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DO BYOD (BRING-YOUR-OWN-DEVICE) TECHNOLOGIES SUPPORT INCLUSIVE VIRTUAL CLASSROOMS?

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Abstract

School represents the natural place of growth not only for the amount of information that it is able to convey, but even also because this it is a social place environment in which students acquire rules, habits and self-confidence, and learn to manage conflicts and to cooperate. In this situation, Web 2.0 and the creation of a virtual classroom can ensure the right to education while fulfilling the need for continuity and normality, decreasing the risk of interference with individual development, isolation and social and cognitive implosion. An experimental triennial project named TRIS (Network Technologies and Socio-educational Inclusion) is underway within this framework, aimed at experimenting innovative technological and methodological solutions for the educational inclusion of homebound students. In this paper we explore how, on the basis of a model of inclusion crossing three dimensions (technological equipment, BYOD adoption and teaching approach), an inclusive educational process was promoted before the beginning of the experimentation.

Keywords: E-inclusion, Web 2.0, BYOD, Homebound Student.

1 INTRODUCTION

The educational context is one of the main places where social exclusion can be prevented, and opportunities for active participation in all aspects of life can be guaranteed for all subjects with special educational needs. The main purpose of school and educational systems in general is to promote the participation of all students in learning and skill-acquiring processes. There are students who temporarily or permanently cannot attend school on a daily basis, either because of psycho-physical problems (emotional disorders, psycho-motor disabilities) or organic ones (long-term or cyclic hospitalization for particular treatment protocols).

In Italy, the right to study is guaranteed, in these cases, by home instruction, which allows ill children/young people to stay as long as possible in their habitual living environment. At the same time, this right enables them to manage the complex of social relations and friendships which they have with their school world, thus contributing to maintaining and/or recovering their psychophysical balance.

Although the law formally guarantees such protection, the onsite support offered to students and families is not always adequate for achieving full social-educational inclusion, because there are pathologies like multiple chemical sensitivity (MCS, on the constant increase) which prevent students' direct contact with their classmates and teachers for fairly long periods. Thus it becomes necessary to develop new models of schooling which take into account the real problems created by the various disadvantaged situations.

In these cases, it is logical to consider the possible advantages of ICT use for improving and maintaining social and learning inclusion processes. Personal mobile technologies connected to the more social dimension, and organization of a virtual classroom, can guarantee the right to study and fulfill these students' need for normality, limiting their isolation and the risk of social and cognitive implosion.

In this paper, we report the findings of an explorative investigation into what kind of inclusive socio-educational process has been activated in some classes where homebound students are present. Specifically, we tried to understand if the presence of students who are fairly permanently unable to attend school had, in fact, stimulated teachers and classmates to seek out solutions which favor socialization, active participation and collaborative learning processes, availing themselves of both personal (BYOD) technologies and those present at school.

This investigation was carried out in the context of the TRIS project, whose aim is to create a technology-based model of inclusive education based on the flexible use of technologies, through the experimentation of specific tools and of formal and informal educational methods at all levels of school.

2 BYOD IN THE EDUCATIONAL CONTEXT

The increasing large-scale, widespread availability of both mobile and non-mobile digital devices is generating new dimensions for interpersonal interaction and new "spaces" in which this can take place.

The so-called BYOD (Bring-your-own-device) philosophy belongs to this context. It derives from the company work environment, from the employees' need to use their own devices (smartphones, tablets etc.) in order to access data and company applications, mainly email. The confines between the times and places of work and of personal life are becoming increasingly blurred, tending to overlap. Moreover, purchase of the latest technology which comes onto the market, be it smartphone or tablet (with their advantageous features, usability and contract conditions) is becoming more and more common, so that personal devices are actually more appealing than those provided by the company.

In the educational context too this phenomenon is beginning to receive considerable attention and to be accepted as the natural, obvious trend to be followed. So, just as students carry pens and books with them, the technological tools they already own may also feasibly be used to promote learning processes.

