

# EVALUATION OF THE DESIGN OF AN ONLINE COURSE FOR SCRATCHJR LEARNING IN STUDENTS OF THE PEDAGOGY UNDERGRADUATE DEGREE

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## Abstract

The objective of this study is to evaluate the structure, contents, and activities of an online course on the ScratchJr programming language, which promotes the development of computational thinking and coding. This course is available for free in the @rcaComum community (hosted on the Moodle platform - <https://comunidade.arcacomum.pt>) and has been based on a training proposal funded by the Arcacomum Association in Portugal (<https://www.arcacomum.pt>), the Scratch Collaborative Education community of the MIT Media Lab, led by M. Resnick and the DevTech Research Group at Boston College, led by Marina Bers, between 2022-2024. For this purpose, the evaluation of the online course design for learning ScratchJr was carried out with 28 Pedagogy students from the University of Malaga, who completed the course. The students completed the ScratchJr online course aimed at education professionals (in initial or continuous training) whose learning is done autonomously for five days and a total of ten hours. At the end of the course, a questionnaire was applied to evaluate the suitability and quality of the course structure, contents, and activities. The findings showed that 100% of the students considered that the documents (PDF) with information about the structure, information, and planning of the ScratchJr course are well structured and contain clear information about the organization, the necessary resources, and the activities to be carried out during the 10 hours. Regarding the content, 100% of the students indicated that the readings provided were sufficient and adequate to understand the ScratchJr application. On the other hand, 92.9% indicated that the Coding Cards activities were sufficient and adequate for learning the basics of the ScratchJr application, as well as 96.4% of the students considered that the Project Design activity (Storyboard) for ScratchJr, as a pre-final task, was adequate and relevant for the subsequent completion of the Final Project in the application. Thus, the ScratchJr course was rated by the students with a 4.60 out of 5. In conclusion, the students' perception highlights the quality of the design, while at the same time allows enhancing the positive aspects and improving those that require it. The ADDIE (Analysis, Design, Development, Implementation and Evaluation) Instructional Design model followed in the creation of this online course is highlighted, since the evaluation phase is fundamental to achieve optimal levels of quality and suitability.

Keywords: ScratchJr; Programming Languages; Online Training; Pedagogy; ADDIE model.

## 1 INTRODUCTION

ScratchJr (<https://www.scratchjr.org>) is a visual programming language that was designed for preschool and elementary school children, ages 5-7. It is a simple and intuitive programming tool that helps to develop children's critical thinking and problem-solving skills, as well as creativity and imagination. ScratchJr was developed by a team of researchers led by Marina Bers, a professor at Boston College and coordinator of the DevTech Research Group (<https://sites.bc.edu/devtech>). ScratchJr arrived in 2014 as an iPad and Android version and is widely used in schools and educational programs around the world.

With ScratchJr, children can create animated stories, games and other interactive projects using colourful, easy-to-use programming blocks. These blocks can be dragged and dropped into the scene to create sequences of actions that can animate characters and objects. This allows children to create simple, interactive animations without having to write complex programming code. The experience of using ScratchJr in Portugal has started since the beginning of its appearance, through the Kids Media Lab Project in which numerous kindergartens throughout the country participated and whose results have been very interesting for the various forms of curricular integration from preschool [1] [2].

The Introduction to ScratchJr online training [3] is aimed at education professionals in initial or continuous training whose learning is conducted in an autonomous and self-managed way for five days

and with a total of ten hours. In this case, we have conducted the ScratchJr course with students of the Pedagogy Degree of the University of Malaga (Spain).

This course has allowed these professionals to acquire the necessary skills to work programming with children in their educational contexts. The course was conducted through the training platform of the Community @rcaComum, of the Association of Education Professionals in Portugal (<https://comunidade.arcacomum.pt/>) and the following objectives have been outlined:

- 1 Start by learning about programming and computational thinking, to understand the basic concepts used in ScratchJr (<http://www.scratchjr.org>).
- 2 Become familiar with the ScratchJr interface and programming blocks, experimenting with simple projects, and learning how to use the different blocks to create more advanced projects.
- 3 Explore the resources available on the official ScratchJr website, including tutorials, discussion forums, international communities of ScratchJr Portugal (<https://www.facebook.com/groups/493182874477115>) and ScratchJr Connect USA (<https://scratchjrconnect.tufts.edu>) users, and examples of projects created by other users.
- 4 Learn to work with ScratchJr according to the methodology, resources, and support of Coding Cards in ScratchJr [4].
- 5 Create their own ScratchJr projects and experiment with different ideas to see what works best, thinking about the future children they will be teaching to work with this tool.
- 6 Consider creating a lesson plan that includes activities with ScratchJr, so that, they can guide teachers in incorporating programming in the classroom in a meaningful and coherent way with all curricular areas.
- 7 Share their projects and lesson plans with other student teachers to get feedback and suggestions on how to improve.
- 8 Maintain participation in ScratchJr online user environments, to continue to follow along after training on the latest trends and technologies in programming and education.

