INTED 2022

16th International Technology, Education and Development Conference

7-8 March, 2022

CONFERENCE PROCEEDINGS

Sharing the Passion for Learning

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MOBILE LEARNING SUPPORTING LINGUISTIC LANDSCAPES EXPLORATION: STUDENTS AND TEACHERS AS GAME CREATORS

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Abstract

Mobile devices are part of modern societies' day-to-day life. They have been explored for learning purposes with positive results, both at cognitive and emotional levels, in several subject areas. One of the most valued features in these devices, pointed by literature, is their potential in promoting contextual and situated learning. However, the lack of adequate tools and materials regarding the specific contexts in which teachers are embedded, namely in the exploration of linguistic diversity and plurilingual repertoires for educational purposes, incited the proposal of the LoCALL project. This is an Erasmus + project in Cooperation for innovation and the exchange of good practices, which included as an intellectual output the development of a mobile app that supports game-based approaches to explore cities' Linguistic Landscapes (LL). The app is fed by a web platform where both students and teachers, from k-12 settings, can create multiple-choice games, prompting the players to go through a path that includes several points interesting from the LL point of view, in a cross-subjects approach. This study presents the process of development of the app, which followed a design-based research, for context. However, the focus is on a project-based approach of game creation involving 20 students from an 8th-grade class and 7 teachers in a Portuguese school, in the scope of informal teacher training. This is a mixed-methods study, where data collection included a teachers group interview and students' questionnaire. The triangulation of students' and teachers' perceptions regarding this innovative teaching-learning experience was conducted for an analysis that considers different stakeholders' views. Results from the interview indicate a higher motivation of students for learning when using the LoCALL app and platform for LL exploration, which seems to be more intense in the case of students who usually participate less in traditional lessons. Moreover, teachers also reported that this strategy promotes students' critical thinking and their capacity of observing their surroundings. Students mainly highlighted that the project supported them in learning more about the spaces, curiosities, and touristic points of their city, whilst they were collecting information and creating the game questions. The developed open technological solution (mobile app and web platform) is relevant not only for the European partners participating in this project but also to anyone who is interested in creating innovative resources to explore the educational value of LL.

Keywords: educational app, game-based learning, interdisciplinary projects, basic education, design-based approach, LoCALL project.

1 INTRODUCTION

The Linguistic Landscape (LL) is a relatively new field which draws from several disciplines such as applied linguistics, sociolinguistics, anthropology, sociology, psychology, and cultural geography. According to Landry and Bourhis [1], LL are visible signs of multilingualism that pervade people's everyday lives. It refers to "the language of public road signs, advertising billboards, street names, place names, commercial shop signs, and public signs on government buildings combined to form the LL of a given territory, region, or urban agglomeration" (p. 25).

Literature reveals that LL can be explored to raise awareness about linguistic and cultural diversity, both inside and outside the classroom [2]. The use of the LL as a pedagogical resource offers educators an excellent opportunity to create meaningful experiences for learners, since the use of public texts places literacy in a broader social context and connects learning to students' neighbourhoods and communities [3]. In this context, students can develop multiliteracies at the same time they increase their awareness of, and appreciation for, diversity and difference [2].

Traditional approaches to explore LL in Education include, for example, taking photographs of landscapes in the city or at home, filling in observation grids (identifying, counting and comparing languages), interpreting maps and geographic coordinates to find points of interest, interviewing people (shop owners, tourists, etc.), writing texts with opinions, descriptions or imagining linguistic landscapes.

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However, given the emergence of new technologies and their adoption on a large scale, it is urgent to integrate them into the teaching and learning processes. In recent years, mobile technology has gained increased focus in Education as a way to enable learning that is not confined by time and place [4]. As mobile devices become more ubiquitous, mobile learning can be a great opportunity for educating a vast population. The benefits of learning with mobile technology have been widely publicized, where motivation is one of the most cited reasons [5]. Additionally, it is also mentioned by many authors that mobile learning promotes gains at a cognitive level in a wide range of areas of knowledge, thus it might promote interdisciplinary teaching processes as well [6].

