



# Learning with an app? It's a walk in the park

Figure 1  
Infante D. Pedro Park,  
Aveiro, Portugal

Lúcia Pombo explains how learning can take place while enjoying a walk in a park using EduPARK, an educational mobile augmented reality app for students, teachers and tourists

As teachers, our first thought about mobile devices is that the gap between their use inside and outside school can lead to students' disengagement with learning activities in formal education, impacting negatively on their academic success (Reyes *et al.*, 2012). However, in a technology-driven society, educators can take advantage of the pervasiveness of mobile devices to innovate their practices and enhance authentic learning. New technologies, such as augmented reality (AR), are claimed to create conditions that promote students' enjoyment, motivation and involvement in learning (Akçayır and Akçayır, 2017). The use of mobile games in formal education has also been shown to promote student engagement, leading to deeper and more authentic learning (Robson *et al.*, 2015). The recent proliferation of mobile devices and applications (apps) makes AR technology accessible to support learning anytime anywhere, even in outdoor environments such as urban green parks.

Urban green parks are areas of high ecological and environmental value that

should be preserved; this requires the community to have positive attitudes about conservation and sustainability. In addition to the use of urban green spaces for relaxation, leisure and physical exercise, there is much scope for environmental education and nature conservation.

The EduPARK Research and Development Project (<http://edupark.web.ua.pt>) has developed an interactive AR mobile app supporting geocaching activities in outdoor environments to create situated learning opportunities to be explored in the Infante D. Pedro Park in Aveiro, Portugal (Figure 1). This park is a large green area, with exotic and native botanic species, avifauna, a lake and several historical points of interest. It enables learning about conservation and sustainability, with understanding of different ecosystems boosted by experiences in real environments, influencing communities' attitudes to nature.

## The EduPARK Google app

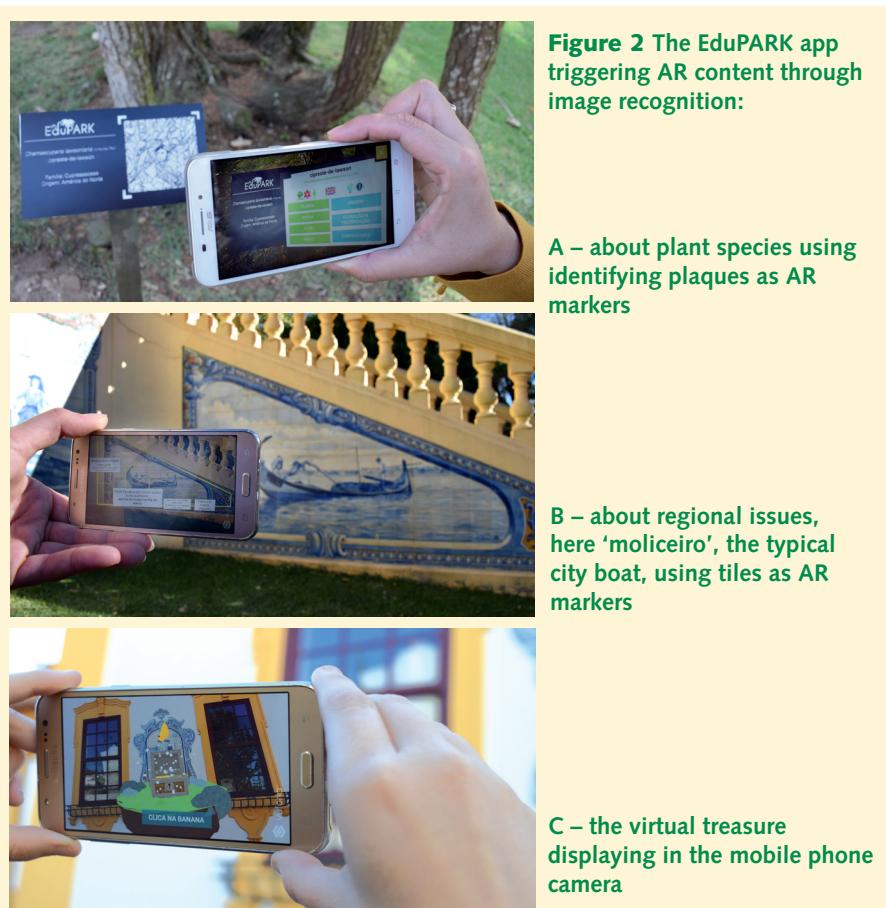
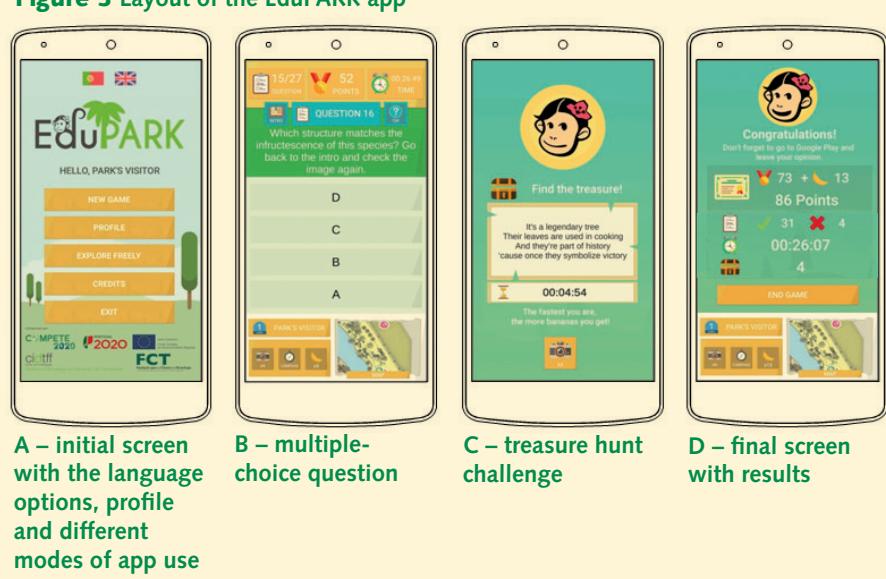
The EduPARK app was developed by the EduPARK project multidisciplinary

