LEARNING WITH #ESTUDOEMCASA PROJECT: THE CASE OF ALGEBRA AND BLENDED LEARNING

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Abstract

To help overcome learning fragilities that resulted from the emergency distant schooling that took place during the first COVID19 lockdown, in March 2020 the Portuguese Ministry of Education, together with RTP, the Portuguese television broadcast channel, created the #EstudoEmCasa ("StudyAtHome") project. It aimed at creating, recording, and broadcasting lessons from different subjects and school years. When schools reopened, in 2021, this project developed a digital platform: #EstudoEmCasa Apoia ("StudyAtHome Support") and started focusing on the recovery of lost learnings during the pandemic. This platform now lodges hundreds of digital educational contents: escape rooms, webinars, podcasts, quizzes, games, online courses, and many others. As Mathematics embrace a central curricular domain, and to understand the impact on algebra learning of using these resources. A qualitative study was performed with K-11 and K-12 students, and two teachers from two Portuguese public schools, in blended learning contexts. Considering students and teachers discourses, preliminary results show evidence of a positive impact on both motivation and learning quality.

Keywords: Algebra, blended learning online platforms, collaboration, digital microlearning sequences.

1   INTRODUCTION

After the first COVID19 lockdown, a need was felt to help students overcome their learning fragilities, that resulted from the emergency distant schooling. To do so, the #EstudoEmCasa ("StudyAtHome") project was created. Formed by teachers from different subjects and school levels, it aimed at creating, recording, and broadcasting lessons on national television. When schools reopened in 2021, this project evolved to a digital platform[1]- #EstudoEmCasa Apoia ("StudyAtHome Support"). A new group of teachers was now focused on developing a variety of contents aimed at the recovery of the students' lost learnings during the pandemic. Studies suggest a positive impact on learning through digital learning resources [1], this platform now lodges hundreds of digital educational resources: escape rooms, webinars, podcasts, quizzes, games, online courses, and many others. Aiming at responding to the curricular learning outcomes of the several school years and curricular domains of the Portuguese official curricular framework, several digital learning resources produced by the #EstudoEmCasa Apoia team are grounded on the *microlearning approach*.

Redondo, Rodríguez, Escobar and Vilas [2] define microlearning approach as a technique for distance learning, provided in small amounts of curriculum content topics that students can assimilate in short periods of time in diverse and interactive formats. It constitutes a challenge for teachers which requires the ability to reflect on teaching practice and students' learning, creating dynamics that promote their professional development and the school culture [3][4]. Leong, Sung, Au and Blanchard [5] highlight some of the key benefits of using microlearning approach which include, (a) better retention of concepts, (b) better engagement for learners, (c) improving learners' motivation, (d) engaging in collaborative learning and (e) improving learning ability and performance.

As learning Mathematics may be one of the most demanding cognitive activities at school [6], learning recovery in this domain constitutes a complex challenge for teachers and for the #EstudoEmCasa Apoia team. Several studies also point to a positive impact on Mathematics learning of using digital learning resources [7][8][9], when observing, for instance, Trigonometry [10][11] – considered a mathematical branch in which algebra, geometry, and graphical reasoning are conjoined [12] – and also Calculus, specifically algebraic and geometric aspects of derivatives [13].

To understand the impact of the microlearning approach on students' learning of different mathematical contents related to Algebra – named trigonometric functions and derivatives –, some resources were chosen from the #EstudoEmCasa Apoia repository to design a study.

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[1] https://estudoemcasaapoia.dge.mec.pt/

2 METHODOLOGY

To understand the impact of the microlearning approach on the students' learning process, students and their Mathematics teachers were participants on this study. The case study research approach was selected as the most adequate, combining quantitative and qualitative components of a research design [14][15] to obtain deep understanding and different perspectives of the experiences. Therefore, participants' opinions about the real-life experiences related to the use of the resources were the main source of data, combined with researchers' observations and interpretations. As two sets of digital learning resources focusing on algebraic mathematical aspects were to be studied, two separate case studies were defined. In both cases, students had already studied the respective subjects in previous classes, and the pedagogical activity aimed at consolidating or recovering learnings. All resources ended with learning regulatory activities, in which students could assess what they had learnt by solving mathematical situations presented mostly through multiple-choice items.

Case study 1 focused on 15 K-11 students, their schoolteacher and trigonometric functions. A set of six sequential digital resources were provided to the schoolteacher, who presented them to the students during a class, in a classroom equipped with computers. These participants explored the resources and engaged in the related learning activities individually or in pairs. Students and teachers' opinions about the teaching/learning experience and the quality of the learning process that took place were collected resorting to questionnaires and semi-structured interviews.

