

Article

Moving to e-Service Learning in Higher Education

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Abstract: Service Learning is a methodology in which students achieve academic and transversal competences related to the curriculum of a subject while performing a service for the benefit of the community. With the COVID-19 pandemic, it was necessary to reorganize the Service Learning activities developed in recent years so that they do not lose their pedagogical value and community service. This scenario has been an opportunity to kick-start an e-Service Learning experience. For that purpose, this work shows how different Information and Communication Technology tools are integrated into an online platform to develop both activities and assessment following an e-Service Learning methodology. Since the experience was performed with two collaborating entities serving people with autism and in two schools of the University of A Coruña, the tools are available not only to professors and students, but also to entities. Our experience includes the assessment of both competences and service satisfaction using different resources for virtual collaborative work. The main contribution of our work is that we have greatly simplified our previous project on-site and also the monitoring of the student's progress, the work of both professors and students, and the analysis of results, providing a virtual service that responds to user needs.

Keywords: autism spectrum disorder; collaborative work; e-service learning; ICT; online



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1. Introduction

When the 2020/2021 academic year began, teaching had changed substantially at the university institutions, due to the COVID-19 pandemic, so that teaching had to be performed in virtual mode. In this context, many of the activities involving contact with people and entities outside the center were completely truncated. Service Learning (SL), a methodology in which students perform a service to the community while acquiring the curricular competences, was an important pillar of activities in the subjects Fundamentals of Physics and Technology in Secondary Education in the last academic years, and formed part of the students' assessment, appearing as such in the respective teaching guides. These activities, materialized in the form of engineering, physics or recycling workshops, in which the students went to non-profit organizations in the A Coruña area to carry them out, were therefore discarded. The fact that classroom teaching was interrupted not only affected the organization of teaching or the presence or absence of students in the classroom, but also, since there was no direct personal contact with the users of the entity, the service was endangered. Moreover, at a time when humanity was facing a global pandemic, service and solidarity and awareness about needs of others were, if possible, even more important [1]. It seemed vitally important to the teaching team to articulate a way for maintaining the experiences, in such a way that they would not lose their pedagogical interest or their value as service to the community, making possible a new type of communication between participating students and entities [2,3].

The value that Information and Communication Technologies (ICT) have had in these times of pandemic to be able to carry out online teaching and continue with the teaching-

learning processes is undeniable [4]. From this perspective, the pandemic has been an impetus to address one of the main pedagogical challenges that had been raised in the European Higher Education Area (EHEA) and that was the need to promote the reception and use of ICT in teaching, always starting from an adequate provision of resources to universities [5]. In this social-health context caused by COVID-19, universities, and specifically the University of A Coruña, have made a great effort to provide faculties with the necessary tools and training to be able to address electronic-teaching (known as e-teaching) [6]. Therefore, in this work, digital tools, available in our university, have been used to explore a new ICT-based path for the continuation of the SL activities that would allow us to develop all this learning experience in virtual mode, which will be referred in the following as electronic-Service Learning (e-SL). This work will describe the procedure to transform the previous SL to the current e-SL, guaranteeing quality in both academic and service plans.

Our main purpose is to show how the entire work methodology, the monitoring of the student's work, and the assessment of both the learning and the service have been transformed to achieve this migration from traditional methodologies based on supervised work and a final oral defense towards an e-SL experience with the aim of maintaining the service to the users of the entity in socio-health conditions that did not allow for face-to-face attendance. This activity was developed considering the following important aspects of an SL experience: (1) to guarantee the acquisition of the curricular competences; (2) to adapt the service to the specific needs of people with functional and cognitive diversity to whom it is addressed; (3) to make the students aware of these needs of their community; (4) to achieve an academic, social, and emotional commitment of students and, in short, to educate not only in contents, but also in values. This paper also includes qualitative and quantitative analysis of data collected from surveys and e-rubrics designed by the authors with regard to the four objectives mentioned above.

The work is organized as follows. Section 2 is a review of the state of the art that will allow us to learn about previous related work and the starting point for our experience. Section 3 frames the experience in its methodological and curricular context. The ICT-based framework is explained in Section 4. Section 5 explains the materials and methods used to carry it out. The results of this teaching experience are included in Section 6 and, finally, Section 7 includes the main conclusions of the article.

2. Literature Review

The development of a complete curriculum in science and engineering requires other competences related to social contexts. In this sense, university institutions should look for strategies to work with students on soft skills that will be useful in their future jobs. Soft skills are desirable in all professions and include critical thinking, problem solving, public speaking, teamwork, digital literacy, etc. SL is a methodology in which students achieve these transversal competences while performing service for the benefit of the community through hands-on experience in a real-world setting [7–12]. This methodology was successfully used by other authors [13–17] and in recent years, in engineering contexts by the authors of [18].

However, the unexpected shift from face-to-face to hybrid or virtual learning has been a challenge for educators who must change the way their activities were performed. Some activities such as SL have been severely affected by the pandemic and professors have been forced to rethink these activities [6,19]. Even a large number of SL programs in higher education have been cancelled or suspended, although some educational institutions have transformed the way SL was conducted [1,20–23], for example, making transitions from traditional SL to online platforms. This is not an easy issue considering that face-to-face interaction and collaboration when performing these activities in collaboration with entities is the great value of SL.

In online SL, this contact is not possible and the learner might feel disconnected from the community in synchronous online communication. The authors of [22] investigated the perception of students in an e-SL course, concluding that students feel engaged

in the same way if the activity is well and attractively designed. Balballi discussed the creation of an online, asynchronous project with audiology PhD students [19] and the authors of [21] described a project in which an SL experience was carried out for the service of children and adolescents in need [21]. In both cases, despite the limitations of a virtual teaching, they found that, similar to traditional SL, students experienced positive growth. Similarly, Leong supported e-SL as an effective tool for working on soft skills with students, demonstrating the versatility of students to incorporate technology and to adapt to emergencies [20]. However, Winkle identified some problems from team and class discussion about the difficulties of online communication, while reflective ability and cognitive empathy scores increased during online activity [23]. Domínguez-Lloria proposed the use of collaborative platforms as a possibility for the development of competences in the teaching-learning process [24]. In all e-SL projects, ICT were crucial [2–5,24], to the point that some authors are already talking about a new SL pedagogy, called service-eLearning [25], which tries to take advantage of online digital resources for distance learning through service. These ICT resources will facilitate the e-SL in a social context of increasing online higher education.

