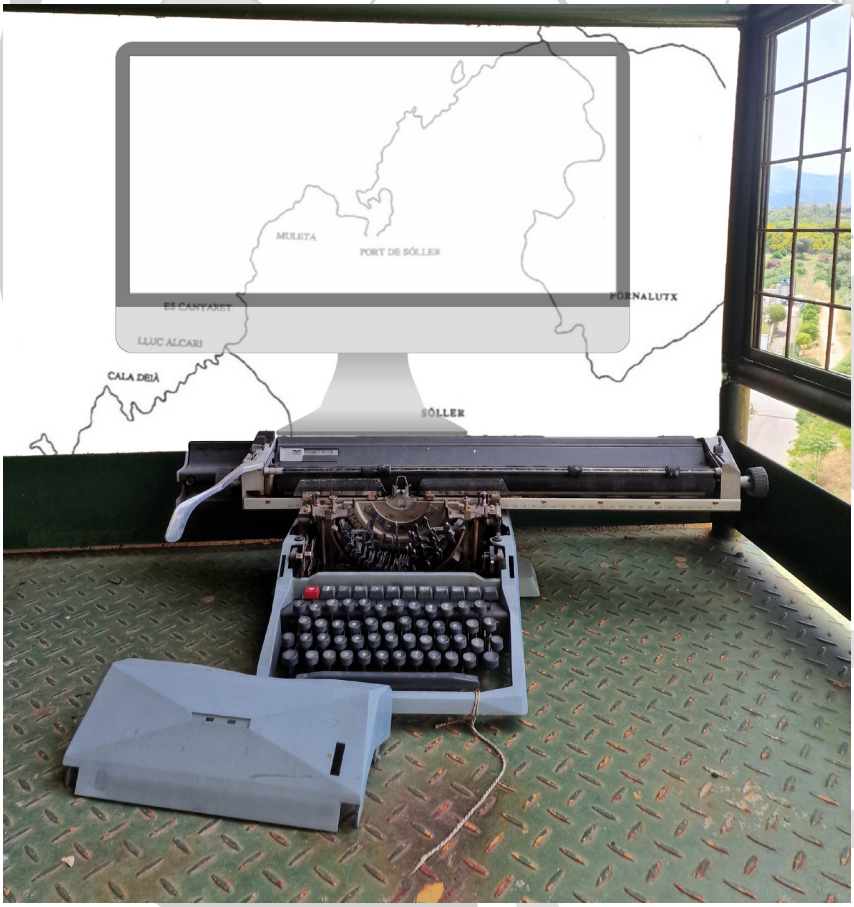
INFORMATION TECHNOLOGIES AND SOCIAL MEDIA: NEW SCIENTIFIC METHODS FOR THE ANTHROPOCENE

Gaetano Sabato, Joan Rosselló (Editors)



Preface by Javier Martín-Vide

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Geographies of the Anthropocene

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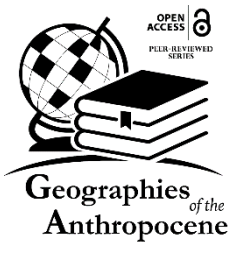

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Gaetano Sabato, Joan Rosselló (Eds.)

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Geographies of the Anthropocene

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Geographies of the Anthropocene

Open Access and Peer-Reviewed series

The book series "Geographies of the Anthropocene" edited by the International Scientific Publisher "Il Sileno" (Il Sileno Edizioni) will discuss the new processes of the Anthropocene epoch through the various worldviews

of geoscientists and humanists, intersecting disciplines of Geosciences, Geography, Geoethics, Philosophy, Socio-Anthropology, Sociology of Environment and Territory, Psychology, Economics, Environmental Humanities and cognate disciplines.

Geoethics focuses on how scientists (natural and social), arts and humanities scholars working in tandem can become more aware of their ethical responsibilities to guide society on matters related to public safety in the face of natural hazards, sustainable use of resources, climate change and protection of the environment. Furthermore, the integrated and multiple perspectives of the Environmental Humanities, can help to more fully understand the cultures of, and the cultures which frame the Anthropocene. Indeed, the focus of Geoethics and Environmental Humanities research, that is, the analysis of the way humans think and act for the purpose of advising and suggesting appropriate behaviors where human activities interact with the geosphere, is dialectically linked to the complex concept of Anthropocene.

The book series "Geographies of the Anthropocene" publishes online volumes, both collective volumes and monographs, which are set in the perspective of providing reflections, work materials and experimentation in the fields of research and education about the new geographies of the Anthropocene.

"Geographies of the Anthropocene" encourages proposals that address one or more themes, including case studies, but welcome all volumes related to the interdisciplinary context of the Anthropocene.
Published volumes are subject to a review process (**double blind peer review**) to ensure their scientific rigor.

The volume proposals can be presented in English, Italian, French or Spanish.

The choice of digital Open Access format is coherent with the flexible structure of the series, in order to facilitate the direct accessibility and usability by both authors and readers.

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5. ICT and the classroom, a difficult relationship?

Iris Morey[1], *Marina Palou*[2], *Joan Rosselló*[3].

Abstract

The COVID-19 pandemic increased the use of ICT (Information and Communication Technologies) tools inside the classrooms worldwide. Nevertheless, this fact allowed revealing the existing differences between students, teachers and the community, which are in part the result of economical and societal inequalities. Furthermore, such inequalities affect classrooms at all levels, from school to university.

Even though the use of technologies has improved education as new communication and learning systems have been implemented, the existing differences can enlarge the gap within the educational structure, something that should be avoided at all costs.

