Reflections on a Scratch summer course: students' perspectives

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Abstract

The GEN10S Portugal project has been offering Scratch programming courses, with a 15-hour duration, in face-to-face mode, to groups of students and two or more teachers of each class, from schools that are project members. Two Scratch teachers per class, hired by the project, have also participated in 12 of these 15 hours, supporting the activities. When the schools' face-to-face activities stopped, in January 2021, a 12-hour Scratch course was tested. This course was then replicated eleven times, between July and August 2021, involving 132 students. In this paper, we will use a qualitative methodology to analyse the perceptions of the students involved about the course they had the opportunity to participate. We will also look at the teachers' evaluation of their final work, carried out in groups, to try to understand if a methodology, totally based on online training, can have satisfactory results with students attending the 5th and 6th grade. The results achieved point out to the success of the courses, having obtained very positive opinions from the students who attended it and most of the final works, done by the students, have been classified above average, when comparing them with all those that were carried out throughout the GEN10S project.

Keywords—Scratch, Online teaching, online course, Remote teaching

I. INTRODUCTION

The GEN10S Portugal project began in 2017 and resulted from a collaboration between Google.org, the Spanish association "*Ayuda en Acción*", the Private Social Solidarity Institution "SIC Esperança" and the ICT Competence Centre from the School of Education of the Polytechnic Institute of Setúbal (CCTIC-ESE/IPS). The aim of the project was to teach programming to children, promoting equal opportunities in the digital area, reducing social, economic and gender barriers [1]. In the courses, the Scratch language was used, in which programming is more accessible to a greater diversity of population, including lower age groups [2].

In this project, in each class, the students are monitored by two Scratch teachers and the class teacher, when developing some activities. The first 6 hours are for initial learning, using worksheets containing guided activities for building Scratch projects. The next 3 hours of this training sessions are dedicated to the construction of original projects and the students are only supervised by the class teachers involved in the project, concluding with another 3 hours with the Scratch teachers, destined to the conclusion of the projects of the different groups and their presentation to the class. The organization of the teaching training sessions results from an articulation between the Scratch teachers' availability and the timetables of the class teachers, and it is natural that some courses take place in a shorter period and others are more extended, throughout the school period. It is important to mention that the class teachers have, prior to the sessions with the students, a Scratch training course as well as the Scratch teachers that also have a training session, this one much more focused on the methodology to be implemented with the students.

The 1st GEN10S Portugal edition, which aimed to reach 5.000 students, was followed by the 2nd edition, which began in the 2019/2020 school year, covering a total of 11.000 students from 5th and 6th grade. The appearance of COVID 19 caused a temporary schools' closure and, consequently, the training sessions had to be interrupted, so it was not possible to achieve the initial goal that predicted to reach about 4.000 students from 5th or 6th grade. This fact led to the extension of the project, which was then established for conclusion in February 2022. In January 2021, there was a new suspension of schools' activities for a period of 15 days, which became the perfect opportunity for CCTIC-ESE/IPS to promote a fully online Scratch pilot course, for students from the 5th and 6th grades, attending Portuguese public schools. So, the course was developed over 6 consecutive days, not including the weekend, and the training sessions lasted 2 hours a day.

The course was designed to run in three different phases. In the first phase, the sessions were implemented according to the following methodology: at the beginning of the session, some features regarding the Scratch language were presented. In a second moment, the students were distributed in groups, with a maximum of four elements and worked in virtual rooms, where they would have to explore and program one of the worksheets of the GEN10S project, addressing movement, animation or sound commands, for example, as well as control and decision structures, arithmetic, logical operations and the use of variables. While the students were working, the Scratch teacher entered the virtual rooms and followed the group work, clarifying any doubts that they had. Also, if the students had doubts, they could call the teacher to help them. At the end of the sessions, the students returned to

the main room for a brief reflection about the projects carried out. This methodology was used in the first two days of the course.

In a second phase, students worked on an "original" idea to present as a proposal for the development of a Scratch collective project. To do that, they were again divided in virtual rooms, in new groups of four elements, responsible for the development of the projects. Their work was also followed, for some time, by the Scratch teacher. In this phase, they not only developed collaborative working skills but also programming skills. This methodology, used in this second phase, was implemented over three days.

The third and last phase was developed in the last day of the course, when the groups presented the projects they had developed to the other groups and teachers, in the main virtual room. Each presentation was followed by some feedback given by the students and the teachers.