In this work, we have used the institutional digital platform, although this tool is not adapted to the development of an e-SL experience like the one carried out for teaching in previous years. There is no digital tool available for this purpose; so, it is necessary to configure, adapt, and develop new elements for integration into the available platform. In addition to the methodological change from a face-to-face SL modality to an e-SL, this work focuses on how we can take advantage of different ICT resources to incorporate them into this institutional platform, so as to guarantee communication with students, faculty tutoring, collaboration with the entities itself and, most importantly, to maintain the service with standards of quality and satisfaction that we are also going to check. To our knowledge, this is the first time that a platform has been designed specifically to develop e-SL activities under this scenario caused by COVID-19; so, we will explain in detail the use of that digital platform oriented to e-SL, showing a study of the effects on all people involved, i.e., students, professors, entities, and final users. This study is carried out by means of self-designed e-surveys and e-rubrics available and accessible from this corporative platform with which we will assess the SL project from a qualitative and quantitative analysis of the data collected, as was also proposed in [26].

3. Methodological and Curricular Context

In this section, we will describe the context involved in this experience.

3.1. Methodological Context

This project is based on the following teaching-learning methodologies:

- Project-Based Learning (PBL): The experience of the American pedagogue Edgar Dale indicates that the deepest learning comes precisely from direct experience, i.e., we learn when we perform the activity we wish to learn, which is known as learning by doing [27]. Therefore, this learning based on projects, problems, and cases is incorporated in the teaching of our subjects [28]. The support of ICT in an increasingly virtual teaching is essential for the effectiveness of this methodology [29–31].
- Tutored work: The learning is based on small work teams (2–3 students), always supervised by the professor. Group work increases individual performance and fosters interpersonal and social skills, enabling efficient time management and the feasibility of projects that otherwise could not be addressed in the classroom. The model selected for these subjects is that of collaborative learning, even though individual student assessment becomes more difficult. In this collaborative work, both the formation of the groups and the division of work are assigned to the student, thus encouraging creativity and learning by discovery, as well as their responsibility not only with their work, but with the final result of the group [32,33].

- SL: Since we must put into practice the theoretical concepts of the classroom in situations close to the student’s reality [34,35], SL, as introduced before, is an innovative teaching methodology to combine both acquisition of academic and other transversal competences and a service to the community.

3.2. Curricular Context

From points of view of learning of service, we can highlight the following aspects related to both subjects.

3.2.1. Learning

This project was developed in two subjects. One of them is the 1st-year subject Fundamentals of Physics of the Bachelor’s Degree in Industrial Engineering and Product Development. In the program of this subject, the thematic blocks are mainly oriented to work Physics concepts, such as Dynamics, Electricity or Magnetism, so that the connection of these concepts with SL activities is evident. On the other hand, this subject has a chapter within Dynamics in which the elastic properties of materials are analyzed, and where students are introduced to the different types of materials, their properties and their recycling, mainly focusing on plastic materials. This subject serves as an introduction to two other subjects in which this subject will be deepened during the degree (these are: Physics Applied to Engineering, in the 2nd year, and Design and Processing with Polymers, in the 4th year). The relationship between contents and activities in which we work with recycling is therefore direct. Table 1 summarizes the competences to be achieved by students of this subject.

Table 1. Competences of the subject Fundamentals of Physics.

Specific	General and Transversal
To work effectively as an individual and as a member of diverse and multidisciplinary teams.	To express oneself correctly, both orally and in writing, in the official languages of the region.
Ability to design, draft, and manage projects in all their diversity and phases.	To develop for the exercise of an open, educated, critical, committed, democratic and supportive citizenship, able to analyze reality, diagnose problems, formulate, and implement solutions based on knowledge and oriented to the common good.
	To work collaboratively. Knowledge of group dynamics and teamwork.
	Communicate effectively in a work environment.

Taking into account all these competences, we can say that the second transversal competence is very difficult to work on any other type of project different from SL.

The second subject is a subject of Technology in Secondary Education of the University Master’s Degree in Compulsory Secondary Teachers in which the proposed activity, based on the development of a small workshop for the development of a technological object, must be connected to one of the curricular contents of the subject, which are related to the technological problem solving process, the connection between the technology and evolution of society, mechanisms and structures, electricity and electronics, control and robotics, pneumatic and hydraulics, expression and communication techniques, technical materials, hardware and operating systems, communication technologies and Internet. The competences of this subject are detailed in Table 2.

Table 2. Competences of the subject Technology in Secondary Education.

Specific	General and Transversal
To know the formative and cultural value of the subjects corresponding to the specialization.	To express oneself correctly, both orally and in writing, in the official languages of the region.
To know the contents that are studied in the respective courses.	Use the basic tools of ICT necessary for the exercise of their profession and for learning throughout their lives.
To know the history and recent developments of the subjects and their perspectives in order to be able to transmit a dynamic vision of them.	Value the importance of research, innovation, and technological development in the socioeconomic and cultural progress of society.
To know the contexts and situations in which the different curricular contents are used or applied.	

3.2.2. Service

This experience aims to respond to the need of entities of our environment to count with significant contributions from students of our university, who can transfer technological knowledge to the daily situation of these groups. The beneficiary entities of the service are two non-profit organizations of A Coruña, formed by families of people affected by Autism Spectrum Disorder (ASD). Therefore, this activity will be carried out with people diagnosed with autism.

The main objective of the project was to promote a taste for science and critical thinking in these users and to foster social relationships with people of similar age. In addition, in the particular case of the Master's Degree, students come from engineering degrees where they have acquired a good grounding in technology, but where they have not developed the transversal competences that we want to promote with SL projects, i.e., to form students committed to society through the development of attitudes and values.

Moreover, the organizations that participate in SL activities do not usually organize activities of technological foundations; so, projects of this type are enriching for their users, often with strong preferences and interests in these issues.