In this chapter, an analysis of the ICT resources used in three classrooms of the Spanish Educational System is presented. The ones used before the pandemic, the ones used during the COVID lockdown and the ones being used nowadays are explained, with a focus on their advantages and disadvantages.

Keywords: ICT, secondary school, online courses, Mallorca

1. Introduction

The technological revolution, which started at the end of the 20th century, provoked large societal changes (Torres Albero, 2002). A result of this revolution has been the arrival of an ICT-based society.

According to Castells (1997-1998), ICT are all those technologies developed in different fields, such as electronics or computing, and its

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evolution in terms of applications, elements and technological advances in robotics or virtual reality.

Technology has improved and facilitated the daily life of people, being the education field one of those most affected by this change.

The arrival of ICT in the educational field implied learning and communication changes between the parts of that system, students and professors.

Authors like Duart and Sangrà (2000) or Roschelle *et al.* (2001) defend that technology entails a large number of advantages for the educational process, especially at the communication level, enhancing the students' participation and creating a more direct and customised learning system.

Nevertheless, this revolution on education also implies some drawbacks. On the one hand, there is an absence of technological capability within the teaching staff, and some of them do not want to use technological tools as they do not know how to (Watty et al., 2016). On the other hand, there is a wide debate about how to properly use those tools. The large scope of available information can provoke misunderstandings and misinformation among the students and they have to learn skills and criterions to search and assess correctly the information at their disposal (Aliaga & Bartolomé, 2006).

Another highlighted problem is the fact that technological innovation does not mean a pedagogic improvement and Fowler (2015) proposed to create virtual spaces from current pedagogical resources.

Finally, it must be taken into account that each student has individual differences, regarding the disposal of advanced devices or the use of them. It is common to observe that the use of technology is not positive even though the devices are appropriate.

In this chapter, the evolution of ICT in a Spanish high school is presented, from the point of view of three subjects: Geography and History, Physics and Chemistry and English. There is an analysis of the use of ICT before the 2020 pandemic, followed by a description of the use of technological tools during the lockdown and, finally, a focus on the current situation, pointing out the advantages and disadvantages of their use, both for students and for professors.

2. Study area

The research is developed at the Institut d'Educació Secundària (IES) Son Rullan, which is located in the city of Palma.

Palma is the capital of Mallorca, the largest island of the Balearic archipelago, located off the Eastern coast of Spain. Palma is the biggest city, with a population of 422 587 inhabitants in 2020 (IBESTAT, 2022). The city is located in the southern part of Mallorca (Figure 1) and it is divided in neighbourhoods as well as by census districts for administrative purposes.

The IES Son Rullan is in the northeastern area of Palma and it serves the population of four neighbourhoods: Es Vivero, Rafal Nou, Son Cladera and Son Rullan (Figure 2).

It is an area largely populated by immigrants, mainly of Spanish origin even though lately there has been a large number of people arriving from South America and Africa.

At present, the IES has 829 students, who can study ESO, compulsory education until they are 16 years old, Bachillerato, two years, which lead to the examination to access university studies and Formación Professional, a formative course related to physical activities and leisure. A total of 87 professors make up the faculty.

The faculty is divided into departments, which are created according to the different knowledge areas. We can find a Mathematics department, a Catalan department, a Spanish department and a Foreign Languages department among others. Each one has a variable number of members, depending on the IES necessities.

The classrooms are equipped with a PC and a projector as well as an interactive board. There is internet connection for the students and the professors. The centre has a computer's room, with 20 PCs but it must be taken into account that, to use it, it is necessary to book the room in advance and there is usually a waiting list. To complete the available resources, there are laptops to be used by the students but there is also a waiting list to use them.

It should be noted that a large number of students come from low-income families, as the surrounding neighbourhoods comprise working-class people, mostly with low-skilled jobs. Such a fact implies that there is a great amount of difficulties, in terms of economic capacity of the families, level of interest in their sons' education and the existence of unstructured families. The faculty has to deal with those problems while trying to properly teach their students.