After the announcement on the CCTIC Facebook page, it didn't take long for the registrations to fill all the 25 available places [3]. The course took place from 28 January 2021 to 2 February 2021. Since the course was held online, it was decided to have four Scratch teachers simultaneously to monitor the students' groups. Part of the time, these groups were separated into different virtual rooms to develop their projects. All the groups presented the final original project to the other participants. This training experience allowed us to recognise that students could, indeed, learn Scratch and collaborate online. Therefore, we believed it would be possible to adapt the methodology used in the GEN10S Portugal project to online courses, based on what we had learned from the previous course. We considered that quite a few students in this age group already had in their possession a laptop computer, headphones with microphone, a backpack, a hotspot and a SIM card, in accordance with the decision of the government of Portugal, made public in November 2020 [4]. We assumed that students applying for these courses, had already spent some time in distance learning and already had the minimum essential skills to work and collaborate with classmates and teacher in an online environment.

So, we made a proposal to SIC Esperança to include this course in the distance learning modality in the GEN10S Portugal project. The proposal was approved, and we contacted with the most experienced Scratch teachers and invited them for a meeting, online, where we explained the methodology to be adopted. In this online version, the class teachers would not be involved, so the Scratch teachers had to guarantee the 12-hour training course. The maximum number of students for each course was set at 16, so that a single teacher could monitor the different groups, which should preferably have 4 students. The receptivity from the Scratch teachers was very good and an implementation schedule was created. The course, called "Let's Scratch together!", was promoted through CCTIC-ESE/IPS and SIC Esperança online channels. Emails were also sent to several teachers who previously had some connection with CCTIC, to increase the possibility of enrolment.

Despite this dissemination, for the total of 176 vacancies, there were not a high number of applications to attend, with 157 students (90%) having their enrolment confirmed by their parents or guardians, which may be related to the fact that the students were already on holidays.

In total, there were 11 classes with students from different regions of the country, and 7 Scratch teachers involved.

In this article, we will try to understand if, according to their perceptions, it was possible to successfully use digital media to work with 5th and 6th grade students, distributed throughout the country. We will present a theoretical contextualization, followed by a description of the methodology adopted for the research and analysis of the students' opinions about the teaching and learning processes used in the course, the presentation of the results obtained, and, finally, the conclusions that will allow us to find appropriate strategies to improve future training in this area.

II. THEORETICAL FRAMEWORK

There is a growing agreement that digital technologies' integration in teachers' practices and in the work developed by the students is something inevitable since we cannot think about youth education disassociated from their preparation for the digital world. In our schools, we have students who no longer identify themselves with practices of mere transmission of knowledge by the teachers, where they have a little active role. Nowadays, students are looking for a space where they can build their own knowledge, where they interact, cooperate, research, select, evaluate, work in groups and are producers [5].

On the other hand, with this new approach, the teacher's role must be different, in a constructivist perspective of learning, that enhances the overall development of the students and the skills they can develop. This new learning environment can give a huge contribution since students are an essential part of the process. This also contributes to the personalisation of their own learning, a greater production capacity and a greater autonomy regarding what and how they learn [6].

However, all this work constantly challenges teachers as they are asked to make use of digital technologies in multiple dimensions of their profession. According to [7], this challenge is characterised by the ability "to integrate digital technologies critically, reflectively and with pedagogical intent to enhance students' learning, and to teach them how to use and harness them for their future lives." (p. 2).

One of the situations that has accelerated all this work was Covid-19. In a short period of time, students and teachers had to adapt to this new situation. Thus, teachers were challenged to move from face-to-face teaching to an online teaching methodology. Many of them focused on e-learning because they didn´t have the possibility to have any physical contact with the students. On the other hand, they have chosen e-learning for the numerous technical possibilities that it offers: i) easy access to information, regardless of time and space; ii) easy publishing, distributing and updating contents; iii) diversity of tools and services for communication and collaboration between all the involved parts in the teaching and learning process [8].

Apart from these more technical features, this methodology has underlying others more associated with the pedagogical relationship that may exist between students and teachers and regarding the teaching and learning processes. Thus, it can allow teachers and students: i) to create empathy, since the internet use is associated with a support technology; ii) to share experiences; iii) to explore the large amount and diversity of resources that are available on the internet; iv) to get involved in the learning community that is being

developed through the virtual space, with students having a fundamental role in the construction of their own knowledge [8].