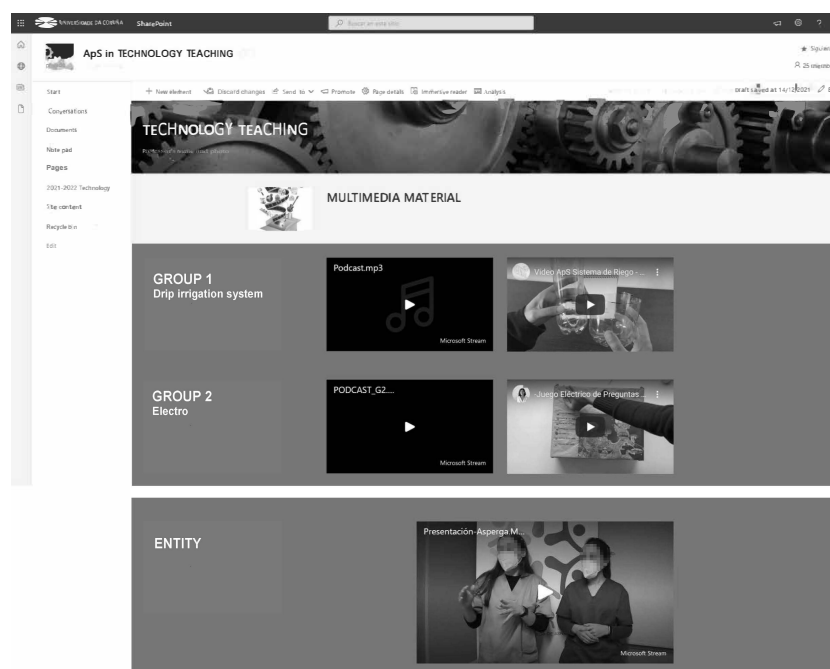
4. Framework for Online Activities

With the social and health crisis caused by COVID-19, visits to the centers, tutorials, and activities could no longer be carried out in-person. We therefore decided to articulate a way to continue our activities virtually, incorporating corporate ICT, available and accessible to all participants, without losing their pedagogical interest for our students or their value as a service for the organization. In this way, it was expected that this work environment would allow virtual tutoring to be carried out, both by teaching and the entities' staffs, and also to carry out a virtual collaborative work that would facilitate the realization of the activity to all agents involved, contributing to eliminate the space-time barriers created by the current situation. Thus, a framework was created based on corporate Microsoft 365, as a tool for the coordination of the activity, communication among participants, and the collaborative development of materials, review, and assessment (see Table 3).

Table 3. Summary of tools used in the SL experience.

Tools	SL Activity
Outlook	Creation of a group for each subject
Teams	Creation of a team for each subject. Video calls and chats between students, professors and entities (staff and users)
SharePoint	Website and documentary management
Forms	Self-assessment, co-assessment, hetero-assessment, entity surveys, and rubrics
OneDrive	Online repository to share material

We created a website of each subject and the respective groups to facilitate communication and coordination of participants both synchronously and asynchronously (see Figure 1). At the beginning of our activity, a section devoted to multimedia material collected both tutorials created by professors and virtual visits to entities. Once the projects were completed, the website served as a repository for sharing the final videos and podcasts, so that all participants of each group (entity staff, professors, and students) could view the materials prepared by the student teams.

**Figure 1.** Workspace using the e-learning platform: communication tools and multimedia material.

The students used many multimedia tools for the elaboration of these materials for the entities (see Figure 1). In the case of videos, they used tools such as Microsoft PowerPoint, Edpuzzle, Active Presenter, CANVA, Youtube or Prezi and, in the case of podcasts, they used tools such as Dolby-On, Anchor or Audacity. In addition to learning how to use new tools by preparing their own materials, they also learned about the existence of others by seeing the work of their classmates on the web. As for the entities, they were able to contribute by providing points for improvement and needs for adaptation of the materials before the presentation to the users, since they had access to the website and, therefore, to the materials created by students.

The initial visit to the entities was developed using tutorials in the web and video calls, so that the students could get to know the work of the center and its participants. Video calls were also used to review all material during the different stages of preparation and to do the workshops. In addition, the utilization of online repositories facilitated

the elaboration and review of the material created by students. Finally, the presentation of their projects and the realization of the activity with the participants were done through video calls, convening the meetings through the teams created in Microsoft Teams and using the materials uploaded to the website.

In an SL project, it is very important to monitor the activity, collecting the reflections of the students at different points of the process, as well as to carry out satisfaction surveys after the experience to all agents involved. To monitor satisfaction and evaluate the activity, the main page of the website was divided into three sections (see Figure 2): one for the students, one for the entities and, finally, one for the professors. In this way, everyone was able to evaluate the SL activity at different times directly from links on the web page to forms designed for each of these three groups. In the case of students, their initial reflections were collected after the experience was presented to them, after the virtual visit to the center and after the activity was carried out. All results collected will be used to carry out a qualitative and quantitative analysis of our experience results.



SURVEYS AND ASSESSMENT RUBRICS

STUDENT



Survey on the degree of access to the master's program
[Link to survey](#)

Initial survey to know your expectations about the Service-Learning activity
[Link to survey](#)

Survey on your environmental sustainability competences
[Link to survey](#)

Survey on the virtual tour and/or training of the entity
[Link to survey](#)

e-Rubric for group co-evaluation and self-evaluation
[Link to e-Rubric](#)

e-Rubric for individual auto-evaluation
[Link to e-Rubric](#)

Final survey to know your assessment of the ApS activity
[Link to survey](#)

ENTITY



Survey to know how you rate the ApS activity
[Link to survey](#)

e-Rubric for student evaluation
[Link to e-Rubric](#)

PROFESSOR



e-Rubric for group hetero-evaluation
[Link to e-Rubric](#)

e-Rubric for evaluation of ApS project
[Link to e-Rubric](#)

e-Rubric for individual hetero-evaluation
[Link to e-Rubric](#)

Teaching self-evaluation survey
[Link to survey](#)

Figure 2. Workspace using the e-learning platform: space for surveys and rubrics from students, entities, and professors.

In the case of entities, they evaluated the SL activity by answering about the difficulties, drawbacks, and points for improvement of the experience, as well as about what the activity had contributed to them and its strengths.

Finally, the professors involved also evaluated the project, the students' work, and their own involvement in the SL activity, accessing it, like the rest of the agents, through the web.

The assessment of student competences was performed by means of a rubric that evaluated the capacity to carry out a project in all its phases, the group work, the capacity to present the work to the participants, the capacity to adapt the materials to the users, the skills in the use of ICT tools, etc. This competence assessment rubric was also completed through the web, both by students, organizations, and professors. In this way, hetero-assessment, co-assessment, and self-assessment were greatly facilitated, since each of the students is evaluated by the professors and by the entities, by his own peers, and by himself. All these rubrics were prepared using Microsoft Forms and were linked on the web so that all agents involved could fill them in comfortably from the web itself, without having to change the work environment.