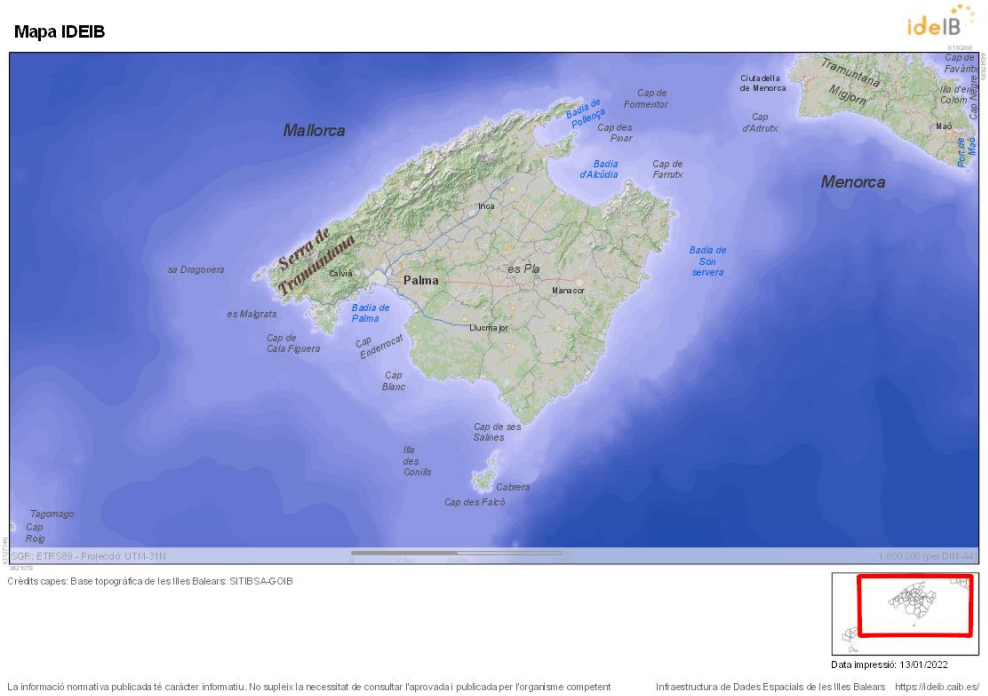


Figure 1 - *Location of Palma within Mallorca. Source: IDEIB, 2022.*

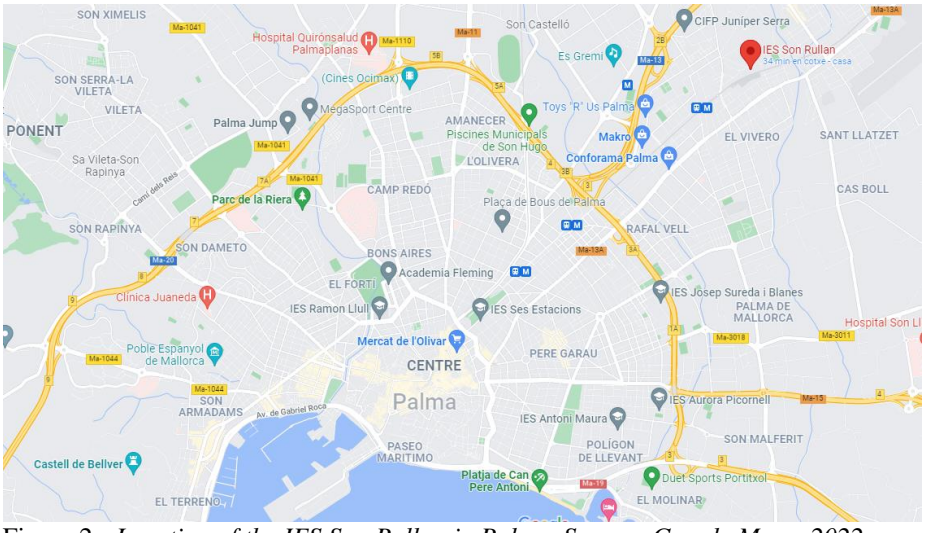


Figure 2 - *Location of the IES Son Rullan in Palma. Source: Google Maps. 2022.*

3. ICT applications before the pandemic

3.1 Management platforms and communication tools

Before the arrival of the pandemic, the most common tool used by the staff was the GestIB application, developed by the Education Ministry of the Balearic Islands (Figure 3).

Despite being the only official application, it was sparingly used by the teaching staff. Its main uses were checking students' assistance, grading them at the end of the evaluation term and, finally, registering the arrival and departure of the professors on each working day. Another available option of GESTIB consisted of texting families and using it as a communication network, but few families had full access to the application and a phone call was easier to establish contact when needed.