In works related with educational digital resources, it is relevant to consider their pedagogical usability. This concept can be defined as "the analysis of the way an educational application (tools, content, tasks and interface) supports students in their learning process within various learning contexts according to learning objectives." [7]. Authors such as Nokelainen [8] and Ivanc, Vasiu & Onita [7] propose a set of pedagogical usability criteria and metrics that may be used to develop and analyse digital resources.

Central to the pedagogical usability concept is the learning theory that frames the analysis. When the option is socio-constructivism [9] the learner's active involvement in learning is paramount and active learning approaches are advised, such as project-based learning. It can be defined as a teaching and learning method that organizes learning around projects. Authors such as Krajcik and Shin [10] and Thomas [11] advise it being prompt by challenging questions or problems that ultimately result in realistic products, artefacts or presentations, among other features.

This study focuses on an initiative of project-based learning that integrates mobile and game-based approaches to learn from and about LL. The Scopus database has presently only three works reporting LL explored with mobile devices in educational settings: Walinski [12], Aladjem and Jou [13]) and Nielsen et al [14]. All have in common prompting the students to have receptive and productive modes of exploring LL outside formal learning spaces, such as classrooms. None involved game playing or creating. Thus, it is evident the novelty of the integration of mobile and game-based learning to promote learning from and about LL. This was one of the proposals of the Erasmus+ project "LoCALL: Local Linguistic Landscapes for global language education in the school context" (https://locallproject.eu). One of the projects' intellectual outputs is the development of a mobile app that supports game-based approaches to explore cities' LL. The app is fed by a web platform where both students and teachers, from k-12 settings, can create multiple-choice games, prompting the players to go through a path that includes several points interesting from the LL point of view.

This work presents a mixed method explorative study about a project-based approach that involved the creation of a game by teachers and students to promote learning on and about LL, using the LoCALL app and web platform. Moreover, this study's main aim is to gain insights into students and teachers' perceptions on their innovative teaching-learning experience.

2 METHODOLOGY

This study presents the process of development of the LoCALL app that supports game-based approaches to explore cities' LL. The app corresponds to an intellectual output of the Erasmus+ LoCALL project with the main responsibility of the Portuguese team.

The app is fed with content created in a web-based platform and its development follows a design-based research, which is presented for context. However, the focus is on project-based approach of game creation involving 20 students from an 8th-grade class and 7 teachers in a Portuguese school, in the scope of informal teacher training. This is a mixed-methods study, where data collection included a teachers' group interview and students' questionnaire. The triangulation of students' and teachers' perceptions regarding this innovative teaching-learning experience was conducted for an analysis that considers different stakeholders' views.

2.1 App and web-platform development

Design-based research provides a useful framework for developing technology enhanced learning environments and improves pedagogical theory [15]. It involves multiple iterations cycles for refinement and evolution of a prototype, hence, the results of a development cycle are used to improve the prototype in the next cycle, until a stable, user-friendly, and reliable version is achieved.

Parker (2011) considers the following phases in this research approach: 1 - analyze the problem, including reviewing relevant literature and accessing practitioners' experiences; 2 - design and develop

a potential solution to the problem; 3 - implement and evaluate the designed solution; and 4 - reflect and report to the broader community. These phases are described below, regarding this study.

2.1.1 Phase 1 – Analyze the problem

The main problem analyzed is related with the development of an innovative approach to LL teaching and learning processes, in an interdisciplinary way, in every city partner of the project. For that, a mobile app and its associated platform should be created to be used in formal education settings, by K12 students and teachers. However, the introduction of a technological tool into the educational processes must add value to learning, for example due to its creative potential, its flexibility and adaptation to learners [8]. Moreover, the technology-based pedagogical solution should be easy to use [16], supporting its adoption beyond the project's scope, by users around the globe. This feature contributes to the project's sustainability after the funded period. Moreover, the app must support the languages of the project partners, so that users can have access to game(s), in their city(ies), to play and learn with LL.