In this way, by integrating all ICT resources of Table 3, we have integrated online assessment into the e-SL experience, which allows not only the continuous monitoring of student progress, but also an analysis of the results obtained from these assessments, by all agents involved, as we will see in Section 6.

5. Materials and Methods

In this section, we will describe the main elements to be used for the development of this e-learning proposal.

5.1. Participants

In the 2020–2021 academic year, 12 students participated in the experience developed in Fundamentals of Physics of the Bachelor's Degree. They were divided into three-member working teams. The four teams developed four corresponding projects: two were physics experiments, one was an engineering project, and one was a recycling experiment. The project involved eight teenagers with ASD belonging to ASPANAES.

For the Master's subject, 13 students participated, divided into four work teams: three teams of three students each and one team of four students. The projects consisted of the development of three engineering projects and one recycling experiment, all of them related to the technology contents seen in the course and indicated above. The activities were conducted by the professor responsible of the subject. The evaluation was done by this professor and an external one. Nine adults with ASD of ASPERGA were involved.

5.2. Service-Learning Project Description

The following steps can be distinguished in the realization of the SL activities.

- Step 1: Distributing work. At the beginning, students enrolled in the course were offered the opportunity to participate in a voluntary SL activity. The students were divided into different teams, so that each team was in charge of organizing a workshop. This distribution was designed to allow the participants to get the most out of the activity. In order to learn about the curricular training of students, a survey on entry profile was used (see assessment instrument 1 in Table 4).
- Step 2: Organizing the SL activity. The first session of the activity was done face-to-face in the classroom. The students received instructions on the general contents of the workshops and the orientation of each of them, as well as information on the entity with which they were going to work.

A website was created for each subject, which included the students, the two entities, and the professors of the two degrees to be able to follow the activities together and compare experiences. The students had on the website all information for the realization of the experience (instructions for the creation of videos and podcasts, calendar, permissions of images, etc.). On the first day, the students were also taught how

to navigate through the information on that website. On the website, the students had a file where they uploaded the signed consents to be able to record and take photos of the activities. Students could find the initial information for the realization of the project in another file: the script of the activity with its chronograph, recommendations for the creation of multimedia material, a summary of activities of previous years so that they would not repeat the experiments, the assessment criteria so that the students are clear from the beginning how they would be assessed or podcasts of students from previous experiences. Until now, students came to the classroom to explain their experience participating in the project. In this course, to safeguard the health of students and not to mix them in the classroom, it was decided to record podcasts in which the students who had previously participated encouraged the new students to participate.

After this first session, the students had to fill out two surveys from the project website: one of them serves the purpose to find out their expectations about the SL activity, and the other to find out students' initial competences in environmental sustainability (see assessment instruments 2 and 3, respectively, in Table 4).

- Step 3: Visiting entities. After this presentation session, a visit was made to each of the entities. This academic year, due to COVID-19, the visit was virtual, that is, students and professors met with entities through a video call in case of Bachelor's Degree, and by means of a video sent by the entity published on the website for the Master's Degree. As everything was connected from the website, requests and messages with the team members were greatly facilitated. In these virtual visits, the entities talked about their work and only in some cases referred to the Bachelor's activity; the students had the opportunity to meet the users of the entity and listen to their life experiences. These visits, although virtual, were very useful to take into account the possible problems that users could have in the proposed activities and to design them in the most appropriate way.

After the virtual visit, each student had to fill out a new survey through a link on the web to comment on their impressions, motivations, and concerns (see assessment instrument 4 in Table 4). The students had approximately one week to search for information and try to outline what they had planned to do in the activity with the users. Considering the predetermined themes (physics, technological projects or responsible consumption/recycling/reuse), the students had total freedom to propose the dynamics used to transmit these concepts to the users (experiments, games, videos, etc.).

- Step 4: Working on the SL activity. After the preparation period, the first tutorial was held for the Bachelor's subject, during which the proposals made by the students were evaluated and modifications were made if necessary. Once the activities were outlined, the students had a period of approximately two and a half weeks to prepare the presentations and the experiments, reuse the prototypes, design activities, games, etc., that would be used in the activity with the entities, and also to prepare videos and podcasts with their projects. In the next tutorial, the students presented all prepared material and the professors proposed all necessary changes. The students uploaded the prepared material to the corresponding web section with their work team. The corrections were made in online documents, so that the students could see the changes made synchronously. In the tutorial, only doubts that arose in this regard were discussed. Once the corrections were made, the entities could also review the materials (videos, presentations, posters, etc.), especially for adaptation. In addition, the fact that therapists of entities could see in advance what was happening in each experiment would also help them to support the participants on the day of the activity. Following feedback from entities, the students made final modifications, where necessary, and the materials were finally ready.

For the Master's Degree, the two tutorials were carried out simultaneously by the professors and all students, in which the projects were shared and the necessary correction and improvement comments were made to achieve the desired result.

- Step 5: Performing the SL activity. Four projects were done in the case of the Bachelor's Degree: playing with magnets, corn, playing with the octopus' game, and construction of lamps. One can see the corresponding photos of these projects in Figure 3. A few days before the activities, the professor in charge visited each center and brought the necessary material to do the experiments simultaneously with the students. The day of the SL virtual session, the students connected with their professors who did the experiments and the participants were replicating these experiments in their center with the help of the therapists. In spite of the sound or Internet connectivity problems that could exist in some moments, the experience went very well and the participants were able to perform the experiments perfectly.
For the Master's Degree, the final projects were a tank-robot equipped with movement, a drip irrigation system made with recycled material, a small electronic game, and a 3D projector that makes use of a mobile application. One can see the respective photos in Figure 3. Due to the complicated social-health situation in the first months of the year 2021, the activity was carried out exclusively online. The therapists of the entity provided their users of the adult life program with all videos made by the students, and the vast majority were encouraged to make them at home. A single on-site workshop was held at the organization's headquarters, selected from among the four projects presented, based on the characteristics of the target audience. The specialists chose the drip irrigation system project. Two workshops were held, each lasting an hour and a half, in which a team of five and a team of four adults, respectively, carried out the proposed activity, with the help of the professionals and the multimedia material prepared by the students. In general, the users were motivated to participate in the workshop and were able to organize themselves autonomously to carry out the proposal. Some of them found the drip irrigation system so useful that they even implemented it in their homes.
Once the activity was over, the student had to fill in the final survey to know their assessment of the SL projects (see assessment instrument 5 in Table 4). At the end of the activity, all materials created by the students (videos, podcasts, etc.) were uploaded to the main page of the web, so that both professors and students could see them for assessment tasks.
- Step 6: SL assessment. The students were invited to an online session in which they watched the different videos and assessed themselves (self-assessment) and their peers (co-assessment). They also received the corresponding assessment from professors (hetero-assessment). For both cases, see the assessment instruments 6 and 7 in Table 4. All professors assessed the SL experience by means of e-Rubric 8 in Table 4 and their own teaching performance using survey 9 of that table. Finally, the entities also filled in on the web (the link was sent to them and they were given access) the students' assessment rubric and the satisfaction survey about the SL experience (see assessment instruments 10 and 11, respectively, from Table 4). The users also answered a series of short questions evaluating different aspects of the activity by means of the survey 12 of that table.