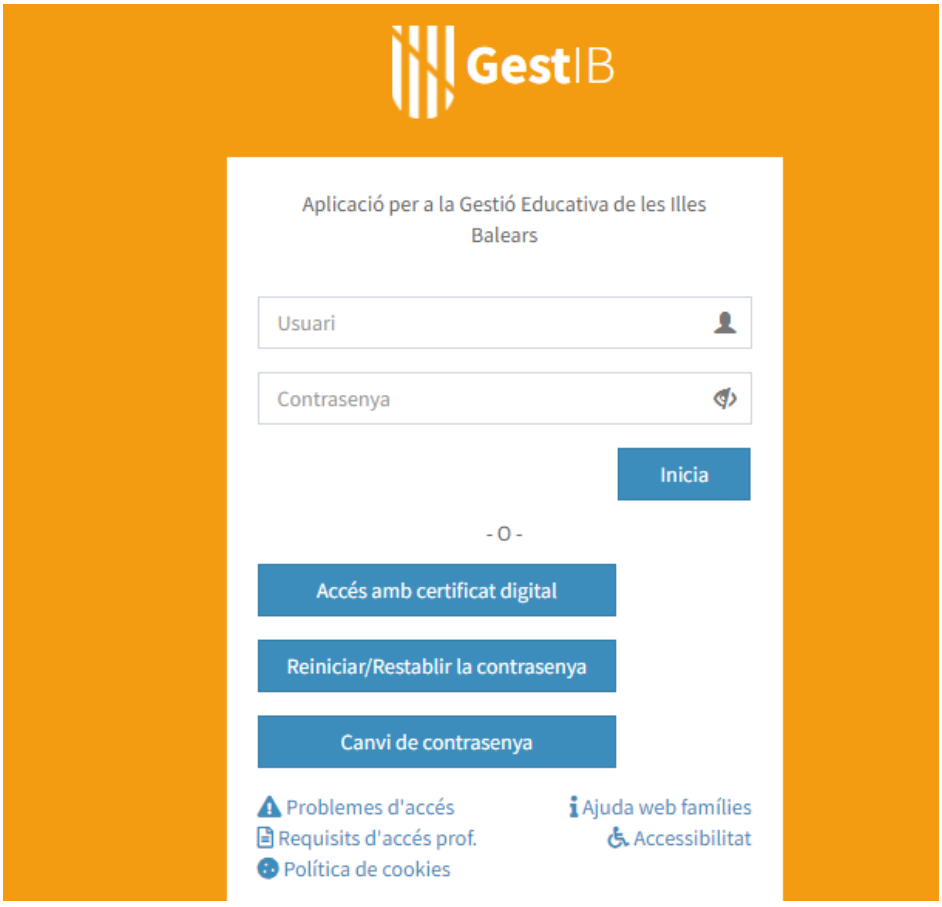


Figure 3 - *Screenshot of the GestIB application.*

Regarding the communication with students before the COVID outbreak, few professors used Google applications, such as Gmail or Meet. The main reason is that their use was not compulsory and face-to-face meetings in class or afterwards were commonly used. Another aspect to take into consideration is that the Moodle platform was being used in some centres and by some professors, thus creating some confusion about which platform was the best option to be on hand.

When the lockdown arrived, there was the necessity of establishing a quick communication tool and the IES decided to use Google Classroom for that purpose. It was clear from the start that there were problems related to the lack of technological formation from the part of professors but also of students, while the situation was exacerbated by the lack of technological means in many families. The IES Son Rullan created an ICT commission, formed by five professors, to help with the implementation of all of those applications. One of the most important actions was to teach how to use a video call system to allow direct and live contact between students and professors.

3.2 Geography and History

Geography and History are both subjects within the educational system and, at the same time; this is a part within the societal system. However, while society has evolved, the teaching of Geography and History has not, as it still has a large theoretical corpus, which is related to the difficulties that exist to develop practices in the real space, away from the classroom (Graves, 1985).

The arrival of the new technologies allowed us to move some reality, in terms of space, to the classroom. The use of educational videos from Youtube and other websites and applications like Google Maps allows a closer contact between theory and reality.

Even so, the broad knowledge of the subjects, which ranges from worldwide to regional and even local topics, makes it difficult for the teaching staff to adjust contents and class time. Another hurdle is the capability of professors in terms of ICT use, as a large number of them are over 50 years old and are not able to use new technologies as younger professors do, as they usually have had some kind of ICT experience during their graduate studies.

Taking all of the above into consideration, the ICT use before the pandemic was low amongst Geography and History classes. Practical research was devoted to field trips of small duration (from three to six hours), where the professor taught about the geographical or historical relevance of

the visited area and students usually had to complete worksheets or answer questions in-situ. There were also cooperative works within the classroom but again the use of computers and presentations using applications like PowerPoint or Prezi were the only ICT-related activities developed.

In some cases, professors used web platforms like Moodle where students could consult notes and presentations as well as they sometimes had to complete tests. In addition, gamification was on hand, with applications like Kahoot or Quizlet, to lure the students into specific parts of the course syllabus.

3.3 Physics and Chemistry

In the early 1970s, science teaching considered the students as a "tabula rasa" (Pinker, 2000, quoted by Solbes, 2009). It was believed that learning should be based simply on attending classes and doing repetitive tasks. However, as soon as other kinds of questions, different from those worked in class, were introduced, a serious misunderstanding of some of the most fundamental scientific concepts was revealed, even those, which had been insistently practised. In addition, it was found that these "conceptual mistakes" (so-called at first) were not unusual errors, but were shown as ingrained ideas, similar in students from different countries, inconsistent and resistant to being replaced by the scientific knowledge of the usual education (Pinto, Aliberas & Gómez, 1996). This problem of conceptual learning led to the so-called "constructivist view of learning", where the previous knowledge of students is considered as the starting point for a meaningful learning (Ausubel, 1983, quoted by Rayas, 2004).

a) Experimental work

The proposal of experimental activities is one of the most obvious techniques to ensure a constructivist view of science learning. "Experimental work" is understood as any activity that involves the manipulation of materials, objects or organisms in order to observe and analyze phenomena (Sanmartí, 2002). Therefore, from this point of view, practical work can be done in the laboratory, in the classroom or in the field.

Before the COVID-19 pandemic started, in IES Son Rullan, almost all the experiments were conducted inside the high school's own laboratory. Thus, ICT applications were just taken into account in the final phase of the research: spreadsheets to analyse or present the experimental data, text documents to make lab reports or presentations to exhibit the research results.

b) Cooperative work

Apart from experimental work, cooperative or collaborative work applied to science teaching is an ideal situation to reinforce the three fundamental levels of learning: knowledge (acquisition of concepts), skills (social, mental and working skills) and attitudes (entrepreneurship, innovation, organization of time...). As with practical work, cooperative work would be considered one of the most effective learning methodologies within the constructivist vision, as it is an excellent opportunity for students to practice what they are trying to learn and to bring out their previous ideas (Gorchs, 2009).

Before the pandemic, the use of this kind of active methodology was relatively easy. In general, it was not strictly necessary to consider the use of any ICT applications to carry out an activity based on cooperative work. Sometimes, Google environment tools, such as its word processor or its presentation creator, could be proposed to facilitate the development of products shared by several students at once. Besides, getting heterogeneous groups of students who could interact and cooperate with each other was as simple as rearranging classroom furniture.

3.4 English

English as a Foreign Language (EFL) is a compulsory subject included in the Spanish educational curriculum, both for the obligatory levels (primary and secondary education) as well as for the upper non-obligatory stages (baccalaureate and some vocational studies).

Nowadays, the development of the linguistic competence in a foreign language appears crucial to adapt our students to an increasingly globalised society, characterised by global exchange, the mobility of citizens and the development of the technologies of information and communication. Considering this, the teaching-learning methodologies in the subject of English have evolved during the last years towards a more *competencial* area, thus reinforcing the role of the communicative skill and including progressively the use of technological resources.