Case study 2 focused on 44 K-12 students and studied a different didactical approach. In this study, the 44 participants explored the resources autonomously outside the Mathematics classroom – most of them probably at home – as asked by their teachers. Learning resources focused on derivatives. Students' opinions about the resources and the learning that took place were collected resorting to questionnaires.

3 RESULTS

Data from both studies suggest that students' studying autonomy, and at ease in using technology were positively associated with the perception of the resource's effectiveness in recovering/consolidating learning.

3.1 Case study 1

Fifteen students accessed the online resources while in the classroom and performed the proposed tasks. Fig. 1 presents snapshots of some of the proposed activities.
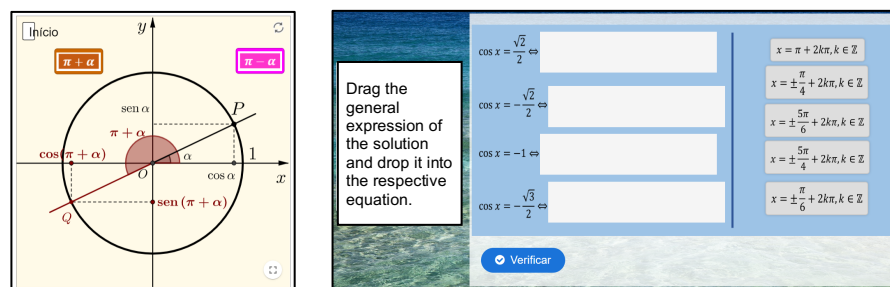

Figure 1: snapshots of "Angle reduction to the 1st quadrant (III)" (left) and "Trigonometric Equations (II)"

GeoGebra applets were embedded in some resources, fostering students to explore them (Fig. 2) and to form and discuss their conjectures, supporting each other to overcome difficulties, as observed in other studies [9].

Figure 2: Students from K-11 engaging in GeoGebra applet exploration

The researchers quickly realised that some students presented some initial difficulties because they did not read the introductory texts that contained the task instructions. However, with the help of the teacher and the researchers, students overcame these difficulties and became involved in the resolution of the tasks. In the activities that started with explanatory videos, researchers observed that same behavior: most of the students did not take the time to watch them. In fact, 73% acknowledged not watching the introductory videos of the tasks. Researchers believe that, because students often associate learning Mathematics with solving exercises, they advance quickly through the webpages until finding questionnaires and exercises. Another possible explanation may be related to the concept of instant gratification, suggested by Wertz according to Leong, Sung, Au and Blanchard [5], which may be associated to microlearning, and affects how people view their time and how they learn.

Students held different previous knowledge regarding the mathematical topics in study. That resulted in different impacts: to some, the activity allowed them to recall and consolidate knowledge; however, to other students, who did not acquire the topics in a significant manner when previously taught during classes, the activity presented real learning challenges. The application of the set of resources to all students allowed for some differentiation in the classroom pedagogical dynamics, where advanced students were able to explore other resources from the repository while the teacher took time to help other students.

Overall, students were very receptive and enjoyed the experience, which is a result in line with other studies [9]. 93% would recommend the #EstudoEmCasa Apoia platform resources to other peers. Two Likert-type questions (5 points) were presented to students, regarding their level of agreeableness with the sentences "The resources were useful" and "The instructions were simple and clear". In both cases, the mean score was 4.35.

The Mathematics teacher also draw a positive impression from the experiment: "The applets allowed students to visualise various scenarios and learn dynamically, grasping by themselves the mathematical concepts behind the formulas, thus facilitating the comprehension of the curricular contents.(…) The resources available at #EstudoEmCasa Apoia repository can be of great help, whether for students to explore them autonomously at home, or for teachers to resort to them to explain certain contents in the classroom."

3.2 Case study 2

Forty-four students accessed the online resources outside the classroom and performed, with no assistance, the proposed tasks. The resources were named "Derivative and monotony of a function" and "Second derivative and concavities".

To address students' opinions about the experience, three open-ended questions were presented through an online questionnaire. Their opinions about the videos embedded on the resources fell into three different categories as shown in Fig. 3:
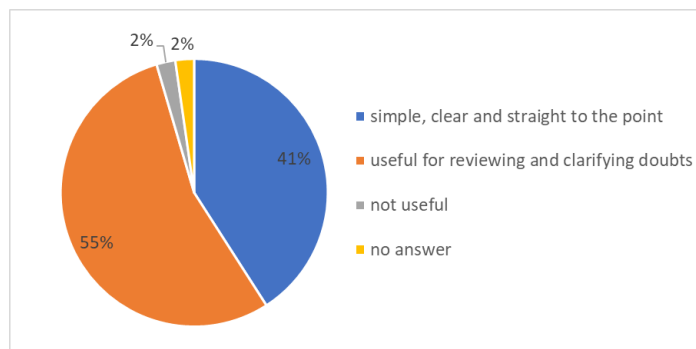
Figure 3: Relative frequencies of opinions about the videos

