computer depends on the kind of homework. For instance, the computer is good for Internet research, but it is necessary to pay a lot of attention: *"when you do online research, you can't simply copy and paste"*, but *"something original"* must be included.

Moreover, teachers are not always happy with digital homework (for instance a PowerPoint presentation), but they want a printed version as well.

3.8 Facilitating Conditions

Facilitating conditions include any kind of assistance or support received for the utilisation of the digital classroom. The interviewer asks if someone trained them with the new technologies and if there were *ad hoc* lessons, if teachers helped with technological equipment and how, if classmates helped.

Learners report that many of them learned to use Microsoft Office tools in primary school. Someone learned alone, parents or siblings helped others. Someone attended a computer laboratory delivered by the maths teacher during the first year of lower secondary school.

3.9 Social Influence

Social influence evaluates the attitude towards the digital classroom by people considered important by students. Learners are asked if parents encouraged them in using new learning technologies and how, if siblings or relatives or friends pushed them to use new technologies, in which way their teachers encouraged them to use computer technologies and how they motivated them.

Their answers clearly indicate that parents warmly encourage them to use the digital classroom, even if some parents prefer that children stay outdoor and do not always use mobile phones. *"When my father is back home from work in the evening, we have to abandon our mobile phones"* because *"it steals time from homework and from family activities"*.

The teacher mentions that not all parents spontaneously participate to school life, but they need to be stimulated. It often happens that when teachers report problems to parents, parents punish students and the punishment often consists in a suspension of the mobile phone.

3.10 Behavioural Intention

Behavioural intention evaluates the inclination to use technology in the future. Students are asked if they would like to keep using digital classroom technologies in the continuation of their studies.

Many learners know that in high school they will use digital classrooms, since they chose to enlist in schools where those are adopted. Six learners would not use it in the future, because *"traditional classes are good too"*. A few students would not like to adopt the electronic register in high school.

In general, students are excited to continue using technology at school, even if they would like to participate in the definition of rules and procedures.

4. CONCLUSIONS AND FUTURE RESEARCH

A pilot field investigation on the user experience and acceptance of students and teachers with a digital classroom has been presented. The Unified Theory of Acceptance and Use of Technology (UTAUT) has been adopted as reference framework, considering the constructs of performance expectancy, effort expectancy, facilitating conditions, social influence and behavioural intention.

The most relevant issues coming from the present exploratory study (from the teacher's and learners' point of view) can be summarised as follows.

Teacher

- *Performance expectancy.* A digital classroom by itself cannot guarantee improvements in learning. In general, digital classroom functions can be helpful, but in some cases they cannot replace, but integrate the tools available in traditional classrooms. For instance, electronic books integrate traditional books, but they do not substitute them.
The relevance of training for teachers in the digital classroom emerged not only regarding training about the use of technology, but also about possible changes in traditional educational methods. In the digital classroom, for instance, students can send their homework to teachers via e-mail, they use Google Drive to write shared documents, etc. Consequently, changes in comparison to the traditional classroom occur in communication between teachers and students, but also among students, introducing the opportunity to experiment cooperative learning situations. Cooperative educational methods utilised in the digital classroom could be effectively exported to the traditional classroom as well.
- *Effort expectancy.* The ease of use of technology is one of the most important requirements for teachers. Technology must be effective and ready to use. Even if the training course was detailed, some features are too complicated and eventually not used.

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At the beginning, various layouts of the classroom were tested, but they did not favour discipline, thus a traditional layout was kept. The use of the technology implies a change in the mentality and in educational methods. Generally, the teachers who are reluctant to adopt new technologies are elderly, but there are some young teachers who are averse as well.

A difficulty in implementing the digital classroom was the lack of technological equipment at home: although most students chose to be part of the digital classroom, at the beginning not all of them possessed the necessary equipment and computer skills. Furthermore, the procedures selected for digital classroom implementation were not adequate to overcome these problems. Among other things, the tablets have always remained at school: students never brought them home.