For the prototype development, principles of pedagogical usability were considered, particularly cooperative/collaborative learning, ease of use, learner activity, motivation and feedback [7], [8]. Initially, the project research team discussed with the designer and informatics team the principles and requirements for the app and web platform: it should promote quiz game-based learning approaches through a set of points of interest in a city, comprising a LL learning path. Moreover, the app and platform should support collaborative learning [7], [8], hence, content exchanges between different user accounts (teacher-students) should be supported, although allowing individual work as well.

The main principle for the app design is that it should motivate players to contextualized learning [11], [17] from and about LL in each city partner in an interdisciplinary way. When students are playing the game, they can play it individually and in groups, promoting collaboration within each group and competition among groups. The app should also be explored in formal and informal educational contexts, with potential utility in a lifelong learning perspective when used, e.g., by tourists to explore a city. Being easy to use is an important feature, so that anyone can use it with no training need.

Relevant media elements need to be considered, not only to support users during the game, but to provide motivation for learning, especially if the game includes a friendly mascot who gives instructions to guide the user and gives accurate feedback according to the players' game performance, providing a true dialogue between the user and the computer.

The ease of use of the platform for games creation is also the main concern. In fact, students should be able to assume both roles of players and game developers. Thus, this way the software will encourage active learning [9], as students have a high involvement either when they are exploring the outdoors or creating a game. The last strategy supports a project-based approach, where the learning objectives must be clear and the activity should be product-oriented [10], [11]. Furthermore, the creation of a game should include the applicability to real situations, with examples taken from authentic contexts and the surrounding environment. For example, students can collect information, by observing the exterior and making connections with curricular contents, to create a game in a real city.

Finally, different access levels to distinct features for game creation and platform management were needed, so the platform should allow different user roles: student, teacher, LoCALL project coordinator and administrator. Each user can have different access and permissions in the platform.

2.1.2 Phase 2 – Design and develop a potential solution

This phase was devoted to the design of the first prototype of the technology-based pedagogical solution, the app and platform, considering the analysis made in phase 1. A multidisciplinary team, integrating researchers of all university partners of the project, defined specifications for the software development. A first proposal of design and user interface for the app and web-platform was developed by the designers and negotiated with the remaining team. After agreement, the informatics team developed the app prototype, created databases and the web-platform interface. In the first stage, the app was developed only for Android devices and for a unique city and language. This first prototype was submitted to internal testing by project team members and correction (1st refinement cycle), to reach a version to be used by different publics in training initiatives for piloting the solution. Then, the second version of the app and platform was tested by 28 teachers and educational researchers in a short workshop in November 2020 (2nd refinement cycle) with an online bug report form to support improvements. Finally, a new set of 63 teachers and researchers tested the solution again in the LoCALL project training week, in January 2021 (3rd refinement cycle). After each testing, proper corrections were

made to correct some initial bugs and reach the users' pedagogical needs satisfaction. When a stable version was achieved, the other languages of the project members were included in the app, and it was developed for IoS as well. Both operating system versions of the app were placed at the respective stores.

✦ *The solution - app*

Figure 1 presents some screens of the app. When initiating the software, the user sees the initial screen with the Mascot Lang, a friendly turtle, welcoming the user (Figure 1A). A turtle was chosen as a mascot because it is an animal who walks slowly, reminding the users who are observing their surroundings while they are walking through the city. Another reason is that the turtle carries his home at the back, so he can walk freely through several countries with no specific belonging country.