5.3. Data Collection and Analysis

The following Table 4 shows the different surveys and rubrics carried out for this experience, the type of questions for each of these assessment instruments, the respondent, people assessed, and the type of analysis performed from the data obtained. Although the number of students is small, a large number of surveys and e-rubrics are implemented, which are filled out by each student work group, by individual students, by professors, and by professionals of the entity, evaluating themselves and also the other groups. All this allows us to obtain a sufficient volume of information for the qualitative and quantitative analysis that we will show in Section 6, and thus to know the degree of satisfaction with service and learning.

To perform the qualitative analysis of these data, widely known software such as webQDA was used, which also allowed this work to be carried out in a collaborative and distributed environment. Thanks to this software, from these non-numerical and unstructured data (in this case only text-based), categorized information was extracted that allowed us to know the most relevant aspects for each required reflection.

Table 4. Assessment tools.

No.	Tools	Type of Questions	Respondent	Assessed	Type of Data Analysis
1	Survey for entry profile	Single-select multiple choice question and open text	Student	Student	Quantitative and qualitative
2	Survey for initial reflections and motivations	Single-select multiple choice question and open text	Student	Student	Quantitative and qualitative
3	Survey for environmental sustainability	Single-select multiple choice question	Student	Student	Quantitative
4	Survey for entity assessment	Open text	Student	Entity	Qualitative
5	Survey for SL assessment	Single-select multiple choice question and open text	Student	Service and learning	Quantitative and qualitative
6	e-Rubric for group work assessment	Single-select multiple choice question	Professor, student	Others and the student working group itself	Quantitative
7	e-Rubric for individual work assessment	Single-select multiple choice question	Professor, student	Others and the student itself	Quantitative
8	e-Rubric for SL assessment	Single-select multiple choice question	Professor	SL	Quantitative
9	Survey for teaching assessment	Single-select multiple choice question and open text	Professor	Teaching	Quantitative and qualitative
10	e-Rubric for student assessment	Single-select multiple choice question and open text	Entity	All students	Quantitative and qualitative
11	Survey for service assessment	Single-select multiple choice question and open text	Entity	Service	Quantitative and qualitative
12	Survey for quality perception	YES/NO question and open text	Users	Service	Quantitative and qualitative



Figure 3. Photos of the projects created by students and developed by workshops.

6. Results and Discussion

We show the results of the assessment process and the agents' reflections. In addition to YES-NO or multiple choice questions, all surveys and rubrics that have been developed for the assessment of the project, student competencies, and service satisfaction included questions whose answer was the respondent's opinion or reflection.

6.1. Students' Reflections and Survey Results

The assessment process included all agents involved in the experience. As mentioned above, a rubric was used to assess the competences assigning a rate to the student, which allows measuring performance levels of the above-described learning outcomes. During the activity development and the meetings with professors, the performance and progress of all students was observed, which allows the rubric to be fulfilled. In addition to hetero-assessment, this same rubric was used for co-assessment (students evaluating each other) and for self-assessment. As mentioned before, the rubrics were filled in on the web page itself, so that the committee can view them directly by accessing the project web page.

It is important to highlight that all students received a rate higher than 1.5 out of 2, which indicates that they have achieved the subject competences, especially those related to

the practical application of the contents. In addition, given the high quality of presentations, brochures, videos, posters, etc., all of them have shown optimal performances and a great interest and motivation for the work performed.

The results of the qualitative students' assessment are presented in the following. The quotes are transcribed verbatim from their reflections to avoid misinterpretation. Some of them referring to their motivation on the SL experience were the following:

"It will be a challenge but also a huge learning" (16 November 2020, girl, 27 years old).

"I would like to do a job that contributes as much as it teaches me and to be able to spread it so that more people sign up to carry out these kind of activities" (16 November 2020, boy, 26 years old).

"The opportunity to get closer to people who are not in our daily lives but who are a significant part of society and it is our obligation to take them into account. In addition, these people tend to see life from another perspective, I am eager to learn from them" (8 February 2021, boy, 18 years old).

"I think it will be a very interesting activity and that in the future it will help us to think about the whole world when we have to design something in our work" (8 February 2021, boy, 18 years old).

"I think it is a different activity, that not many teachers would be willing to do and with which we are going to feel very fulfilled" (8 February 2021, girl, 18 years old).

"Learning and seeing life differently are my highest expectations" (8 February 2021, girl, 18 years old).

In order to learn about doubts and concerns of our students, some of their quotes for analysis are included here:

"In the pandemic situation we are in, I don't know how it will turn out if we are not able to have direct contact" (16 November 2020, boy, 26 years old).

"The main question I have would be how to prepare a robotics activity and explain it in a 10 min video" (16 December 2020, girl, 27 years old).

"I have not knowledge about Asperger's and how we should treat people with this disorder, nor what type of activities are best suited by them" (16 November 2020, boy, 31 years old).

After the virtual visit to entities, some of the reflections collected from our students using a survey, were:

"Everything they told us about Asperger syndrome, and especially the treatments and recommendations they made for our work, I mean; use short and simple sentences, but it was surprising for me the motivation of entity staff tackle these collaborative tasks" (26 November 2020, boy, 26 years old).

"They seemed much more accessible than I expected" (26 November 2020, girl, 27 years old).

"I was surprised that users have such a large range of technical skills" (16 November 2020, boy, 31 years old).

"The visit to the organization, the psychologist's talk and her presentation, have helped me eliminate the damage or low awareness I had about cases of autism. Overall, I really enjoyed the visit, expanded my knowledge on the subject, and opened my mind more to autism. I'm looking forward to starting work" (22 February 2021, girl, 18 years old).