Several authors retain that since mobile technologies are already a significant part of students' lives [1], they should also be integrated into their learning lives. Such devices, which every student has, afford seamless learning opportunities which bridge the gap between normal learning in schools and informal learning outside classrooms and schools [2].

However, the adoption of a BYOD philosophy in the school context requires radical rethinking of the organizational and pedagogic models of the educational institution. The fact that students have their devices with them is no guarantee that these devices will be used to favor their learning processes.

Implementing bring-your-own-device (BYOD) programs in school may be one way for educators to improve student engagement, peer interaction and communication, and to extend the place and time of learning, not restricting it to the classroom.

Although there is insufficient research to demonstrate the benefits of adopting BYOD in the educational context, MacGibbon [3] claims that "schools that have adopted bring-your-own technology are experiencing better outcomes from a more personalized education and enhanced engagement between home and school".

In the Alberta Guide [2], five dimensions in favour of BYOD at school are indicated:

- Familiarity, transparency and facility with the device by the students: a device owned by students and their parents/families is typically a device that the student is already using and has already customized with applications, software and organizational tools.
- A seamless bridge between formal and informal learning: if the devices the students use beyond the school day are the same ones they use for school, the students can seamlessly switch from personal use to learning anytime, anywhere.
- Currency and immediate traction: encouraging personally-owned devices can result in unprecedented levels of access to technology in the classroom.
- Social creation of knowledge: the use of personally-owned devices can promote co-construction of knowledge through social learning [4]. Cognitive science research reveals that students learn more when they are actively collaborating and cooperating with peers, their teachers and other experts. One of the common uses of personally-owned devices by students is in online collaborations with peers after school, about their school work.
- Cost and sustainability: a BYOD model often includes the potential for cost savings.

BYOD is a model which reproduces the extramural reality which students and teachers constantly must and will have to address. However, the problems and difficulties to be faced are of various

orders, including the ethical, organizational and pedagogic ones. At the moment, BYOD presents more questions than answers.

Although the questions about whether BYOD should be used or not still have to be clarified, it is evident that the models of BYOD applicability to the educational context vary from one extreme (the school indicates what device to use), to the other (each student can use any one of his/her devices as long as it is connected to the Internet).

Dixon and Tierney [5] identify five models for the use of BYOD:

- School-defined single-platform laptop: in this model the school defines the minimum specifications for students' laptops.
- School-defined single-platform laptop, plus another device: a similar model to the previous one, but the students are also allowed to use smartphones etc.
- School-defined multi-platform laptops: similar to the first model but while the laptop must comply with minimum specifications, several platforms are acceptable.
- Student choice of laptop or tablet: the students can bring a laptop with full PC functionality or a tablet.
- Bring–your-own whatever connects to the Internet: students can bring any device that connects to the Internet.

The Alberta guide for schools [2] cites five models as follows:

- Limiting personally-owned devices to a specific brand/model of device.
- Limiting personally-owned devices to those that meet specific technical specifications (e.g., specific versions of operating systems, minimum amount of storage space, Internet-ready, etc.).
- Limiting personally-owned devices to those with specific functionality (e.g., compatibility with software, compatibility with online testing requirements, etc.).
- Accepting all personally-owned devices provided they are Internet-ready.
- Hybrids or combinations of the four models listed above.

It can be intuited from this brief list that integration of personally-owned devices into learning processes requires changes in organizational and pedagogic approaches in which the various actors (teachers, students and family) are strongly involved.

3 TECHNOLOGY-SUPPORTED EDUCATIONAL INCLUSIVE PROCESS

School is a place of normal life, a place to grow up and learn in, a place to interact with people of one's own age and with adults [6]. The interruption of the normal educational path for students forced into long periods of hospitalization or home stays is a source of apprehension and fear [7]. The maintenance of social and educational links with school offers young homebound students a sensation of normality, of not everything having been wiped out by a more or less invalidating illness.