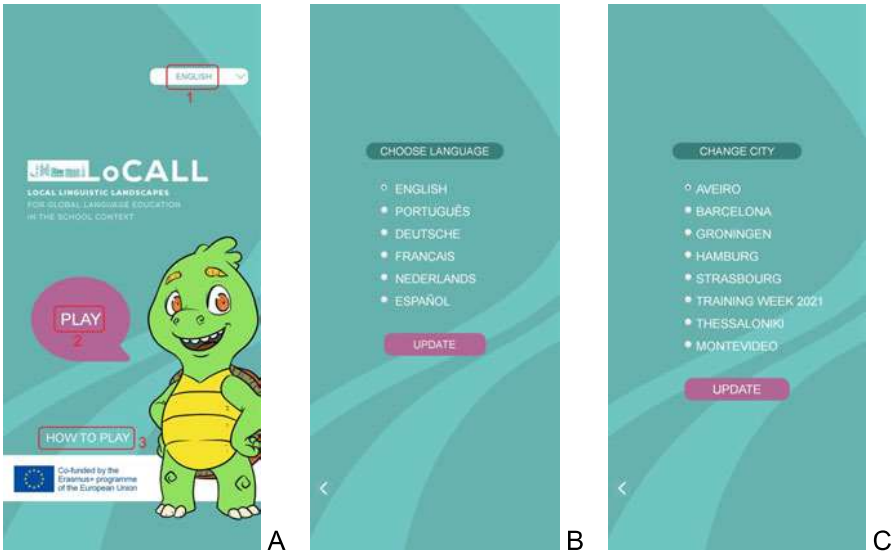

Figure 1. LoCALL app screens: A) initial; B) language selection; and C) city selection.

This friendly looking mascot is used to explain the game rules, which are presented to the user by hitting "how to play" (Figure 1A-3) and to provide immediate feedback after the users answer the game questions. This is an opportunity to learn through trial and error.

The user can choose a language from the ones listed in the app (Figure 1A and 1B) to interact with it. The available languages are to the ones of the members of the LoCALL project. The first time the user hits "Play" (Figure 1A-2), he is prompted to select one city to play a game, according to the ones available in the app's list (Figure 1C). This list of cities may increase, according to the project's needs.

Finally, the user can select a game to play, from the list of games available for the city/language selected. The list presents the games organized by the schools or other educational institutions that create them. This list is also dynamic, as games are being created, updated and, maybe, deleted by the users of the web platform.

After starting one game to play, the user can see the city's map with all the points of interest marked and read the instructions to pursue the game. The game aim is to correctly answer the multiple-choice questions of the quiz, while following a route composed by the points of interest. Google maps technology is used to support the user in finding the right point of interest. In each one, it is necessary to carefully look at the surroundings to find the aimed LL and answer correctly. Each question can be associated with different kinds of media, such as a video, an audio or a photograph. After choosing an answer option, the user receives immediate feedback. The user must keep answering questions until the app prompts him to move to another point of interest. When reaching the end of the game, the user can see the scores and can try out another game or play the same again.

✦ *The solution – platform*

Students and teachers can co-create games for the LoCALL app in the web platform: https://locallproject.web.ua.pt/. For that they need a user account, so games are associated with their creators. The Data Protection Regulation was respected. Student's accounts allow them to create points

of interest and associated questions, but they cannot create games. This is a feature for teachers only who can have access and permission to edit the questions and points of interest created by the students' accounts associated with their teacher account.

To create a new game, the creator writes a start message that explains the aimed learning goals and the number of points of interest to visit during the game, so the players may have a notion of the extension of the game. The start message can be associated with a media, such as image, audio, or short video. Next, instructions are given to the players so they can find each point of interest of the game. Each point of interest may have associated more than one question. The questions may have an introduction and may also have associated a media resource. Each question may have two, three or four answer options, and one or more than one can be the correct ones. The game creator should add feedback for the players after selecting an answer. It should be different according to the players' performance, to make this a learning opportunity. It is also possible to introduce a media file associated with the feedback and to mark the game as ready to be accessed in the app. Finally, the game creator writes the final message, so the players know they have reached the end.

The teacher account allows as well to access anonymous logs with game results and to manage students accounts - to accept or reject the association of specific student accounts.

Besides the student and teacher account, two more profiles were predicted for platform management: Local Coordinator and Administrator. The Local Coordinator role is given only to members of the LoCALL project team. Each city of the project has one or two LoCALL Coordinators, who have access to the following features, related with their city: a) the games created, having editing permissions; b) anonymous logs with game results; c) a list of the teacher accounts - pending approval or already approved - for users' management; and d) a list of the questions. The Administrator role is given only to the projects' main mentors of the app and platform. These accounts give access to all the platform functionalities described before and they also allow to: a) create/manage countries, cities, and schools in the platform (sustaining the increase of the project's scope); b) create/manage all the remaining types of users.