Before the pandemic, ICT tools were already on the rise at the educational level and this fact was naturally influencing many aspects of the teaching language process. The use of new technologies in the English classroom was showing several benefits in the increase of the students' language awareness and motivation and in the wider variety of resources for teachers to apply in their lessons. "*The implementation of ICT will lead to variety in English content, contexts and pedagogical methods in the teaching environment. ICT makes English language environment interactive, flexible and innovative*."

(Qin and Shuo, 2011; quoted by Çakici, 2016). The versatile character of the subject favoured the introduction of new resources and methodologies, mainly on the part of innovative teachers with a desire of changing the approach to teaching a foreign language. Nonetheless, even though the introduction of innovations was gaining ground, it was still far from being adapted to our daily basis in the classroom.

Overall, the technological equipment implemented before the pandemic consisted of:

- The teacher's computer connected to the digital screen and to the speakers to develop explanations, project PowerPoint presentations, show videos, recordings…
- A digital interactive whiteboard and an overhead projector.
- The individual students' cell phones, used as a resource in some occasions to look up information on the internet or words in the online dictionary.

Even though it is true that several teachers were already implementing new tools and methodologies into the EFL classroom, many teachers remained sceptical about changing their teaching focus. It was also favoured by the difficulties for introducing new technologies at the school, which counted with few technological resources, a deficient system of internet connection and students with economic difficulties to access the internet from home. As a result, those teachers who tried to introduce innovative resources into the foreign language classroom had to put a great deal of effort to overcome all these obstacles.

4. Applications during and after the pandemic lockdown

4.1 Geography and History

Once the pandemic caused a lockdown, first thought to be for 15 days, it was decided by the Education Ministry that professors should provide online classes and activities. In our case, as stated before, the IES decided to use the Google Classroom app to maintain the communication. Before the start of school year, 2019-20, as a department it was agreed to use Classroom as a communication tool with students, where syllabus and activities would be uploaded, even if it were not compulsory to be used by all students.

Once the lockdown became a reality, the need to use the app for all school related activities showed the failure of the system. During the first weeks, meetings were scheduled using the Meet application but turnaround was

small, as a large number of students did not have full internet access from home and/or did not have computers to be utilized. It was clear that doing online classes was not a possibility, as the students left behind were more than the ones being attended.

The solution was to use the Google Classroom as a tool to upload contents and activities and to solve doubts once the students had finished their assignments. When it was time to mark students at the end of the year, the questionnaires of Classroom appeared to be the best option.

When the next school year, 2020-21 started, it was on a *semipresencial* basis; students attended class one day at the IES and remained at home the next. As it happened during the lockdown, the differences between students with access to resources and those without were evident from the start and, again, it was decided to use the Classroom app to assign activities and assess results (Figure 4). Students staying at home had to work to be able to follow the courses when they were attending the IES. As it happened during the lockdown, the intent of developing online classes was a failure, as a large number of students could not connect from home, usually for the lack of proper tools such as computers or laptops. In fact, there was an important number of pupils using cell phones to connect with the classroom and do their assigned activities.

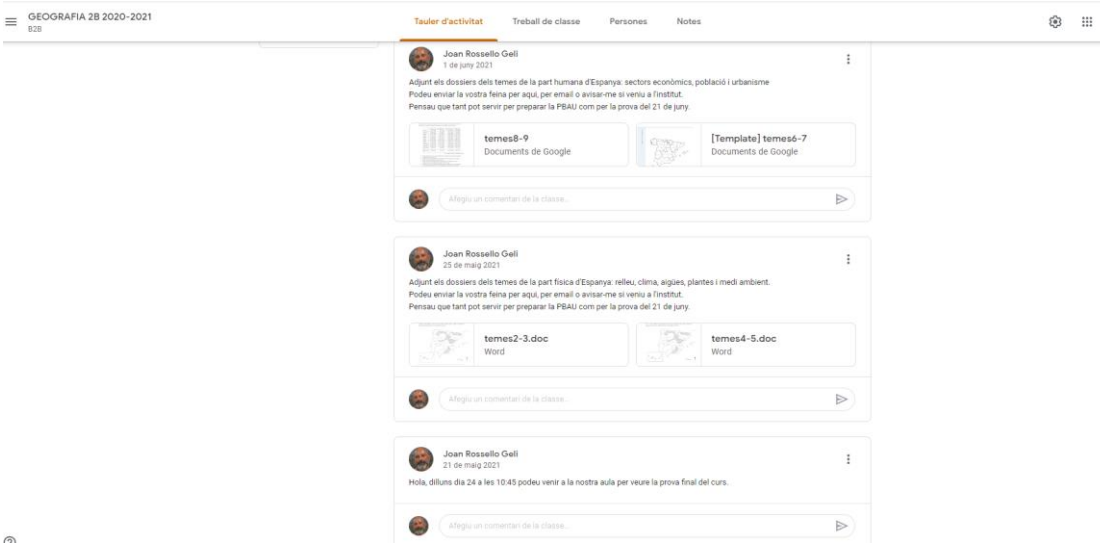


Figure 4 - *Screenshot of the Geography Classroom 2020-2021.*

Regarding practical activities, it was impossible to have the students together due to the necessity to maintain social distance, so the use of cell

phones was a solution. The students worked in groups but from their seats or worked remotely from home, when they were to stay there. Clearly, it was not the best solution but it allowed working on practical exercises and developing cooperative teamwork.