"Before the visit I was worried about how to adapt the materials, now I'm sure that from the entity they will lend a hand" (22 February 2021, girl, 18 years old).

As can be seen from these reflections after the virtual visit to entities, the students did not show any concern about dealing with the participants; rather, all their fears were transformed into surprise because of the good reception by both entities and participants with whom they were able to communicate quite easily. They were also surprised by the life stories of people with mental illness and, in general, after that visit they were all enthusiastic and eager to start working on the project.

From those reflections, the summary graph of Figure 4 is shown as a result of their qualitative analysis. This graph shows the motivations and concerns identified with a higher percentage of occurrences that could be extracted from the data analysis performed with webQDA. From the figure, we can say that it highlights the motivation to help others and their doubts about their lack of knowledge about the diversity of users and how to adapt activities to their needs.

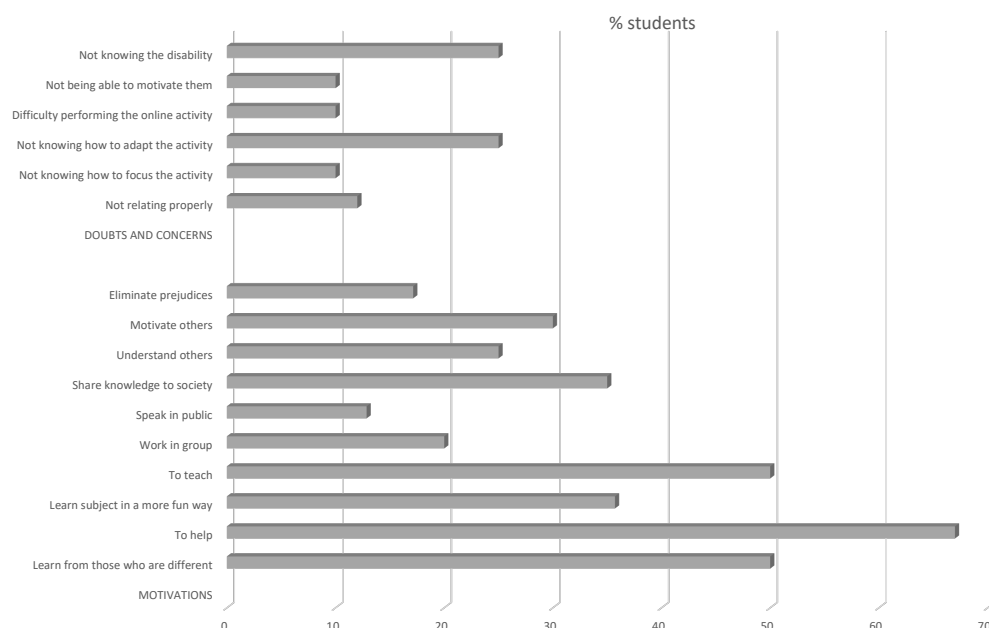


Figure 4. Doubts, concerns, and motivations of students before SL experience.

In reference to the quantitative assessment, the students showed their satisfaction with the experience since, as can be seen in the graph of Figure 5, practically all answers are “totally agree” or “agree”. Those with some disagreement answers correspond to the facilities provided by the faculties and the duration of the activity, which should be longer in order to obtain more visible results in the community and to better understand their role as citizens. Taking into account those questions with higher scores, they highlight that the activity was convened with enough time and such positive contact with entities so that they would recommend the activity to their peers. Finally, they affirm that the professor was adequately involved in the development of the SL activity. There is no difference between entities since the responses were similar in percentages regardless of the project in which they were involved.

In the final student’s survey, they positively valued the group work as a channel for the sum of ideas and points of view for the project development, but also to comment on the experience with classmates and reflect on what each one had learned. About task assignment, they pointed out that it was not easy to agree on schedules and to collaboratively work due to restrictions and rules caused by COVID-19.

From the tutorials with professors, they highly appreciated the receipt of feedback on the failures and points for improvement, as well as the advice to adequately focus the activity so that it would be attractive to the participants.

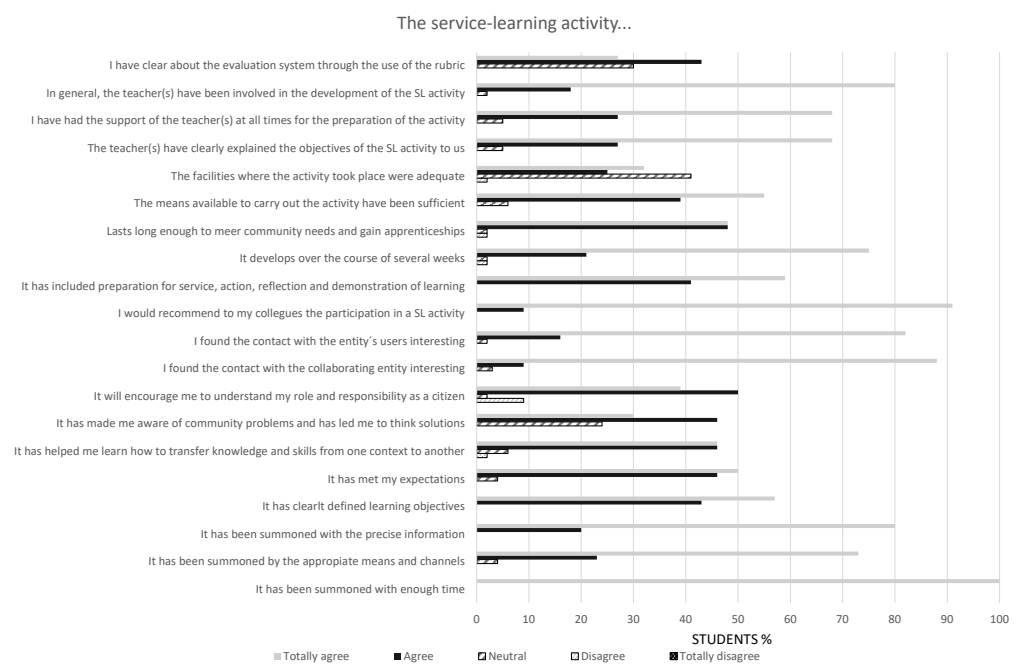


Figure 5. Results of the student's satisfaction survey.