2.1.3 Phase 3 – Implement and evaluate

In this phase, the app and platform were used in an educational interdisciplinary project conducted by 7 teachers who teach different subjects to an 8th grade class with 20 students. They attend an urban school in Ílhavo, in the vicinity of Aveiro (Portugal).

The teachers were supported by 5 researchers through two online 3h-workshops and email communications from April to May 2021. The workshops included theoretical background on LL and its educational potential (first workshop) and offered an opportunity for teachers to explore the app and platform by themselves, while accompanied by the researchers (second workshop). The contacts through email included sending a planification template and feedback on the first version of the lesson plans developed by the teachers. No classroom observations were possible by the research team due to the COVID-19 pandemic.

The interdisciplinary project from and about LL included the subjects of Portuguese, English, French, Citizenship and Development, Information and Communication Technologies, History, Geography, and Physics and Chemistry. The common learning objectives of the project were: a) to raise awareness to linguistic and cultural diversity; b) to develop critical thinking and autonomy; and c) to promote reflection upon the local surroundings linking it with curricular content. For more information on the project developed, see Marques et al [18].

Although the project comprises three main dimensions: analyzing the LL at home, analyzing the LL in the school, and analyzing the LL in the local community. This paper focuses on the last one, which involved creating a game (in Portuguese) for their city: "O mar começa aqui" [The sea starts here]. Students collected photos illustrating LL in the streets, organized information, selected 10 points of interest in the city and defined the game itinerary, formulated 60 questions for the App including feedback and media resources, and finally tested the game. The game is freely available through the LoCALL App, when selected the Portuguese language and the Aveiro city.

2.1.4 Phase 4 – Reflect and report

The last phase involves triangulating empirical data to support reflection on the positive and negative aspects of the process and designed solution. This corresponds to future work to be conducted under the Erasmus+ LoCALL project, as further work with schools, in all city partners is being organized and

conducted, for a broader exploration of LL for learning purposes across Europe. The dissemination plan of the results for this last phase of design-based research aims to reach other educational communities, even outside the project's partner countries, so it is expected to promote the adoption of the developed technology-based pedagogical solution to a larger set of educational professionals.

2.2 Data collection and analysis

Data collection included a students' questionnaire and teachers semi-structured group interview.

At the end of the interdisciplinary project, teachers designed and applied a small online questionnaire to the students for self-assessment under the interdisciplinary project. The questionnaire includes five open questions: 1- The Erasmus + LoCALL project is…, 2- With the project I have learned..., 3- What I most liked to do…, 4- What I least liked to do..., 5- Suggestions/Observations. The questionnaire was answered by 17 students in a lesson.

Regarding the teachers' interview, one of the objectives was to understand their views on students' reactions to the project and the competences they had developed. For the interview, a guide was developed by one of the researchers involved in the workshops and tested internally (Kallio et al., 2016), through critical analysis by the remaining four researchers.

The teachers' interview was conducted online. Five teachers gave informed consent to participate in the group interview and for the session to be recorded for transcription. They were given the opportunity to review the interview transcripts.

Data was categorized through inductive coding (Bardin, 2016). Thus, students' responses to the questionnaire open-ended questions and the interview transcripts were read to create provisional codes considering this study aims. Then, the codes were refined to create categories and subcategories.

3 RESULTS

Through the analysis of the questionnaire applied to students regarding how this innovative teaching-learning experience was conducted, based on the app exploration, three categories were considered: i) what they have learned with their involvement with the project; ii) what they liked the most; iii) what they liked less.

Concerning their learning, most students (14 out of 17questionnaire respondents) mentioned their learning about their city, namely "I've learned more things and facts about various places and tourist attractions in Ílhavo", 3 students referred to know more about other countries and their culture; 2 students stated location skills, namely "I have learned how to locate points in the map". Only 1 student mentioned that this experience promoted their skills about how to formulate questions and another student referred his/her knowledge about LL: "With this project I have learned that our city there are several linguistic landscapes that I hadn't realized".