For these students, new models of schooling based on the regular and methodical use of the new information and communication technologies need to be worked out [8] [9]. These new models should improve not only the management of the teaching/learning process but also communication among the subjects in contact with the young person (teachers, classmates, parents, health workers) and among the various subject teachers who will be following his/her studies over the various school years [10].

In this scenario, ICTs allow homebound students to participate in more meaningful ways and, at the same time, to feel less isolated from the class [11]. It is easy to hypothesize the affective, emotional and social advantages and results deriving from the use of the most innovative tools like the Web 2.0 and instant messaging services (e.g. Skype and Hangout), or of the digital media (e.g. LIM or portable devices like smartphones or tablets and mini-tablets), for all those students forced into long periods of isolation.

Taking into account the social and educational needs of homebound students, who should be enabled to take an active part, inclusion might be seen as the result of a process which integrates the following technological and methodological dimensions (Fig. 1): use of technologies in class (technological

equipment); appropriate use of BYOD in the educational context (BYOD technology); the use of collaborative strategies (didactic approach).

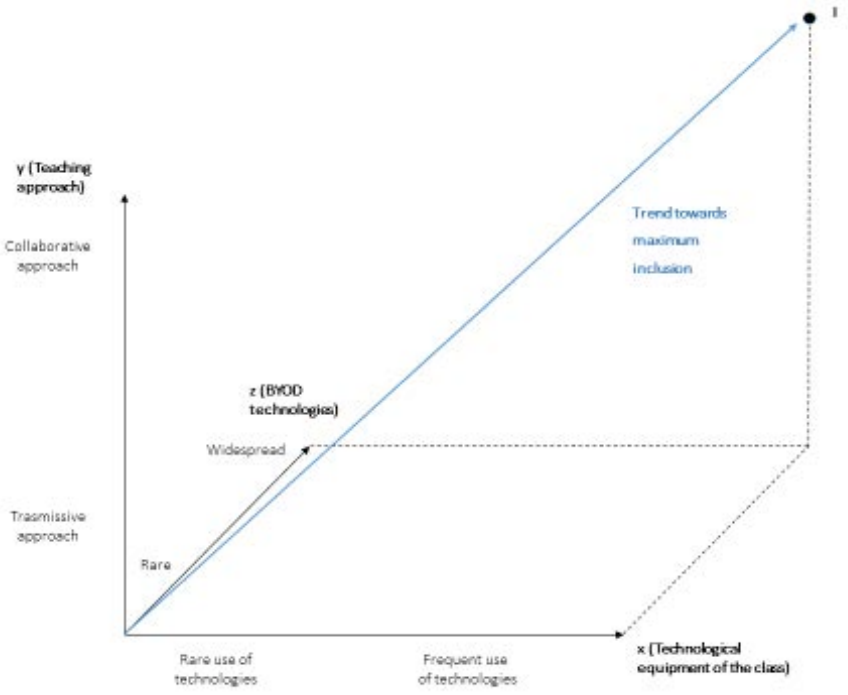

Fig. 1 –The inclusion model

Technological equipment of the class (x)

The technological dimension shows the presence of technology within a class or integrated by teachers' personal initiative. The term "technological level" applies here to the technologies making up the school hardware equipment which are used by the teachers for actual teaching purposes.

Teaching approach (y)

The approach dimension shows the approach used by the teacher to promote learning processes. It finds, at one extreme, transmissive teaching strategies centered on face-to-face lessons; at the opposite extreme, the use of collaborative strategies. The homebound student benefits from the use of collaborative approaches in two different ways: first, these are an opportunity for enhancing his/her social relations with the rest of the class; secondly, since collaborative work is horizontal and networked, it reduces the difference between students able to attend and remote students. For these reasons, it is appropriate to consider the teaching approach as an element which influences the level of inclusion.