However, despite of all the efforts made by teachers and students, much of the work done became associated with another term, Emergency Remote Teaching. For some authors, like [9], this was the possible answer to something completely unexpected. Thus, during this time, we were facing a learning methodology, antagonistic to other distance learning modalities, which emerged from something that was neither planned nor designed, from the beginning. It involved the use of totally remote teaching solutions and was aimed, not at developing a robust educational ecosystem, but at providing temporary access to education, in a quick to set up and reliable way, during the crisis we have experienced.

However, according to the same author, it was a time when we had, mandatorily, to "think outside standard boxes to generate various possible solutions that help meet the new needs for our learners and communities." (p. 10).

Taking this premise into account and based on all the work that was done, during this period, we agree with the idea of [10], when he states that emergency remote learning has contributed to the change of the educational scenario, reinventing education. If we analyse the transformation that exists in schools, after the pandemic, accelerated also by the Digital Transition Plan, we can see that there is an intense period of training in and for the digital. Thus, we believe that technologies have an "increasingly relevant role in supporting the development of students' learning, supporting innovation, namely in new ways of conceiving and organising learning (...)" [11, p. 3].

So, when organizing the Scratch courses, which we will address in this article, entirely online, we took into consideration that they would have to be different, mainly because the ones that we had caried out so far had been developed face-to-face but also because of the work done in emergency remote teaching. Therefore, we knew that we had to involve students in a more flexible and individual way, considering synchronous and asynchronous moments, trying to overcome any inequality and exclusion factors that might occur. In addition, we had to create activities that would promote meaningful learning for all students [12] attending the designed courses.

In order to do that, we carried out an accurate planning, with a solid structure, taking into account some quality criteria, in an integrative and constructive perspective of the teaching and learning processes, defined by [13]: i) promotion of active involvement by the students; ii) construction of knowledge by the students, from the interaction with other people; iii) development of autonomous learning; iv) promotion of project development as an answer to some problems; v) communication, discussion and collaboration; vi) application or transfer of built knowledge to new scenarios and contexts and vii) reflection on the development and results of the projects carried out.

We also tried, through the methodology used in the courses, which we will address later, to respond to the ideas advocated by [15], when he states that for online learning to occur, we should "create challenging activities that enable learners to link new information to old, acquire meaningful knowledge, and use their metacognitive abilities (...)" [15, p. 3].

III. METHODOLOGY

The study carried out has a qualitative nature [14] since it seeks to investigate ideas, discover meanings in individual actions and social interactions, from the perspective of the actors involved in the process [16].

Hence, we have chosen case study because we believe that it is the method that best fits the characteristics of this study. Case study is a research method widely used in Social Sciences when we want to seek for the "how?" and the "why?" [17], when the researcher has little control over real events and when the field of investigation focuses on a natural phenomenon within a real-life context.

Unlike experimental studies, in case study the researcher has no intention of experimenting changing factors that can be controlled. On the opposite, the descriptive and interpretive elements have more importance than the cause-effect questions. The use of case study method does not presuppose the intention to generalize the results obtained in each case, but, on the contrary, seeks the understanding of the phenomenon under observation [16].

Thus, we sought to know the opinions about the teaching and learning processes used in the course and find appropriate strategies to improve future training in this area.

Data collection was carried out through an online questionnaire completed by the students, alone or with the help of their parents, at the end of the course, for the purpose of evaluating the courses they had attended. The communication platform used to support the collection of data was designed by CCTIC-ESE/IPS for the management of teacher courses, as Short-Term Actions, and the questionnaire applied was the same as the one used in all other actions carried out, usually with teachers. In this questionnaire, users were asked to rate on a scale of 1 to 5, where 1 corresponds to a negative point and 5 to a very positive evaluation, regarding the following aspects: (i) Achievement of goals (ii) Satisfaction of expectations (iii) Interaction with the teacher (iv) Clarity of explanations (v) Logistical support and (vi) Overall satisfaction.

In addition to the closed questions, there were two open questions in the questionnaire, one where the students could point out some positive aspects and the other aspects that could be improved in further actions.

The answers to these open questions were organised into categories to find regularities and discrepancies [18]. The categories found were: Teachers; Training environment; Learning; Strategies used in training and Online course.

In addition to the data collected by the survey, the students' productions throughout the course were also analysed. The productions consisted of small projects developed during the training sessions and, with this analysis, we intended to understand if the quality of the students' productions in this context differed from the one obtained in face-to-face courses.