Regarding the virtual modality for activities, they were very positive because they were less nervous than in a face-to-face SL and also they thanked professors and therapists for the effort to make them feel similar sensations to those they would have in-person contacts. However, all of them pointed out that they would have enjoyed meeting participants face-to-face to be able to interact more with them and get to know them better. For the Bachelor's activity, they also pointed out that there were sometimes some Internet connectivity failures that made them nervous, although those problems were quickly solved. Another important point is the helplessness of not being able to help when any participant could not follow some step, but they rated very positively the work of monitors to do it instead and the security against COVID-19 that gave them not to travel to the headquarters of the entities.

In general, the activity was very positively evaluated by the students mainly because it encouraged teamwork through the creation of their own idea to present it to people with diversity not belonging to the University of A Coruña. According to the student's opinion, the most important thing was the personal enrichment thanks to contacts with entities. Our students highly appreciated that access to materials could be provided to the entities in advance for receiving feedback and improvements before service. Some of the reflections collected from the final survey were the following:

"This project has made me think about the possibility of having to focus my classes and my explanations for other types of students and understand and try to adapt to their level of attention" (2 February 2021, boy, 27 years old).

"In my opinion, the best project done in the Master's Degree, by far. A motivation goal while learning first hand to use a very interesting methodology" (2 February 2021, girl, 26 years old).

"It simply came to our notice then. I think public speaking is very important and it was an opportunity to practice and improve. I also learned a lot about recycling" (13 May 2021, boy, 18 years old).

"How I can contribute something on a personal level" (13 May 2021, girl, 18 years old).

After the activity was completed, the students acquired all competences of both subjects, but other soft competences were also detected as detailed in Table 5.

Table 5. Transversal competences and social skills achieved by the SL experience.

Interpersonal	Instrumental	Systemic	Personal
Public speaking	Decision making	Self-learning	Recognition of diversity
Defend ideas	Capacity for analysis and synthesis	Apply theoretical knowledge	Awareness of prejudices
Accept other opinions	Organization and planning skills	Quality motivation	Ethical commitment to society
Meet deadlines	Critical thinking	Ability to react to unforeseen events	Empathy
Tolerance and respect	Ability to select truthful information	Initiative	Solidarity
Capacity for group work	Adaptation of materials	Creativity	Improvement of self-esteem
	Use of ICT	Leadership	Learn to teach
	Effective oral and written communication		Learn from mistakes
	Capacity for argumentation		Learn from those who are different
			Recognize their role as designers

6.2. Feedback of Entity Staff

About satisfaction surveys, the entity's staff highlights that the SL activity has given them the opportunity to explore new perspectives and ideas and also visibility in the media, social networks, etc. In general, they have not found any difficulty in carrying out this activity; however, they would prefer it in-person. Some include comments about strengths of these SL activities. Thus, for ASPANAES, they highlight the involvement of the professor responsible for the subject, the excellent adaptation of activities to users, and also the kind treatment and patience in communicating with users. As weak points, entities would like the project to last longer and to be face-to-face. They also report some Internet connectivity problems which had to be solved by professors in the course of the online sessions.

Regarding ASPERGA, they emphasize that the students from University of A Coruña have been motivated during the workshop and have been able to organize themselves autonomously to carry out the entire proposal. As weakest point, it would be interesting if some student could be in the videos because the final activity would be closer to users, making it friendlier and more dynamic.

6.3. Feedback of the Users

Regarding the satisfaction of the participants, the survey 12 of Table 4 included not only single-select multiple choice questions but also open text type, allowing the student freedom of response. After quantitative analysis of the answers, we can say that no negative evaluation has been received for any of the questions listed below, except for the question 5, where 100% of answers were negative because they did not consider the activity long enough. Due to this unipolar behavior, no graphs are depicted here.

1. Did you enjoy participating in the online activity?
2. Did you enjoy getting to know the university student?
3. Did you find the experiments fun?
4. Did the experiments help you better understand some things?
5. Would you tell your friends and acquaintances that you had a good time?
6. Would you like to do it again?
7. We leave you a space in case you want to tell us more about the activity.

Regarding this last question, some users said that the slides, the steps, and the explanations were clear and that they will repeat the experience at home. In addition, the users

have sent us some letters with their opinion about the experience in which they say that they enjoyed the activity very much.

6.4. Professors' Reflections

As for the professors' self-assessment, they perceive that the service has been satisfactory for users, with interesting and attractive activities for them, as reflected from surveys. In view of the competences achieved by students, they also agreed to ensure that the activities had defined learning objectives related to subject contents, which were achieved after the activity. They also considered that all reflection activities are well planned, allowing thinking and analyzing existing problems in society and overcoming stereotypes. They highly appreciated their involvement with roles of conflict resolution and decision making, and as motivating agents of students to encourage their creativity and get them involved in the activity in unfavorable social circumstances.

The professors agree that it would be desirable to have more time to contact users, although this is not a simple matter because the activities are carried out in one semester and it is not possible to dedicate more days. The professors could identify the virtual service as weakest point; so, the knowledge of the needs had to be based on external information and not directly from the experience or direct contact with entity and users. The online connection obviously truncated the personal interactions.

6.5. Project Assessment

The e-rubric used for the assessment of the e-SL project contains single-select multiple choice questions about ten aspects of the SL-experience: needs, service, sense of service, learning, participation, teamwork, reflection, recognition, evaluation, partnership, consolidation of centers, and consolidation of entities. The maximum score could be 4 for each of these items. As can be seen in the graph of Figure 6, the assessment of the project from that e-rubric is quite good, although there are points for improvement that are described below:

- Needs: it would be desirable for the student to discover new needs of the participants throughout project development. For this purpose, a longer time scheduling would be decisive and this is precisely one of the weakest points identified by all agents involved.
- Sense of service: similarly, for the student to be aware of social dimension and service limits, a longer time of involvement with entities is necessary.
- Collaboration: although the entities collaborate actively in the project design, it would be desirable for them to be more involved in the activity organization.
- Consolidation of centers: although SL is included in the teaching guides of several subjects and University of A Coruña reinforces and facilitates these methodologies, they are not included in educational programs as such, so that there is room for improvement in this aspect.
- Consolidation of the entity: SL activities are part of activity programs of entities but they do not represent a purpose of their work; so, this will be achieved over time.