BYOD Technology (z)

The BYOD dimension shows the use of personal technologies also for didactic purposes. The advantage of the BYOD approach derives from students' familiarity with technological devices they interact with on an everyday basis. As concerns the models of BYOD use, in this case we refer to devices which each student has at his/her disposal (corresponding to the fourth model of Dixon and Tierney, [5].

4 THE RESEARCH

4.1 Context of the study: the TRIS project

This study investigated whether and how the presence of homebound students has stimulated socio-educational inclusion processes, taking into consideration the dimensions described in the aforementioned inclusive model (Fig. 1). More specifically, our aim was to understand whether the teachers and classmates of the homebound students have been stimulated by the widespread presence of both school and personally-owned technologies to create moments of greater formal

and/or informal social and educational involvement. Thus, specific questionnaires were prepared and administered to teachers and students involved in TRIS experimental project.

The main aim of the TRIS project is the identification and experimentation of new models of schooling for students who are temporarily or permanently unable to participate in normal education. The research project comes within a triennial frame agreement between the MIUR (Italian Ministry of University and Research), the CNR (Italian National Research Council) and the Telecom (telephone company) Foundation, and its aim is to promote experimental activities for the socio-educational inclusion of students who have difficulties in normal school attendance.

From the methodological point of view, the research develops along three closely complementary lines: (a) study and experimentation of didactic/methodological approaches targeted at socio-educational inclusion and centered on the use of a hybrid learning space [12]; (b) the study and experimentation of sustainable technological settings for the application of the aforesaid didactic/methodological approaches; (c) planning and experimentation of teacher training actions regarding the planning, conducting and assessing of the inclusive activities.

It was thus necessary to conduct an experimental investigation into the variables of the problem and to define a sustainable model of inclusive teaching which takes into account both the students' status and the role of the social organizations (Fig. 2) which are concerned with them [13].

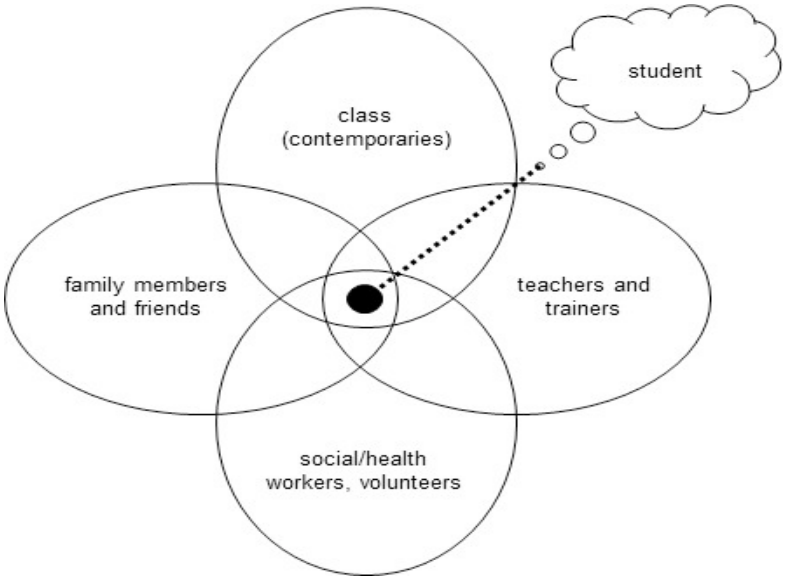

Figure 2 – The complex of social networks involving the student

One of the main aims of the project is to work out didactic/methodological solutions which are sustainable, i.e. functional to the socio-educational inclusion of the homebound student and at the same time in harmony with the class teachers' teaching styles.

4.2 Participants

Three classes from Primary School and one from Upper Secondary School took part in the project.

The teacher population was made up of 21 subjects (17 females and 4 males).

The student population consisted of 64 subjects (31 females and 33 males), 49 subjects from Primary School and 15 from Upper Secondary School.