Finally, the design of the ScratchJr course was developed with the application of the ADDIE model, which served as a guide to carry out the processes in a systematic and exhaustive manner to meet the training needs of the users. Of the five phases that make up the ADDIE model, the evaluation phase is an essential component as it is necessary to determine its continuation and effective implementation. Hence, this paper focuses on the evaluation phase, specifically, on the design evaluation phase, which aims to examine the validity and effectiveness of the online course, so that, in this first internal evaluation, the students' perception allows the identification of strengths and weaknesses to be improved [5].

## 2 METHODOLOGY

The ScratchJr course aims to provide or increase the level of knowledge about Computational Thinking and Programming through ScratchJr in Education professionals in initial or continuous training. The course was created with the ADDIE (Analysis, Design, Development, Implementation and Evaluation) Instructional Design model, so this study focuses on the Evaluation phase, specifically on the evaluation of the design and development of the course to find out if it is necessary to make changes in the structure, contents, or activities of the course.

The study population consisted of 48 students in the third year of the Pedagogy Degree at the University of Málaga (39 women and 9 men, aged between 20 and 25 years). Of this population, 28 students delivered the final project with ScratchJr and, therefore, completed the evaluation questionnaire, as one of the requirements to consider the training completed and obtain the training certificate issued by the @rcaComum Association (<http://www.arcacomum.pt>). Thus, the sample is composed of 28 students, 22 (78.57%) women and 6 (1.42%) men, aged between 20 and 24 years.

For data collection, a questionnaire created in Google Form integrated as a Moodle URL resource in the ScratchJr course structure was used to evaluate the design of the ScratchJr course. The students answered a total of seven questions, five of which are dichotomous (yes or no) and assess the relevance, clarity and sufficiency of the information contained in the documents, the readings (in PDF format) and the activities that make up the course. Each of these five items is accompanied by an open-ended question asking participants to indicate what they would improve in each case, as well as the

sixth question on the structure of the course. Finally, the participants rated the course on a likert scale of 1 to 5, where 1 corresponds to the lowest score and 5 to the highest.

Data analysis was carried out with the interpretation of absolute frequencies and percentages for each of the closed-response items, and content analysis for the open-ended questions. Data processing and analysis was performed with Microsoft Excel.

### 3 RESULTS

The analysis of the data obtained from the ScratchJr course evaluation questionnaire yields the following results:

- 100% of the students consider that the ScratchJr course information PDF is well structured and contains enlightening information about what is needed to start the course, although one student suggests providing more detailed explanations (item 1).
- 100% of the participants consider that the ScratchJr course planning PDF is well written and contains clear information on how the course will work and what activities will be carried out during the 10 hours. In this case they do not indicate suggestions or improvements (item 2).
- 100% of the sample consider that the readings provided for the ScratchJr course were sufficient and adequate to understand the application. In this case they do not indicate suggestions or improvements (item 3).
- 92.9% (n=26) of the participants consider that the Coding Cards activities made available for the ScratchJr course were sufficient and adequate for learning the basics of the ScratchJr application. However, 7.1% (n=2) indicate that they were not sufficient and adequate, so they suggest increasing or providing full access to the Coding Cards (item 4).
- 96.4% (n=27) of the total student population considered that the Project Design activity (Storyboard) for ScratchJr, as a pre-final task, was adequate and relevant for the subsequent completion of the Final Project in the application. However, for one (3.6%) of the students the pre-final task was not enough, so they suggest extending this task (item 5).
- Item 6 compiles the proposals for improvement suggested by the students with respect to the entire structure of the ScratchJr course. The answers provided fall into the following categories: Nothing, everything is correct (f=7); NS/NC (f=4); Activities, specifically, regarding the increase of activities (f=3) and their typology (f=2); Promote communication with the student body (f=2); Software (f=2), they suggest an update of the system and that ScratchJr characters be the same both on PC and Tablets; Readings in the native language (Spanish, in this case) and not in English (f=1); Increase practical examples (f=1); Include examples of application in the school setting (f=1); Broaden the age range (f=1). Some of the responses about what they would improve in the structure of the ScratchJr course are: "Nothing, it is very good"; "I don't think there is anything to improve"; "...larger battery of examples and options where it can be used in the school setting"; "...including more activities"; "communication with the student"; "could cover more practical things to know and have more mastery".