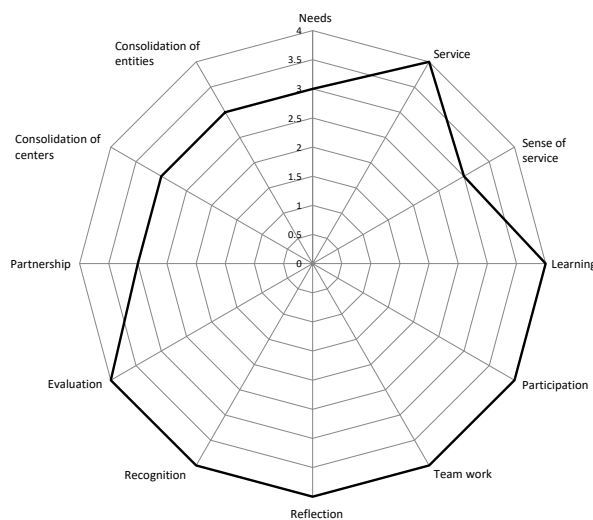


Figure 6. Project assessment.

6.6. Website Assessment

With the students’ assessment of the tools elaborated in Microsoft 365 in mind, a survey was sent to the mailing list asking them about the usefulness of such tools for document viewing and sharing tasks, evaluation, etc., in which an open text answer was required about their advantages and disadvantages.

From the results of that survey, we can say that it was very convenient for them to have all project data only on a shared environment, i.e., the web page developed for this project. All that information was organized and accessible at any time asynchronously. They also positively appreciated the real-time display of the professor’s corrections. The possibility of seeing other works also gave them ideas to be applied in their own work and learn from previous mistakes by colleagues, which enhanced collaborative work and improved the final quality of the proposed activities.

Table 6 shows some of the strengths about the work environment detected by students.

Table 6. Students’ assessment about work environment using Microsoft 365.

Tool Strengths	Students Percentage
Easy access to the assessment	80%
Allow to work collaboratively	80%
Allow to learn about the work of others	60%
Allow to store shared documents	60%
Allow to comfortably view the work done	60%
Facilitates communication with teachers	60%
There is a lot of work from teachers	20%

7. Conclusions

The authors show in this paper an e-SL project resulting from the migration from the in-person SL experiences carried out in previous academic years. In this work, we explain in detail how different ICT resources have been integrated into the e-SL experience, and how these resources and the online platform in which they have been integrated, have allowed us to move to this e-learning experience while maintaining the degree of satisfaction of the service and, more importantly, the service itself in safe conditions for all. The system articulated in Microsoft 365 for monitoring the project has been very useful for all agents and will continue to be used for the next academic course, since students had centralized information and received online corrections in a synchronized manner, announcements of meetings or news reached all group members immediately, and results of surveys, competence assessment rubrics, reflections, etc., were directly collected in Excel, which greatly facilitated the work of data analysis from the professors. Although the creation

of the web space implies additional work for them, its advantages far outweigh this inconvenience, since, in short, it greatly facilitates project monitoring, students' work and assessment, and the analysis of results.

Although the next academic year could see the resumption of face-to-face activities in our centers, the advantages to be gained from the use in our experience of these tools accessible to all at the University of A Coruña means that they will continue to be used for the future developments. The possibility of having a web page to which all participants have access at any time to consult the information available asynchronously and which allows both monitoring and assessment of activities, will greatly simplify the whole process of the SL activity, even when the workshops can be carried out in-person at the centers. Such advantages of incorporating technology into the SL methodology have also been explored in [25], with the proposal of the service-eLearning pedagogy.

As can be seen from the evidence presented throughout this work, all students achieved the skills and learning related to the curriculum, which can be seen by the quality of their presentations, podcasts, videos, posters, etc. Although the activity was carried out in a virtual mode, the students demonstrated to be able to speak in public, to carry out a project in all its phases, to know how to work in a group, and to have interest and concern for the repercussion of his work. Despite not having direct contact with users and entities, because everything was virtually performed, their reflections are enough to see that they have thought about a social reality that many were unaware of and have empathized with people with special needs or in vulnerable situations. Therefore, they have also grown in values.

Moreover, it is clear that university institutions must address the problems of the society, especially in a socio-health context such as the current one, integrating the Sustainable Development Goals (SDG) in the development of their projects and activities, both teaching and research. This e-SL project fits perfectly with goals 4, 10, and 17, as it brings knowledge closer to groups with functional or cognitive diversities, promotes inclusive and egalitarian education, providing new opportunities, and integrating them into the digital society in which we live and for which, on many occasions, they are also great strangers. Moreover, in the current situation, in which face-to-face attendance has been so seriously affected, these groups with some type of diversity have seen their communication and educational needs, already often limited, unattended.

All these results shown in the previous sections report that the learning and service performances are very good; so, we can say that they do not differ from those achieved in the previous face-to-face experiences. These results also coincide with those included in [26], in which, based on data extracted from a questionnaire, the author showed that students achieved similar learning outcomes.

However, the weakest point of the e-SL experience, as indicated by all agents involved, was the non-face-to-face service modality, since both students and users did not have the possibility of such enriching face-to-face interaction. In relation to that, again the work in [26] pointed out an advantage that would compensate for this drawback, which is the anonymity of distance learning as a factor that reduces the stress and anxiety produced in both groups by face-to-face learning [36]. In line with this statement, as we reported in Section 6.1, we have also identified that students are less nervous if they are not face-to-face with service recipients and feel safer from COVID-19 infection.

One of the limitations of the experience shown throughout this paper is that it is only possible to work with small groups of users to perform the activity in online mode. Another restriction is the fact that working with computers is not easy for people with autism, and because of this, they need a great deal of support from entity's staff. Finally, Internet connectivity problems sometimes make communication difficult. Regarding contributions, the designed online platform allows the students to reach the same competences as in a traditional face-to-face course. This platform could be useful to share information related to the SL project even in case of a complete return to a class in face-to-face mode. Due to its versatility, this platform could be used in other pedagogical activities involving different subjects.

In the future, we would like to extend this methodology to other subjects and projects and compare results to obtain higher populations to better validate those results. Furthermore, as the health care situation improves, we would like to migrate to a hybrid-SL learning, in which, on the one hand, we continue to exploit all advantages of the incorporation of these ICT resources and, on the other hand, allow the service to be carried out in-person, in the form of some kind of technology fair.

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Abbreviations

The following abbreviations are used in this manuscript:

ASD	Autism Spectrum Disorder
COVID	COronaVIrus Disease
EHEA	European Higher Education Area
e-SL	electronic-Service Learning
ICT	Information and Communication Technologies
PBL	Project-Based Learning
SDG	Sustainable Development Goals
SL	Service Learning

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