4.3 Tools used

Questionnaires with open and Likert scale questions were administered for both teachers and students.

The questionnaire for the teachers consisted questions targeted at gathering information about technological equipment, skills in technology use, the most frequently-used applications, the main

teaching approaches adopted, the habits of home and school use, and the relationship set up with the homebound student.

The students' questionnaire was made up of questions regarding:

- the presence and type of technologies owned by the students and available in the family context;
- technology skills;
- the use of technologies for leisure but also study;
- the ways of interacting with the homebound classmate.

Finally, to collect data on the technological equipment and type of connection present in class, a check-list was prepared and was compiled by one teacher from each class.

4.4 Results

4.4.1 Teachers' profile

The participating teacher population consisted of 21 subjects, 52% of whom work in Upper Secondary School, 48% in Primary School. 55% of the population are over 50 years of age.

Regarding the technological equipment, all the subjects have a computer (desktop or laptop), over half of them own a smartphone and 38% declare they own a tablet. In the population as a whole, all the teachers possess at least one device and all of them have an Internet connection.

The level of skill in the use of technologies is generally medium/high for the computer. At the opposite extreme, at least a quarter of the teachers have no skill in using other devices (tablets, smartphones, LIM). Regarding skills in using applications and online resources, those claimed by the teachers are medium/high for Office applications and communication environments (group communication and videoconferencing) and medium/low for course management environments, collaborative writing and sharing.

As for the places in which the use of certain specific technologies is preferred to others, at home the teachers mainly use the laptop (76%), followed by the desktop computer and the smartphone (55% and 52%, respectively). At school the laptop is mainly used (62%), followed by the desktop computer (48%) and the tablet (31%). Outside home or school the most used technologies are the laptop and the smartphone (57%)

The use of technologies for teaching purposes seems to be fairly frequent, but it is predominantly a personal, behind-the-scenes use, mainly linked to lesson preparation (86%), updating (66%) and maintenance of professional contacts (57%) (Fig.3).

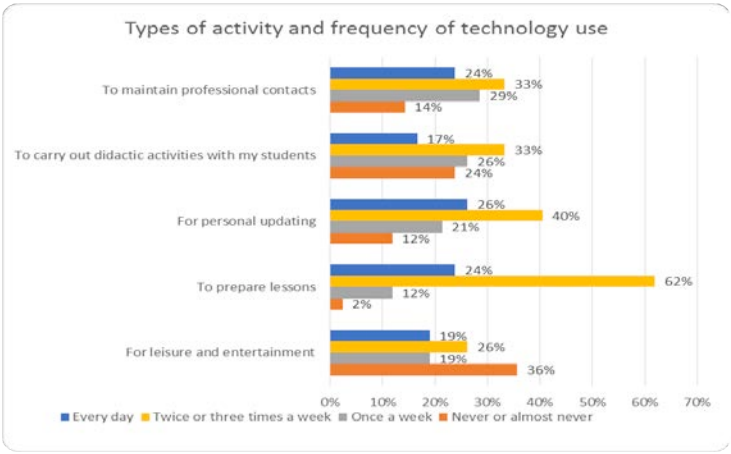

Figure 3 – Types of activity and frequency of technology use

Only half the population carry out technology-based learning activities directly with the students. The most used technology for didactic purposes, both at home and at school, is the computer, while LIM, the tablet and the smartphone are much less used (19%, 17%, 12%, respectively).

Focusing on the teaching approach adopted at school, it was found that the most widespread type of technology use tends to emulate the traditional model of the face-to-face lesson. 45% use them in this way daily, while only a minor percentage regularly use technologies in a more active way involving the students (28%). Use of the computer lab is still quite frequent, the most common approach there still being the face-to-face lesson. A third of the teachers give technology-mediated assistance to absent students or those requiring particular reinforcement, on at least a weekly basis.