As going out of the classroom for field trips was not allowed, the use of live video feeds and applications such as Google Maps allowed students to see “almost “real explanations of the syllabus contents while sitting in class or at home.

Once the 2021-2022 school year started and students returned to classes on a daily basis still keeping regulations such as masking or social distancing, the department decided to continue using the same teaching approach, with the Google applications as a tool to teach and communicate with students, and the GestIB to communicate with families. Day by day activities are defined by the current situation, as in some cases, a large number of students are missing classes as they are confined at home so online lessons and tasking is the most common option nowadays.

A wider use of applications like Kahoot and Quizlet is also common, to introduce gaming into lectures and increase the student interest. Now that the use of mobile phones is allowed within the classroom, it is easier to develop tasks that allow students to play and learn at the same time. To introduce topics, tools such as Creately or LucidChart are being used in the classroom, facilitating the interaction between students and professors.

4.2 Physics and Chemistry

a) Experimental work

During the March - June 2020 lockdown, as well as during the following school year (2020-21), it became impossible to perform, physically, any experimental work, due to the new regulations about security distance between students. In addition, in many cases, the Physics and Chemistry laboratories had to be temporarily transferred to other didactic departments, since more classrooms and spaces were required to allow the blended-learning system.

Fortunately, many digital resources and ICT applications can be found on the Internet to make this up, such as virtual labs. According to De Jong *et al* (2013), a virtual laboratory is understood to be a computer simulation in which the activity to be carried out by the user is similar to that which should be carried out in a real laboratory, but which does not necessarily reflect the

reality of a real lab. Virtual experiments can be adapted to see, for example, phenomena that would not be observed in a physical laboratory.

Virtual labs have a number of advantages over physical labs. First, virtual laboratories are ideal for very abstract phenomena or for those that cannot be seen with a naked eye (structure of atoms, chemical bonds…). The availability of space, materials and equipment is obviously unlimited. In terms of safety, there are no risks and their cost is usually more profitable than traditional practical work. However, they have some disadvantages: on the one hand, they are not so favourable for the development of practical skills, since in a physical laboratory students have to pay attention to the assembly of equipment and materials and, on the other hand, they do not place so much emphasis on hygiene and safety measures.

Currently, the range of available virtual labs is quite wide. Take as an example the comparative table (Table 1) prepared by Padilla (2021), where you can see the main differences between some of these platforms:

- Go-Lab: https://www.golabz.eu/labs
- Educaplus: https://www.educaplus.org/
- PhET: https://phet.colorado.edu/
- OLabs: http://www.olabs.edu.in/
- Labster: https://www.labster.com/
- Chemcollective: http://www.chemcollective.org/
- Labovirtual: https://labovirtual.blogspot.com/p/fisica.html

Table 1 - Comparison of different virtual laboratories' platforms.

Lab name	*Go-Lab*	*Educaplus*	*PhET*	*OLabs*	*Labster*	*ChemCollective*	*Labovirtual*
General info							
Language	E, Sp, C	Sp	E, Sp, C	E	E, Sp	E, Sp, C	Sp
Research field	Ph, Q, +	Ph, Q, +	Ph, Q, +	Ph, Q, +	Ph, Q, +	Q	Ph, Q
Grade	P, S, B	P, S, B	P, S, B	S, B	S, B, U	S, B	S, B
Free	Yes	Yes	Yes	Yes	No	Yes	Yes
Technical aspects							
Digital devices	PC	PC, T, M	PC, T, M	PC	PC	PC	PC, T, M
Online access	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Design	2D	2D	2D	2D	3D	2D	2D
Username	No	No	No	No	Yes	No	No
Experiments	Both	Both	Both	Real	Both	Real	Both
Assessment	Yes	No	No	Yes	Yes	Yes/No	No

Note. The language row shows the language in which the simulation can be found: E. English; Sp. Spanish; C. Catalan. In the research field, there are the subjects treated by the virtual laboratories: Ph.D. Physics; Q. Chemistry; +. Other fields of research other than physics and chemistry. The following row reflects the grades to which the laboratories are directed: B. Baccalaureate; P. Primary education; S. Secondary education; U. University studies. The digital devices row shows the electronic devices that can be used: M. Smart mobile; PC. Computer; T. Touch tablet. The username row indicates whether you need to register to access the virtual labs. The experiment row specifies whether the simulations show practices that can be performed in a (real) lab or whether they include variables that could only be performed in a virtual lab (impossible), or both. The last row (assessment) indicates whether the virtual lab allows you to evaluate tasks automatically.

The most used platforms at IES Son Rullan during lockdown (March - June 2020) and during the 2020-21 school year were mainly: Labster (Figure 5), PhET and Educaplus.

Figure 5 - *Labster (2022). Virtual practical [Image]. (https://www.labster.com/).*

b) Cooperative work and development of other active methodologies.

As well as with experimental work, collaborative activities had to be transformed after the COVID-19 pandemic. As it has been stated before, IES Son Rullan adopted a blended learning system, so new interaction formulas

between students had to be designed in order to guarantee an equal and synchronous access to school tasks.

In Physics and Chemistry, “Miro app” was the platform which best fitted to this situation. “Miro” is a visual collaborative whiteboard that can be used online (Figure 6). It allows inviting other users to the same session-class and carrying out a videoconference with them. Besides, a large group of people can be split into several smaller groups, so each of them can perform a particular task autonomously, and then reconnect again with the entire group-class. The resulting whiteboard is shared and everyone can write on it, encouraging brainstorming, taking notes, keeping track of what is being written, and so on.