Some of the categories and, therefore, of the answers provided by the students, require clarification or explanation:

- a) Activities; the participants allude to an increase of the proposed activities as well as their typology, however, this course is an introduction to ScratchJr, i.e., it provides basic knowledge about computational thinking and coding for a ScratchJr mastery at user level. Otherwise, the extension of tasks, and therefore, content, timing, etc, would imply an advanced training.
- b) Promote communication with the students; it should be remembered that the ScratchJr course is autonomous and self-managed, so communication with a tutor or instructor does not occur. However, it seems that proposing the realization of this online course in a context of university training in face-to-face modality may have confused this student.
- c) Software; students suggest an update of the system and that ScratchJr characters be the same on both PCs and Tablets. However, it should be noted that the official application was developed for mobile devices, so the application works correctly on Tablets with Android or iOS operating systems. The version made available in the Scratch for PC course is an unofficial version but authorized for use. For this reason, many of its functionalities are limited and cannot be improved or altered.

- d) Extend the age range; in the absence of more information, it is not possible to define whether the student suggests that the age range be increased for the target audience of the course or for the users (children) of ScratchJr.

Finally, the respondents rated the ScratchJr course on a Likert scale from 1 to 5, where 1 corresponds to the lowest score and 5 to the highest. The 30.7% of the students rated the course with the highest score and 39.3% (n=11) gave a score of 4. Therefore, the average rating of the ScratchJr course is 4.60 with a standard deviation of 0.48.

## **4 CONCLUSIONS**

The application of the ADDIE model in the development of the ScratchJr course design served as a guide to carry out the processes in a systematic and exhaustive way, allowing to cover the training needs of the users. Therefore, the results obtained in the evaluation phase show the effectiveness of the ADDIE instructional model in the design of the virtual and autonomous course for learning ScratchJr and the strengths and weaknesses of the evaluated elements (structure, contents, and activities).

Considering the results obtained, the ScratchJr course has an adequate structure, solid and flexible at the same time, which facilitates learning in this virtual environment. All the students say that the PDF files of information and planning about the ScratchJr course are correctly written and provide clear information to know from the beginning of the course what exactly they need to learn, what they must do to learn it, how and when they must do it, but at the same time, the absence of control by a teacher/instructor provides the necessary flexibility so that the students can decide their learning pace and the distribution of work. In addition, students openly state that they do not need any modification or that they do not know what they would improve in the course.

The analysis phase of the ADDIE model made it possible to carry out an exhaustive diagnosis of the audience and their training needs, so that the type of content, times and dynamics are determined accordingly. By establishing tangible and concrete objectives, specific contents are included, which are broken down, hierarchized, and ordered in the structure of the course, which, in turn, allows the students to adapt the knowledge acquired to the times of the digital era. Hence, all the students consider that the readings are sufficient and adequate for the use of the ScratchJr application.

The activities are a fundamental element to promote active and meaningful learning in the students, and in this case, it has a greater incidence given the autonomous and self-managed nature of the training. Therefore, the configuration of the activities attends to the objectives and needs of the students, so they are designed to help the students to understand and apply the contents provided in the virtual learning environment, which leads to the acquisition of knowledge and skills about the ScratchJr programming language. In fact, the students perceive the sufficiency, adequacy, and relevance of the proposed activities (Coding Cards and Project Design -Storyboard-), for learning the basics of the ScratchJr application. On the other hand, although a small percentage of students suggest increasing the number and type of activities (alluding to the functionalities of the application), this can be interpreted as a greater interest in learning the ScratchJr programming language.

Finally, students rated the ScratchJr course with a score of 4.60 out of 5. Thus, the information provided by the students in this first internal evaluation suggests that the online introductory training course for learning ScratchJr is valid and effective, which leads to maintain its continuity and availability for education professionals, although the option of incorporating a section of exemplification in the school and pedagogical field is valued.

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