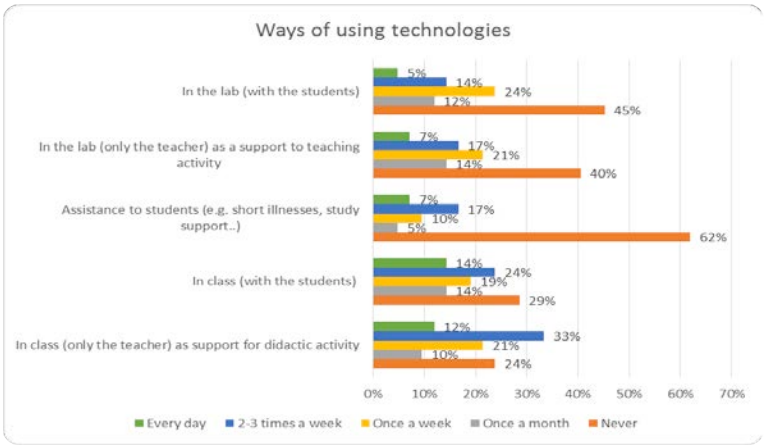

Figure 4 – Ways of using technologies

Regarding the experiences with the homebound student participating in the project, three-quarters of the population have already had him/her as their student and interact with him/her via Skype.

4.4.2 Students' BYOD

In order to assess the students' technological equipment and the frequency of its use in their relations with the homebound student, non-parametric, descriptive and statistical analyses were carried out.

Regarding the technological equipment, all students possess at least one personal or family device. Differences may be observed between the Primary School population and the Upper Secondary School population regarding the type of device (Fig. 5). 93% of the Upper Secondary School population possess a PC, as against 20% of the primary school population, a finding which is inverted for family PC use (7% of the Upper Secondary School students use it, versus 75% of Primary School students). Cellphones are possessed by 59% of Primary schoolchildren and 66% of Upper Secondary School students, while only 8% of the younger students have a smartphone, as against 86% of the older ones. Tablets are owned by a higher percentage of Primary schoolchildren (55% of Primary schoolchildren as against 26% of Upper Secondary School students).

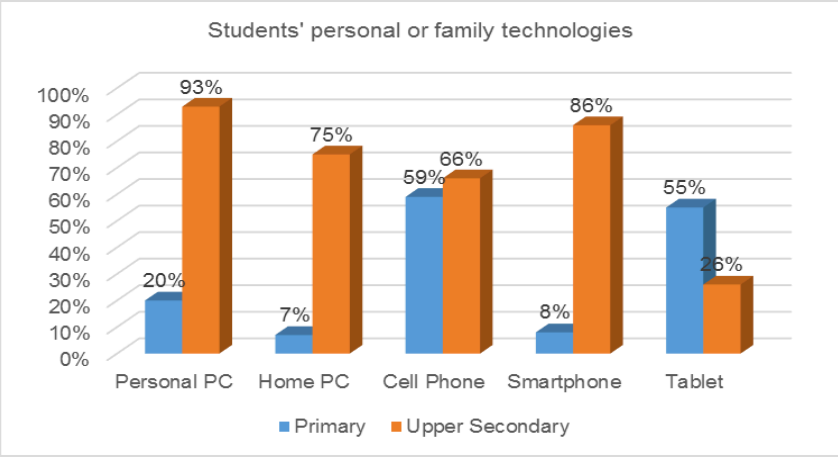

Figure 5 – Students' personal or family technologies

Regarding the frequency with which students communicated with the homebound classmate from school or home, the frequency distribution was calculated for each single item related to the type of interaction with their homebound classmate (Table 1).

The findings of Table 1 below show a fairly high percentage which exceeds 80% of the Never or Almost Never answers to the majority of the Items, apart from the following Items: “We do exercises together from school” (64% of Never or Almost Never answers), “We do exercises together from home” (72.9% of Never or Almost Never answers) and “I explain to him/her the contents of the school lessons” (76.2% of Never or Almost Never questions).