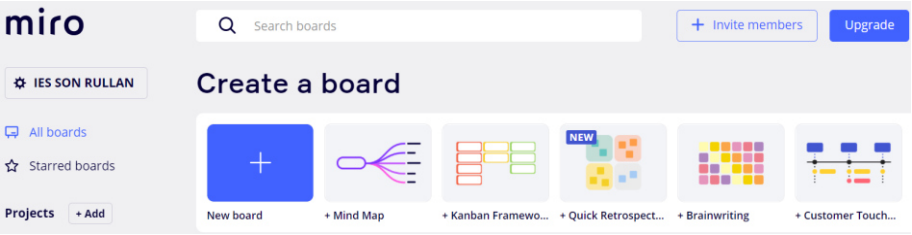


Figure 6 - *A personal dashboard in Miro app (https://miro.com/app/dashboard/).*

Despite the use of these advanced ICT tools, very soon after the pandemic started, the students’ decreasing interest in the subject became evident. The advantages derived from face-to-face teaching (better attention to diversity, quick communication, closer relationship…) are difficult to beat up by a blended learning system. For this reason, other active methodologies, such as gamification and game based learning (GBL), were brought into the Physics and Chemistry class. Gamification consists of applying mechanics and dynamics, which are common in board games or videogames in a non-play environment (as a classroom). For example, giving “experience points” to the students when they do their homework correctly is possible so they can use these points to buy "rewards” that give them benefits during an oral or a written test. On the other hand, in game-based learning, concepts and procedures are acquired directly through board games or digital games. For example, the popular game "Battleship" can be versioned by using a periodic table as a board, marking the coordinates of the missiles by using the name of chemical elements. Thus, all these games can be used online as well.

One of the examples of GBL which worked best, during and after the pandemic, were the digital escape-rooms or educational breakouts. In an escape-room, students must solve a series of challenges or missions related to

the subject in order to achieve a final goal (opening a lock, uncovering a closed box, getting an object…). Different puzzles are usually related to each other through an immersive story and many of them have to be solved as a team. An example of a digital escape-room created for the purpose of Physics and Chemistry is shown on Figure 7.

Figure 7 - *Part of a breakout created to study Hydrostatics [Screenshot]. Source: Morey, 2021 (https://fisquiris.wixsite.com/elinstitutodepapel/c3-1-2).*

Both types of methodologies allowed students to become more motivated and more willing to work on the subject. Given the good results, during the current academic year (2021-22), the teacher decided to continue using these active methodologies.

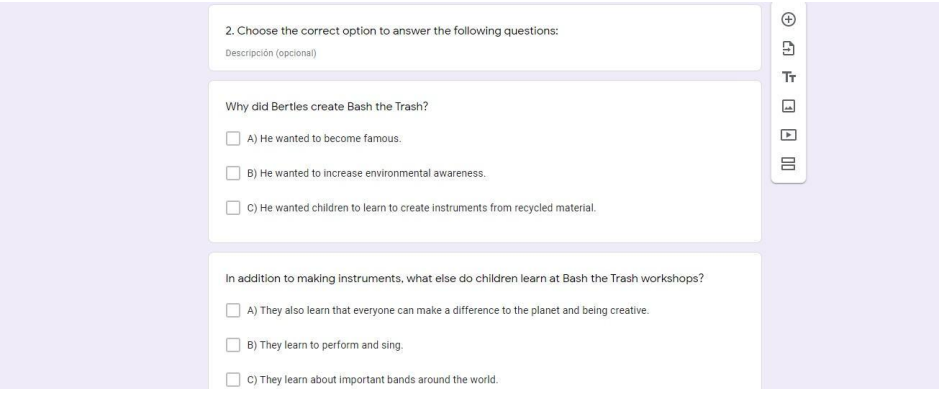
4.3 English

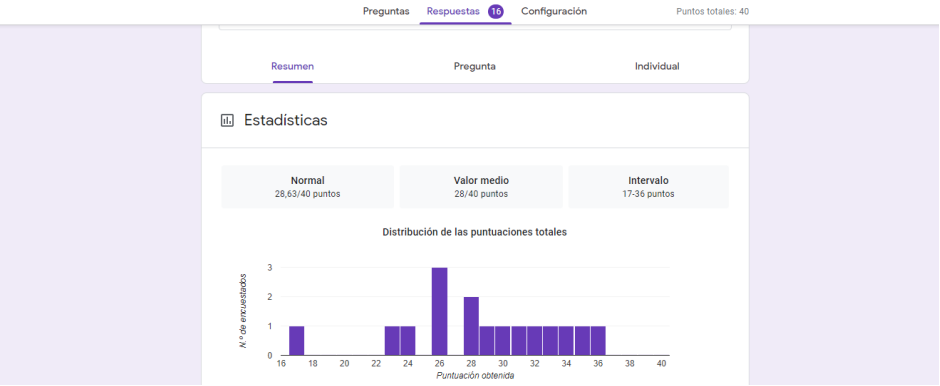
As it has been stated above, with the arrival of the pandemic and the consequent lockdown, the educational system had to assure the access to education of all students in a new scenario. Both teachers and students had to tackle an improvised online education, many without being technologically prepared and without having the necessary tools to face virtual lessons. This portrayed the deficiencies of education in terms of ICT resources and technological training.