team, involving researchers from the University of Aveiro (Portugal) from three specialisms: education, biology and computer science. The project aimed to create attractive and effective strategies for interdisciplinary learning, relying on the development of an interactive mobile AR app that supports geocaching activities to be explored in the Aveiro urban park.

In collaboration with Aveiro City Council, plant identification plaques were installed in the city park with AR information in images, audios, videos, schemes and 3D plant leaves. That information was overlaid on top of a real-time camera feed of a feature within the park, augmenting the reality (Figure 2A). Tiles, already existing in the park, are also used as AR markers to augment information about historical and regional issues (Figure 2B), and virtual treasures can be found along the game both in plaques and in tiles (Figure 2C).

The EduPARK app is available in the Google Play Store ([edupark.web.ua.pt/app](http://edupark.web.ua.pt/app)) for Android devices, and does not require internet connection after download.

Key words: ■ Mobile device ■ App ■ Research

**Figure 3 Layout of the EduPARK app****Let's play!**

The app can be used autonomously, and at any time, using the game mode, or freely explored (Figure 3A), promoting authentic learning so that visitors can enjoy a healthy walk while learning. The game includes several learning guides for different target groups: teachers and students from basic to higher education, visitors and the general public, providing a lifelong learning perspective. The tourist guide is also offered in English. The guides

integrate multidisciplinary issues under the Portuguese National Education Curriculum and pose interdisciplinary questions (Figure 3B) linked to educational challenges along the park in treasure hunt format (Figure 3C). The game enables visitors to explore and access information about the plant species in the city park, historical references, different multimedia content and an interactive park map. The goal is to accumulate points by correctly answering the questions,

visualising AR markers that help to answer questions, and finding virtual caches/treasures (Figure 3D).

The mascot of the app is a female monkey who guides the players and gives them formative feedback after answering the quiz questions. When an incorrect answer is given, the mascot provides the correct answer with a full explanation. (The inspiration for the EduPARK mascot was the informal name of the park – 'Monkey Park' – because some decades ago a female monkey lived there!)

**Learning with AR technology**

AR is typically defined as a technology that allows overlapping or aligning virtual elements with real objects in the physical environment in real-time, producing a new experience (Dunleavy and Dede, 2014). In educational settings, AR has been recognised as being aligned with situated learning theory (Zydny and Warner, 2016), as it can promote authentic learning within local and contextualised environments, and constructivist learning theory, '*as it positions the learner within a real-world physical and social context while guiding, scaffolding and facilitating participatory and metacognitive learning processes*' (Dunleavy and Dede, 2014: 735). Moreover, AR can be another instructional approach available to educators, especially when the aim is to facilitate collaborative problem solving within a real physical environment.

This type of technology can make boring content more enjoyable, provide immediate feedback and support autonomous learning, which can promote student motivation. As AR allows 3D visualisation of phenomena or concepts, which is not possible with traditional textbooks, this technology can support students' understanding of the learning content and increase learning performance itself (Pombo *et al.*, 2017a).