In what respect what they liked the most, three aspects were highlighted: to work on the questions for the game (9 students), to explore the game in the outdoors (5 students), and to learn more about their own city (3 students). They have also mentioned the collaborative work (2 students): "to work with my colleagues and teachers while we decided what we were going to do". Two other students stated specifically to look for LL: "I enjoyed walking around the street looking for linguistic landscapes".

About what they liked less, most of students (10) recognized "There's nothing I didn't enjoy doing". Nevertheless, some students pointed out to write a text (2) or to create the questions (3), and 1 student mentioned to choose an answer among different options choices.

These results show that the outdoor exploration of the app, using mobile technologies, as well as creating the game could promote gains at a cognitive level in the majority of students, not only in an interdisciplinary point of view [6], but also culturally promoting motivation for learning, as widely cited in the literature [5].

The group interview (GI) data allowed to aggregate the results in two main categories of teachers' perspectives: a) regarding students' reaction; and b) regarding teachers' practices.

Teachers commented on their students' reactions to the project-based approach, which can be organized in four sub-categories: i) increased subject learning, ii) increased soft skills learning, iii) improved attitudes and dispositions towards learning, and vi) difficulties related with the process. In what concerns increased subject learning (i), teachers mentioned both language related knowledge and skills,

and local context related awareness and knowledge. E.g., Charlotte[1], one of the most intervening teachers in the interview, highlighted the relevance for Portuguese language learning: “It was curious to see them [the students] realizing: «Look this word is misspelled [in the app] … we need to correct it» and take note of these little things.” (Charlotte, GI, p.16). The same teacher also presented episodes regarding students learning about their city as well: “the most important thing was discovering the various places [and history behind each of these spaces] in your city that they didn't know” (Charlotte, GI, p.14). This observation is in line with the results from the students’ questionnaire, where students emphasized their learning at this level as well, as explained above. Hence, teachers considered the developed project was interdisciplinary, not only because teachers from different subjects participated in the project, but also because it promoted learning in all the subjects involved.

The above results are also in line with the literature, as they constitute empirical evidence of learning connected to students’ neighborhoods and communities [3]. Besides, the project planned by teachers explicitly aimed at increased awareness to linguistic and cultural diversity and promotion of reflection upon the local surroundings linking it with curricular content. Hence, it is possible to infer that teachers considered that the developed project reached the defined aims in terms of curricular learning objectives. Moreover, teachers believe that the interdisciplinary project yield learning gains at different levels, inclusive at cognitive level, which is in line with the literature as well [6].

Other dimensions of learning were promoted, according to teachers. Soft skills were enhanced (ii), such as critical thinking, “All this is learning that they were doing and in relation to which they were becoming more conscious and more critical as well.” (Charlotte, GI, p.17), and autonomy, "I was called out of the classroom ... When I arrived, they [students] had already produced more questions. I think they have developed a lot even in terms of autonomy." (Violet, GI, p.12).

Contrarily to expectations, teachers did not explicitly mention the promotion of digital or collaborative skills. In a project where students are prompt to work with digital technologies (at least, smartphones, LoCALL app and web platform for game creation) and in groups, it was expected teachers to mention the enhancement of those skills. This may be due, despite students’ acknowledgement of collaborative work, to teachers considering students were already competent in those areas, from previous work with the class, or teachers may have considered the development of those skills was so evident that it was no worth mentioning. This latter supposition is reinforced by the fact that the planned project explicitly aimed to promote critical thinking and autonomy in students and not digital and collaborative competencies.