As regards the English subject, the department decided to use Google Classroom as a platform of communication between students and teachers. It became truly useful for both: for teachers because it allowed them to post

tasks with the possibility to attach documents, and for students as they received an immediate alarm on their mail notifying a new task had been uploaded. Once completed the task, students had to send it through the same platform and receive a correction from the teacher. Communication between teacher and students was mainly carried out through Google Classroom, but other tools were also applied, including Gmail and GestIB (a program of educational management from the Balearic Islands' Ministry of Education and University), the latter used to a large extent to contact with the families.

Another aspect teachers had to solve during the lockdown was how to evaluate whether students had acquired the contents of a unit. Through Google Classroom, it was possible to create Questionnaires, scheduled and with a variety of questions which ranged from multiple choice to questions requiring short or long answers. Once the time to do the questionnaire had expired, the teacher received a summary with all the students' answers and a graph with the results, as well as the punctuation each of the students had received. The disadvantage of using this platform was, on the one hand the difficulty of some students to have internet access at a specific time of the day to do the exam, and on the other hand, the failures on the internet connection some students had to deal with while completing the questionnaire.





Figures 8 and 9 - *Screenshot of a Questionnaire from the English Google Classroom 2019-2020.*

Furthermore, if we take into account the communicative character of the language it became crucial to assess the students' oral skill. In this respect, the resource Meet was highly used to do video calls with students and, therefore, develop oral activities. They were allowed to prepare oral activities either individually or in pairs, in both cases using different online resources like Google Drive for presentations or Canva to create posters, which had to be presented afterwards in front of the teacher, with a previously prepared speech and developing their foreign language abilities. In addition, other activities included recording videos about a certain topic or creating an animated video using the application Powtoon, which offered the possibility to insert their own voice to an animated character. ICT tools like these demonstrated an increase in students' motivation towards language learning, as they were allowed to create their own virtual material, inserting images, audio, animation and video clips.

In the two school years that have followed the pandemic lockdown (2020-2021 and 2021-2022) the ICT tools aforementioned have been implemented into the English classroom. Students have already been accustomed to using platforms like Google Classroom to receive and post tasks and Gmail to communicate with the professor. These platforms have been helpful for those students who have been confined at home for a few days, since they have been able to follow the lessons from home and participate in the learning process. However, it must be noted that the problems of connectivity and lack of technological devices like a computer with internet access or a mobile phone on the part of some students continue to be present today.

The benefits of applying ICT tools in the English classroom seem to be directing education towards a new scenario. Information and Communication

Technology has enhanced the development of students' autonomy and digital competence and has boosted their involvement in the learning process: "*A dynamic class environment makes teaching more flexible and adaptable and creates classes featuring activities and tasks such as project work, cooperative learning and peer tutoring that allow students to develop and control their learning, thus leading to a less teacher-dominated learning environment and encouraging personal initiatives and more individualised learning.*" (Kassim et al., 2007, quoted by Azmi, 2017). Despite all its advantages, the challenges and barriers teachers face seem to hinder this process of change towards a more innovative, student-centered learning environment.

5. Results and conclusions

The ICT implementation in secondary schools shows a wide variety of results, mostly related to the societal and economic situation of the students and their families.

In that sense, the IES Son Rullan is a perfect example of a centre located in a low-income neighbourhood, with a large number of students that are not properly equipped with home internet or computers. Even though the Education Board and the IES provided laptops to students in need, the ICT gap is really large and increasing even today. Obviously, the presented situation is not representative of all the schools located in Palma or Mallorca. The social and economic trends affecting each centre, as well as the implication of parents' associations and the professors' formation, largely influences the implementation of ICT resources.

Amongst the positive aspects of ICT implementation, the personalization of the education stands out as a main thing. The possibility to fulfil activities online and the immediateness of the e-mail communication are some of the advantages of such application. On the other hand, as stated before, the digital gap is becoming a reality that should be addressed as soon as possible by educational authorities.

The use of video calls to teach has become common and nowadays, once a student must remain at home due to health problems, he can attend online classes, something almost impossible two years ago. Also common is the use of an application, in that case Google Classroom, to upload syllabus and tasks, as well as a tool to assess students and contact them if necessary.

Technology makes learning easier and more interesting and allows the acquisition of objectives but there still exists a lack of competence and training on the part of both professors and students.

In that sense, one of the negative aspects of ICT is related to the lack of technological capabilities of the teaching staff, widely recognized across Spain (Fernández-Cruz and Fernández-Díaz, 2016). The option of voluntary workshops is not a solution and there is a need for an increase of financial support, both for schools and staff.

Future can be bright even if it is a result of the Covid pandemic. Nevertheless, there is clearly a necessity of greater and better cooperation between all those involved within the education system: administrators, professors, parents and students.

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The development of technology during the Anthropocene has affected science and the ways of "doing science". Nowadays, new technologies help scientists of several disciplines by facilitating knowledge and how to manage it, but also allow for collaborative science, the so-called "Social Science", where everyone can be a scientist and be involved in providing data and knowledge by using a computer or a smartphone without being a specialist. But is it really that simple? Actually, the daily and integrated use of different digital technologies and sharing platforms, such as social media, requires important reflections. Such reflections can lead to a rethinking of epistemologies and scientific paradigms, both in human geography and social sciences. This volume titled "Information Technologies and Social Media: New Scientific Methods for the Anthropocene" includes 10 chapters exploring some changes related to the way to do science with a multidisciplinary approach. From classroom experiences to the use of Citizen Science, from Artificial Intelligence use to how Social Media can help researchers, the book reflects on the ICT influence during the last few decades, exploring different cases, complementary perspectives and point of views.

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