In order to preserve the anonymity of teachers and students, the courses were coded with a letter (A… K) and for the students we have chosen a sequential numbering.

IV. DATA ANALYSIS

We start the data analysis by processing the closed questions of the questionnaire survey.

At the end of the courses, all students received an email message to proceed to the evaluation, which was not compulsory. However, to receive the participation certificate, they had to do the evaluation first. We obtained a total of 78 answers from 132 students who finished the course (59%).

TABLE I.   STUDENTS PER COURSE

Course	Enrolled	Completed	Evaluated	
A	16	9	7	78%
B	17	13	11	85%
C	16	15	8	53%
D	16	11	10	91%
E	15	14	5	36%
F	13	12	5	42%
G	11	10	4	40%
H	13	11	5	45%
I	16	15	10	67%
J	13	11	6	55%
K	11	11	7	64%
Total	157	132	78	59%

a. Source: Data collected by the authors

The percentage of answers given by the students in each of the courses has a few variations. In course D, the percentage reached 91% while in course E it stood at 36%. However, as the response to the questionnaire was not compulsory, we accept these variations and assume to treat all the data collected by the questionnaires.

TABLE II.   EVALUATION OF THE STUDENTS WORK

Indicators	Media
Achievement of goals	4,76
Satisfaction of expectations	4,58
Interaction with the teacher	4,72
Clarity of explanations	4,88
Logistical support	4,87
Overall satisfaction	4,78
Global Media	**4,76**

b. Source: Data collected by the authors

The global averages of the evaluation made by the students regarding the 11 courses are shown in Table II.

The overall satisfaction with the course was 4.76 and the item with the lowest score is the satisfaction of expectations (4.58). The item with the highest rating is related to the clarity of the explanations given, which seems to indicate that the quality of the teachers was highly valued by the students. This was corroborated by the open answers' treatment, where 16 students referred specifically the teacher, emphasizing his friendliness and working strategies.

"The teacher was very nice and clarified all the doubts". (Student 7, course I). Or even their friendliness and availability: "I really liked the way the teacher explained the subject, as well as her friendliness." (Student 3, course D); "I liked it very much and the teacher is very nice and helped me whenever I needed it." (Student 5, course K).

These references to the teachers were made by fourteen students from nine different courses, so it seems that the teachers' ability to motivate the students and to support them in their learning was one of the success factors of the course. This student-teacher relationship and the new ways of teaching and learning are also mentioned by [6].

The atmosphere experienced during the course is recognised by 15 students (19.2%) as relaxed, fun and providing new friendships: "We learned a lot; We had fun and spent quality time together" (student 5, course F) or "It was funny, I learned how to work with Scratch and met new people." (Student 2, course J).

The learning aspects were also mentioned by fifteen students (19.2%). Among the most significant statements made, we highlight: "I learned a lot" (student 4, course E) and "I learned a lot of new things that will certainly help me in the future" (Student 6, course J).

The strategies used in the course were one of the aspects mentioned by more students. It was mentioned by 20 students, which corresponds to 25.6% of the answers obtained in the open questions.

Group work was also valued by almost all of those who commented on this aspect, however, one of the students mentioned that he preferred doing an individual work. The promotion of group work, which took place in separate rooms, by groups, gave students the opportunity to have time to talk about other topics and, consequently, to get to know each other a little better, "Group work so they can get to know each other better". (Student 2, course I). These are aspects related to autonomous learning and communication, discussion and collaboration [13].

Some of the open answers seem to be written by parents or educators, by the use of some unusual words in students of this age, but they also reflect on the course "Teaching methodology adopted and applied by the teacher. Interaction of the teacher with the students. Interaction between students." (Student 3, course E) The interaction between students, related to the group work dynamics and teacher/students interaction, are also referred as positive aspects.

The references to the project work strategy also emerged as positive aspects, in connection with group work and teacher/student and student/student interaction. This strategy was used in previous face-to-face courses and was migrated to the online context, similarly to the transformations that occurred in emergency remote learning [9]. The topics chosen for the development of the projects are also mentioned, with particular focus on games and stories "I learned new things, I had fun and we can make games and stories." (Student 7, course B).

Only one of the students mentioned the online course as a positive aspect "I learned more things about the programme, being online, being interactive, [...]" (student 6, class D). However, six mentioned the advantages of having met other children from different parts of the country or having made

new friends, which would be less probably in a face-to-face course.