In addition to the above learning dimensions, teachers also valued students’ improved attitudes and dispositions (iii), being the high enthusiasm and motivation to learn the most mentioned one: “I think that, when they found out that the final product was an application [game] and that they were going to make it, that's when they got completely involved in the project.” (Mia, GI, p.16). According to the teachers, this increased involvement in the class activity was also observed in students who do not regularly participate: “Even students who are typically less involved in class ended up being influenced by the enthusiasm of the others. All of them, in general, liked to participate in the activities.” (Amelia, GI, p. 16). Hence, this ability to motivate the less participating students and challenging them to leave their comfort zones was highly valued by teachers. Moreover, when asked about the activity students valued the most, Charlotte did not present any doubts: “For me, it really was the game. It was the game creation… They made it and then they saw the result” (Charlotte, GI, p.16). In sum, these results suggest that student engagement and motivation can be associated with the digital component of the project, in line with prior studies on mobile technology in education [5].

Despite all the positive results reported by teachers, they also pointed students’ awareness of difficulties related with the process (iv), such as the formulation of false answer options, a task to which students are not accustomed to: “one of the things that they [students] became aware of was the difficulty of writing the false answers for the multiple-choice questions [of the game]” (Charlotte, GI, p. 15). Other mentioned difficulties were the high time consumed by the approach and the COVID-19 related restrictions, which made it impossible to teachers to accompany students in the visit to potential points of interest, for LL information collection. According to teachers, some students visited a few points of interest in the city with the support of their families. A more detailed report of these teachers’ perspectives on the effects of the project on students’ learning is presented in Marques et al [18].

Besides the impact of the project on students, teachers also reflected on its impact on their own practices. This category was organized in three sub-categories: i) stronger teacher collaboration, ii)

[1] All participant teachers were given fictitious names, to keep anonymity.

curricular integration and articulation, and iii) change in teaching methods. The stronger teacher collaboration (i) was highly valued by teachers, as this project involved repeated teacher meetings to plan and collect data to prepare lessons for the several subjects involved in the project. These meeting occurred both online and face-to-face. An illustrative comment comes from Charlotte: “It forced us to work collaboratively; forced us in the right meaning. Note that this word always has a very negative connotation and here it is frankly positive” (GI, p. 21).

The high collaboration levels reported by teachers aimed a high curricular integration and articulation (ii). The curricular integration was possible in most participating subjects, or even easy for language subjects: “this year, the thematic units covered in the subject had a lot to do with the work that was being done [in the project]. And I think it's a theme that is easily [integrated], in the case of languages, isn't it?” (Mia, GI, p. 13). Other non-language subjects were also easily integrated: “it was time to talk about primary sector activities, so fishing had everything to do with this region and it [the curricular integration] was easy ... I took advantage of a lot of what they brought to the classroom [LL information, including photographs] to then advance a little further to other activities, it was relatively easy” (Violet, GI, p. 13). However, teachers also tried to horizontally articulate the curriculum of the participating subjects: “we were also choosing the moments when this [curricular articulation] was possible. I'm thinking on Physics and Chemistry, which entered in very specific moments in this project” (Charlotte, GI, p. 13).

Finally, teachers also reported a change in teaching methods (iii): “It's this type of activities that helps us to realize this, we probably need to change the pattern, change that pattern we have of just teaching, debiting and I don't-know-what, but it is also necessary to relate, to associate with certain real situations because, perhaps, with this relationship, they [the students] will learn more and better.” (Amelia, GI, p. 22). So, teachers did not only mention the need to change their teaching practices, but also highlighted the dimension they valued the most: the contextualization of the aimed curricular learning to make it meaningful for students. This result is in line with Hewitt-Bradshaw [3] study, which highlighted the relevance of stablishing connections of subjects’ learning to students’ local contexts, to create meaningful experiences.

When asked about the relevance of the initial workshops with the LoCALL project’s researchers, teachers stated: “they were very important, essential for the completion of the work and even for the development of the game, because if it weren't for the workshops, we wouldn't be able to follow all those steps to use the application, follow the necessary steps...” (Amelia, GI, p. 20). Nevertheless, teachers made a relevant suggestion for those participating in this type of initiatives in the first phases: “I felt this need: to see a game model … to get an idea, to understand if, in fact, the questions are exactly what we did or not … eventually, even an example of the game … To play, take a game path, to have this experience of a path with questions.” (Charlotte, GI, p. 25).