- *Facilitating conditions.* A financial bonus was given to teachers, for instance to buy personal equipment. The teacher responsible for the information laboratory tries his best, but he does not succeed in satisfying all the needs of technical support. Support for the equipment use is provided by other colleagues and sometimes by parents of the students. The role of the teacher changes in the digital classroom. The ideal teacher should be an organizer, who guides each student according to his/her needs. New skills are needed for the teacher in the digital classroom: to find websites and software for lesson management, to make use of the time available in a different way, etc.
- *Social influence.* The initiatives of the government were effective. The school director promoted the new technologies and the digital classroom. The teachers readily accepted the electronic school register, appreciating its usefulness.
- *Behavioural intention.* The experience has not been complete: something more could have been done. There was an initial strong effort, later the traditional status has been gradually re-adopted, especially in the third year. This could be related to some digital classroom weaknesses, i.e. time management, discipline management, lack of room, lack of greater economic resources.

Learners

- *Performance expectancy.* All of the students believe that the digital classroom is useful. The analysis of perceived usefulness of each functionality shows that the most useful functionalities are IWB, Google Drive and e-mail. The main advantages in using the digital classroom are related to the opportunity to learn the use of new computer programs as Microsoft PowerPoint (making learning an easier process), the use of video lessons (learning more quickly because concepts not assimilated can be reviewed over and over), the help for learners having problems in handwriting work, the acquired skills with information technologies which are crucial for future job careers.
- *Effort expectancy.* The digital classroom is generally preferred to the traditional one, even if there are problems with access and reliability of the equipment, especially at home. The home computer is often kept busy by parents or it does not work and sometimes there are difficulties in establishing the Internet connection. Furthermore, there are problems with the consultation of electronic books when connecting to the website. The procedures adopted to manage tablets produced a waste of time and the need to complete the work at home.

The pleasantness of the digital classroom use is depending on the school subject, not on the teacher. Some problems in the interaction among students were found in using Google Drive.

- *Facilitating conditions.* Computer courses were set up in primary school and in the first year of lower secondary school. Someone learned the use of the digital classroom alone. When parents were unable, siblings and friends helped the students.
- *Social influence.* Parents greatly encourage the use of the digital classroom, even if some of them prefer their children to be outdoor and not using the mobile phone.
- *Behavioural intention.* In general, students are excited to keep using technology at school, even if they would like to participate in the definition of rules and procedures. However, a fraction of learners do not want to use it in the future.

Due to the limited size of the sample observed, little emphasis should be given to the specific results obtained. As a matter of fact, the study has been intended to be a preliminary exploration, i.e. a pilot research whose main interest resides in testing the *ad hoc* methodological tools employed. This approach has proven adequately effective and efficient and has found the children's and teachers' satisfaction.

Further studies, based on wider field research campaigns and on the use of other analysis tools, both qualitative and quantitative, could ensure a greater representativeness of the results and allow the investigation of dynamics of adoption and use, attitudes and cultural patterns, user profiles, consumptions and psychological and social risks.

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REFERENCES

- Giaoutzi, M. and Sapio, B. (Eds.), 2012. *Recent developments in foresight*. Springer-Verlag, New York.
- European Commission, 2010. *EU Digital Agenda*. March 2010. [http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52010DC0245R\(01\)](http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52010DC0245R(01)).
- Gnisci, A., Papa, F., Spedaletti, S., 1999. Usability aspects, socio relational context and learning performance in the virtual classroom: a laboratory experiment. *Behaviour & Information Technology*. Vol. 18 (6). pp. 431-443
- Hassenzahl, M., Diefenbach, S. and Goritz, A., 2010. Needs, affect, and interactive products - Facets of user experience. *Interacting with Computers*. Vol. 22 (5). pp. 353-362.
- ISO 14915-1:2002, 2002. *Software ergonomics for multimedia user interfaces - Part 1: design principles and framework*.
- Mazzolini, C., Livi, S., Nicolò, E. and Sapio, B., 2013. Young people's new consumption practices of information and communication technologies: a field research. *Second International Symposium on Media Innovations*, Brussels, April 2013.
- Mazzoni, E., Nicolò E. and Sapio B., 2015a. Children and technological artefacts: an exploratory study. *Proceedings of IADIS (International Association for Development of the Information Society) International Conference "e-Society 2015" (13th International Conference on e-Society)*. Madeira, March 2015. pp. 79-86.