49 of the 78 students (62.8%) have completed the space into the questionnaire that was related to the things that need to be improved. 24 students, around half, only mentioned that they had nothing to suggest. Among the aspects to be improved are: the length of the course, with 10 students writing that it should have been longer; issues related to the functioning of the working groups (4), for example: "At the beginning, the teacher sent students from the class that I knew to the same room, so I was nervous and hardly spoke, but then the teacher let us choose who to stay with". Ten students (7%) indicated issues related to the methodology used or techniques. One mentions the quality of their own internet and others the tools used to communicate. Just one student mentioned that he would have preferred the course to be face-to-face "Just really because it was an online course, (...).".

In the course final sessions, students had to, as a group, design and present an original project in Scratch. These projects had to integrate technical aspects similar to other exercises covered during the course. However, they should be original, appealing and creative and the groups were invited to tell a story or create an original game.

A total of 42 original projects were created in the 11 courses. These projects were rated by the teachers who facilitated the course on a scale of 1 to 5, according to the Scratch project evaluation grid [19].

TABLE III.　　EVALUATION OF THE FINAL PROJECTS

Level	Number of projects	Percentage	Global percentage
1	1	2 %	3%
2	0	0 %	8%
3	1	5 %	44%
4	28	67 %	35%
5	11	26 %	10%
Total	42	100 %	100%

c. Source: Data from the national coordination of the project

Table III shows the level assigned to the projects developed in fully online courses and the comparison, in percentage terms, with the levels assigned to all projects (2615) recorded in all completed courses at the time of writing (479).
As we can see from the table, the number of projects assigned a low level (1 or 2 - 2%) is much lower in online courses than overall (11%). Similarly, the projects that stand out positively (level 5) are also considerably more.

V. CONCLUSIONS

The experiment carried out had, as we said at the beginning, the purpose of understanding if, according to the perceptions of the students who attended the course, it would be possible to work in an environment exclusively mediated by digital technology with children attending 5th and 6th grade. On one hand, these students had already experienced emergency remote teaching. On the other hand, in the case that we present, they didn't previously know each other or the teacher who followed them on the course.

Thus, in this experience, more than reflecting on the contents covered, we were interested in understanding if the courses that normally functioned in a face-to-face environment, 100% synchronous, with groups of students who knew each other, could also function with students who didn´t know each other. We also wanted to understand if they were able to work in groups, using digital tools exclusively, that would allow them to follow the course without meeting face-to-face. The students' evaluations average of the course is frankly positive. Overall satisfaction is close to the upper limit of the scale used in the questionnaire and the interaction with the teacher, made exclusively by digital means, as well as the rating of his presentations are also frankly positive. Unlike the emergency remote teaching, in these courses, teachers and students did not know each other previously and were from different backgrounds. The experience carried out in a pilot course prior to the 11 courses we deal with in this article, was an added value for the preparation of this work. The knowledge that the teachers had of the presential courses and of the materials used, which continued to be the same, although previously selected, was certainly a factor that allowed an easy transition to this new methodology which, as we have seen, was taken into account in the aspects highlighted in the literature [12].
The aspects that the students mentioned as points for improvement were related, on the one hand, with the course length that many suggested it should be longer. This aspect, although pointed out as negative, denotes that those students, even during holidays, would be willing to continue the activities proposed in the course, for a longer period. There were also some questions related to the functioning of the working groups which, considering that there were groups of students who were asked to work collaboratively, without knowing each other previously, is totally understandable.
If we focus on the final products produced by the student groups, we can conclude that, according to the evaluation made by the teachers, using the same instruments they used to evaluate the projects produced in face-to-face mode, the results were very satisfactory, overcoming the results obtained in the generality of the courses offered in the project. We think that the fact that these courses were optional, i.e., it was the student and his/her parents who took the initiative to enrol in the course, may have contributed to this. In the presential version, the schools, in a first moment, and then the class teachers, secondly, make the decision to join the project by bringing entire classes that, obviously, have students with different degrees of motivation for programming.
The materials produced for the face-to-face version of the course were made so that they could be used autonomously by the students, in the form of very detailed workbooks. This fact allowed them to be easily used also in this modality, supporting the first synchronous sessions and the asynchronous work that was requested to the students.
In general, from the results obtained in this experiment, we consider that, even with students of this age group, it is possible to work in a fully geographically distributed system, using digital technologies.
In this article, we focus mainly on the students' view and the Scratch teachers' evaluation of their productions, however, we feel that this data could be complemented in the future with the view of the teachers involved in the process.

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