Table 1 – Cumulative percentages concerning the types of interaction between the homebound and his/her classmate

Item	Level of answer on Likert scale	Cumulative Percent
I explain to him/her the content of the lessons from school	Never	46,0
	Sometimes	**76,2**
	Often	93,7
	Always	100,0
I help him/her to do exercises from school	Never	46,0
	Sometimes	**81,0**
	Often	93,7
	Always	100,0
We do exercises together from school	Never	37,1
	Sometimes	**64,5**
	Often	80,6
	Always	100,0
It is he/she who helps me do the exercises from school	Never	66,7
	Sometimes	**88,9**
	Often	80,6
	Always	100,0
I explain to him/her the content of the lessons from home	Never	63,3
	Sometimes	**85,7**
	Often	98,0
	Always	100,0
I help him/her to do the exercises from school	Never	63,8
	Sometimes	89,4
	Often	95,7
	Always	100,0
We do together the exercises from home	Never	58,3
	Sometimes	**72,9**
	Often	91,7
	Always	100,0
It is he/she who helps me do the exercises from home	Never	71,7
	Sometimes	**89,1**
	Often	97,8
	Always	100,0

As regards differences between the two school levels of the student population, the differences in the following Items were found to be significant in the Mann-Whitney test: “I explain to him/her the contents of the lessons from school” (z=2,006 p=,039); “I explain to him/her the contents of the lessons from home” (z=3,061 p=,002); “I help him/her to do the exercises from home” (z=2,481 p=,013); “We do together the exercises from home” ((z=2,716 p=,007); “It is he/she who helps me do the exercises from home” (z=2,716 p=,024).

4.4.3 Class technological equipment

All the classes were equipped with a laptop with internet connection and two of the four classes also had LIM.

4.5 Discussion and conclusion

An analysis was made in this exploratory study of whether and how the presence of a homebound student inserted into a traditional class was able to activate and foster a process of greater socio-educational inclusion, supported by intensive use of the different technological devices. The

investigation was carried out at the start of the TRIS project and was mainly aimed at the construction of a map which would indicate the directions to be followed in the subsequent experimentation.

It was hypothesised that the presence of homebound students might activate and/or modify methods of communication and the educational behaviour of both the teachers and the classmates, in view of the widespread presence of both personal mobile and school technologies.

As regards the teachers, it emerged that the technologies were used both for personal and teaching purposes. In the latter case, the findings confirmed that a high percentage of the test population tended to follow a traditional educational model when using technologies in class. In fact, the most frequently used teaching strategies are still the transmissive ones rather than the collaborative ones.

The student population as a whole own at least one personal device or use the family one. Interaction with the homebound classmates still seems to be poor and sporadic. Only a low percentage of schoolchildren interact with the homebound classmate both from school and from home. Despite this low percentage of interaction, the Primary School students are much more active than the Upper Secondary School ones. These findings are justified by the fact that the didactic organization of the Primary School is much more orientated towards interdisciplinarity, while Upper Secondary School didactics tend to be subject-driven.

If we suppose that in a didactic context where a homebound student is present, the process of socio-educational inclusion is determined by the presence and more discerning use of (i) class technological equipment; (ii) students' BYOD technology applied to the educational context and (iii) collaborative approaches and strategies, then we can reasonably state that in the four classes examined this process was not activated in an endogenous way.

The large-scale, widespread presence of both personal and institutional technologies does not modify teachers' teaching habits, just as students' BYOD technology use, encouraged by the teachers, was not particularly influential in students' formal or informal interaction.

Thus it is along these lines that the TRIS experimentation is now proceeding. Specifically, a combination of initial teacher training, followed by a research-action approach synergically involving teachers and researchers, has generated a process of transformation in all three of the dimensions of socio-educational inclusion identified in this study.

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