One of the most reported challenges of AR is its usability (Akçayır and Akçayır, 2017), as it can be challenging to integrate a high degree of user interaction. Therefore, AR experiences need to be well designed to guide the students during the process and games should keep the player engaged in learning for a sufficient length of time (Robson *et al.*, 2015). However, to be a relevant approach, the multimedia material should have curricular and educational relevance and it needs to



**Figure 4** Example of botanic AR content. The leaf can be digitally rotated to show its upper and lower surface



**Figure 5**  
Example of an AR tracking tile in the park: the additional information is about Portuguese tile production

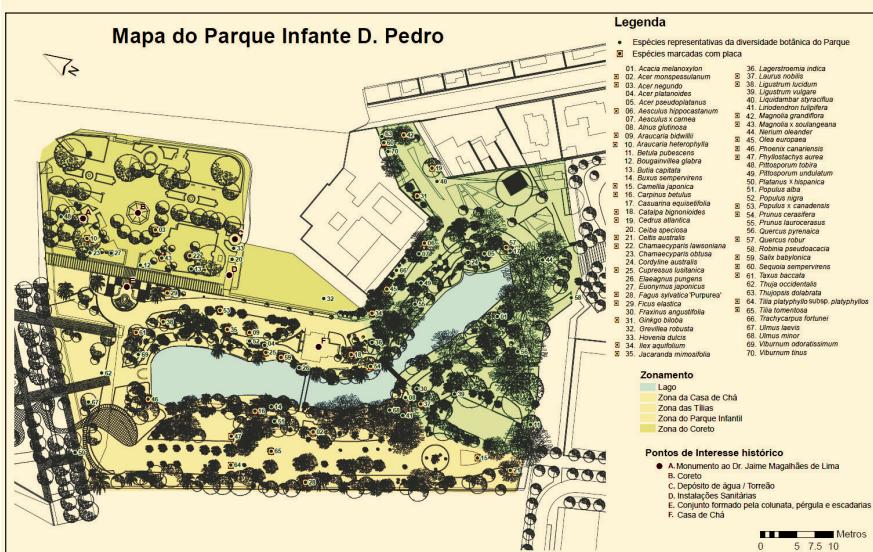
be well organised to prevent cognitive overloads (Akçayır and Akçayır, 2017). All in all, it is quite a complex process!

In the EduPARK project, the 32 plaques installed in the park all have the same layout, although the information in each one varies according to the botanic specimen. The information includes the scientific and common names, its family (in biological classification), its origin and the AR marker, with the project's mascot (Pombo et al., 2017b). The AR content associated with each plaque includes resources about the identified species (texts, photos, videos, 3D models), as illustrated in Figure 4.

The app also includes tiles, as AR



**Figure 6** The Infante D. Pedro Park map, showing the park's zones, the historical interest points and the 70 identified plant species, from which 32 are signed with plaques (designed by Vânia Carlos and adapted from Pombo et al., 2017c)



markers, increasing the number of opportunities for situated and authentic learning in the park (see Figure 5).

### Activities within the park

The Infante D. Pedro Park is an urban park located in Aveiro, open to the public since 1927. It serves as the 'lungs of the city', presenting rich botanical diversity and historical patrimony: seventy species of trees and

**Figure 7** Student activities



**A – formal activity within the open week for science and technology 2016 involving 74 students from three classes (photo shows a medal as a prize for game winners)**

**B – 24 school students aged 10–12 enrolled in Summer Academy 2017 in non-formal settings**

shrubs were identified and described in Pombo et al. (2017c) (Figure 6).

The EduPARK project followed a design-based research methodology, with successive app refinement cycles, based on the users' feedback. The project has been organising activities for students, teachers and visitors to collect systematic data to better understand mobile learning in outdoor settings (Figures 7 and 8). To date, EduPARK has involved 258 students from primary and secondary schools, 60 higher education students/future education professionals, 7 masters students who develop their masters dissertations within the project, 100 teachers who were enrolled in teacher training about mobile learning in schools, and 32 park visitors.



**Figure 8** A – 3 hours of outdoor teacher training ending with a friendly picnic in the park, involving 36 teachers



**B – tourist activity during an environment week organised by Aveiro City Council, involving 32 people over a weekend in informal settings**

### Students' and teachers' points of view



**Figure 9** 13–14 year-old students

I think we can achieve better results outside the classroom, because we are in physical and visual contact with the content we are supposed to learn.



**Figure 10** 9–10 year-old students

I enjoyed it, because if we answered wrongly, the correct answer would appear and we could learn more.



**Figure 11** Primary education teacher

It was beneficial, specially for agitated children, because they overcame concentration difficulties, improved their behaviour and enhanced their learning.

**Figure 12** Masters degree student/ future primary teacher during an activity with her students



*My involvement in EduPARK allowed me to develop teaching practices that had never been carried out in my career as an education professional.*

### In conclusion

The main relevance of this research is its innovation in terms of outdoor learning strategies in formal, informal and non-formal contexts, its interdisciplinary approach, and use of mobile technology. This allows learning to move beyond traditional classroom environments to natural spaces where students can physically explore at the same time as making connections with curricular content (Figure 13). The project promotes articulation between research, teachers, professional practice and initial and advanced teacher training, constituting a very useful theoretical and practical framework, with impact not only in schools, but also in the community and in the tourism sector (Pombo and Marques, 2017). This research also encourages capitalising on the educational value of urban spaces, in association with the City Council.

Future work involves organising regular activities for students, teachers and the general public, as well as conceiving several teacher-training sessions to collect systematic data about the benefits of using this mobile learning strategy in outdoor settings.



**Figure 13** Students exploring the AR EduPARK app in the park

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