4 CONCLUSIONS

The LoCALL project proposed developing an innovative approach to LL teaching and learning in every city partner. With that aim, the team followed a design-based research approach to create a technology-based pedagogical solution integrating a mobile app and web platform. The created LoCALL app (available for Android and IoS) supports game-based learning of LL in the city. It is fed by the web platform, where K12 students and teachers can create multiple-choice games through a city path with LL points of interest. The innovative nature of this proposal is based on the scarcity of similar studies proposing exploring LL in education with mobile devices: only three are retrieved from Scopus [12]–[14], to date. Moreover, LL does not seem to have been explored in game-based approaches.

This study presents the development of the LoCALL technology-based pedagogical solution to contextually frame the project-based approach [10], [11] of game creation by 8th grade students and their teachers in a Portuguese school. Previously to the project implementation, teachers had informal short-term training where they contacted with LL as a pedagogical tool and explored the app and web platform. They also received advisement on the project planning by email.

This mixed-methods study aims to access teachers and students’ perceptions regarding their innovative experience, so students’ questionnaire with open-questions and teachers group interview were used to collect data. Both students and teachers considered that the experience was very positive and pointed learning gains, despite the reported difficulties were related with the game creation process. Moreover, one of the key aspects highlighted by teachers, with enthusiasm, was students’ improved attitudes and dispositions towards learning, particularly higher motivation, which seems to be more intense in the case of students who usually participate less in traditional lessons.

In what concerns learning gains, students focused subject related learning, such as geolocation skills, local context knowledge or language related skills, whereas teachers also pointed soft skills, namely critical thinking and autonomy, in line with the general educational aims they defined for the project. The interdisciplinary [6] nature of the project was also valued by teachers. Collaborative work, which is advised in project-based approaches [10], [11], was mentioned by the students as one of the project dimensions they appreciated the most. However, teachers did not explicitly point collaborative skills as a learning gain. Surprisingly, in a project taking advantage of a technology-based pedagogical solution, digital skills were not mentioned either by students or teachers.

In light of these results, the bet on developing the LoCALL app and platform respecting several pedagogical usability principles [7], [8] paid off. In fact, the app and platform are easy to use, as a short-term informal teacher training was enough for teachers to implement the project. The easiness of use of the app and platform supports the sustainability of its exploration beyond the project's scope, as anyone who is interested in creating innovative resources, to explore the educational value of LL, will be able to become autonomous in the exploration of this educational resource.

Moreover, the technology-based pedagogical solution sustained collaborative work among students, and probably also between teachers and students, as the questions and points of interest created in students accounts were compiled in a teacher account to create the game "O mar começa aqui" [The sea starts here]. Finally, higher motivation of students was also achieved, as the majority reported that they enjoyed the most working in the game creation or playing it. Moreover, teachers' statements reinforced this interpretation, as they highlighted students' high enthusiasm and motivation to learn during the project, even students who are usually difficult to engage in school learning.

Additionally, teachers reported the project impacted their teaching practices. It happened by increased collaboration, which resulted in the project's curricular integration and interdisciplinary articulation, and even change in their teaching methods. Moreover, this last change was presented as being from traditional teacher centred methods to contextual teaching methods, as advised in the literature [17].

This study main limitation is the lack of data from observation, due to the COVID-19 pandemic restrictions. Moreover, this is a study focused on a single experience, by one group of students and teachers. Thus, more similar studies, with the same group or with other groups from diverse educational contexts, are needed to analyse stakeholders' views on this innovative approach to LL.

Finally, taking in consideration the work presented in this contribution, the LoCALL project concours to addressing the lack of adequate tools and materials regarding the specific contexts in which teachers are embedded, namely in the exploration of linguistic diversity and plurilingual repertoires for educational purposes. The developed open technology-based pedagogical solution (mobile app and web platform) is relevant not only for the European partners participating in the project, but also to anyone who is interested in creating innovative resources to explore the educational value of LL.

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