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TEACHERS AND STUDENTS

- Mazzoni E., Nicolò E. and Sapio B., 2015b. Children, multimedia content and technological artefacts: an exploratory study using text analysis tools, *Interactive Technology and Smart Education*, Emerald Group Publishing Limited, Vol. 12, n. 3, pp. 202-221.
- MIUR, 2015. *Piano Nazionale Scuola Digitale*.
http://www.istruzione.it/scuola_digitale/allegati/Materiali/pnsd-layout-30.10-WEB.pdf
- Nicolò, E. and Sapio, B., 1999. A hypermultimedia and multitechnology networked laboratory for advanced education, *Proceedings of Ed-Media & Ed-Telecom*. Seattle, USA, 19-24 June 1999.
- Nicolò E. and Sapio B., 2016. Preferences and Uses of Video Content and Technologies among Young Pupils: A Pilot Methodological Study. *Proceedings of the 14th International Conference e-Society 2016 (Vilamoura, 9-11 March 2016)*. pp.79-86.
- Nicolò, E., Mazzolini, C. and Sapio B., 2014. Young students, ICT and video content: a pilot longitudinal field study. *Proceedings of IADIS International Conference "ICT, Society and Human Beings 2014" (International Association for Development of the Information Society), part of IADIS Multi Conference on Computer Science and Information Systems 2014 (MCCSIS 2014)*. Lisbon, July 2014. pp. 21-28.
- Norman D.A., 2013. *Design of Everyday Things: Revised and Expanded*. London: MIT Press (UK edition).
- Papa, F., Nicolò, E., Livi, S., Sapio, B., Cornacchia, M. 2010. Factors Affecting the Usage of Payment Services through Digital Television in Italy. *Proceedings of EuroITV 2010 Conference*, Tampere, 9th-11th June 2010
- Rogers, K.R., 1969. *Freedom to Learn*. Columbus (Ohio), Charles Merrill Publishing Company
- Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolò, E., Livi, S. (2010), 'Building scenarios of digital television adoption: a pilot study'. *Technology Analysis & Strategic Management 2010*; 22, 1: pp.43-63.
- Sapio, B., Nicolò, E. and Persia, S., 2012a. Children's viewing practices: first results from a field research. *Proceedings of IADIS International Conference "ICT, Society and Human Beings 2012" (International Association for Development of the Information Society), part of IADIS Multi Conference on Computer Science and Information Systems 2012 (MCCSIS 2012)*, Lisbon, July 2012. pp. 107-111.
- Sapio, B., Nicolò, E. and Persia, S., 2012b. Exposure of young people to video content: a qualitative investigation. *Proceedings of IADIS International Conference "e-Society 2012" (International Association for Development of the Information Society)*. Berlin, March 2012, pp. 473-477.
- Sapio, B., Nicolò, E., Papa, F., 2017. User Experience in a Digital Classroom: A Qualitative Investigation with Teachers and Students, *Proceedings of the 14th International Conference "e-Society 2017" (International Association for Development of the Information Society)*. Budapest, 10-12 March 2017, pp.161-168
- Scapin, D.L., Berns, T. (eds.), 1997. Usability and evaluations methods. Special Issue of *Behaviour & Information Technology*. 16, 4/5.
- UK DfES, 2006. *2020 Vision - Report of the Teaching and Learning in 2020 Review Group*. Department for Education and Skills, Great Britain. Nottingham. 04255-2006DOM-EN
- Van Der Heijden, H. 2000. Using technology acceptance model to predict website, usage: extensions and empirical test, Research Memorandum Universiteit of Amsterdam 2000-25
- Venkatesh, V., Morris, M. G., Davis, G. B., Davis, F. D., 2003. User Acceptance of Information Technology: Toward a Unified View, *MIS Quarterly*. Vol. 27 No. 3. pp. 425-478.
- Venkatesh V., Thong J, Xu X., 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology, *MIS Quarterly*. Vol. 36, No. 1. pp. 157-178.