Their opinions about the mathematical tasks embedded on the resources fell into two different categories as shown in Fig. 4:
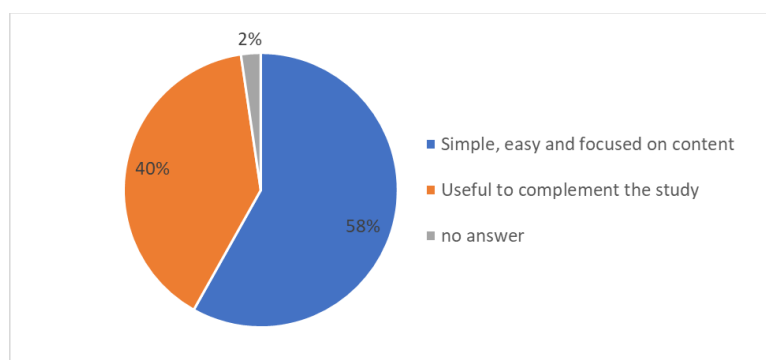

Figure 4: Relative frequencies of opinions about the tasks

The last question solicited suggestions to improve the quality of the resources. Participants answers followed three different categories as shown in Fig. 5:
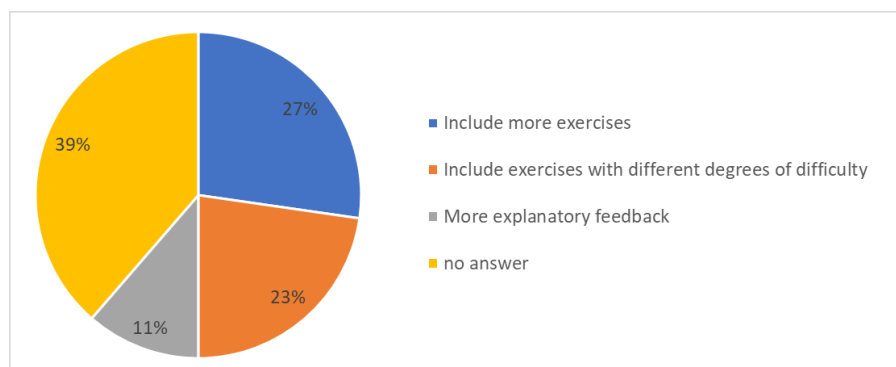

Figure 5: Relative frequencies of improvement suggestions

From the students' opinions, the activities should provide explanations about the correct answers instead of just presenting them, so one can fully understand what was not done correctly. From the answers provided and from teachers' posterior feedback, researchers conclude that the participants enjoyed the resources but felt that more opportunities to regulate their learning were needed. Solving more exercises, adding different difficulty levels, or even getting feedback with an explanation about right or wrong answers could help them get in the right track to develop a more meaningful learning.

4   CONCLUSIONS

As found by Kepceoglu and Yavuz [11], GeoGebra is an effective teaching tool regarding trigonometric functions, that are typically taught algebraically rather than visually. Again, in its capability to bring visual aspects to domains with traditional pedagogical approaches grounded on algebraic manipulations, GeoGebra allows for students to turn their algebraic thinking into geometrical thinking while dealing with problems related to derivatives.

This study suggests that digital resources designed for microlearning should contain interactive tasks, with simple instructions, and with immediate feedback which allows students to regulate their learning process and, autonomously, establish a learning recovery path. Apparently, students prefer tasks that involve and challenge them, compared to explanatory videos of content, despite considering them useful, clear, and complete. Following students and teachers' suggestions, and to improve efficiency in communication with students striving to study autonomously, resources are being improved with an increase in opportunities to regulate learning both through self-correcting exercises and automatic feedback.

Conceiving digital resources for a microlearning approach to a subject and, above all, for learning recovery is, therefore, a demanding task in comparison to the traditional approach of face-to-face and supported learning. As this study focused on digital learning resources produced by #EstudoEmCasa Apoia team, we conclude that authors must work in collaboration with schools to improve the resources effectiveness. The richness that comes from collaborative work as the ability to share experiences [4] can also be highlighted. The structure of collaborative work is quite demanding since all actors are necessary: it does not demand complex logistics but requires real experience and sharing concerns, knowledge, expectations, and principles of actions-research, since all teams' work is focused on improving students learning, which reinforces the importance for community of practice [16].

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