Designing Location-Based Gaming Applications With Teenagers to Address Early School Leaving

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Abstract: Early school leaving (ESL) is an urgent and serious problem, both for individuals and society as a whole. Factors such as learning difficulties, social problems or a lack of motivation, guidance or support all contribute to ESL, although the situation varies across EU countries. High rates of ESL are detrimental to making lifelong learning a reality and increase the risk of unemployment, poverty and social exclusion. Since normally there is not a unique reason for leaving education or vocational training, answers are no easy. In response to these concerns, the Code RED project (http://www.codered-project.eu) has been created to address the high proportion of drop out from Initial Vocational Education and Training (IVET) and ESL in the UK, Greece, Italy and Cyprus via the development of new games-based learning applications (both desktop and mobile) to inform young adults (aged 16+) of the issues surrounding ESL. Location-based gaming (LBG) applications represent a form of play that is designed to be undertaken on a device in motion which changes the game experience based on the location. The design of these products presents many challenges to developers surrounding user interfaces, processing power and the availability of space. The ARIS platform (Augmented Reality and Interactive Storytelling) covers a broad field of LBG design components such as geo-location data, location-sensitive informational objects, interactive dialogues and QR code input. As such, ARIS has been selected by Code RED researchers to teach LBG and mobile augmented reality design concepts and prototype new design ideas with young adults. This paper will discuss the issues which are contributing to ESL within the EU and report upon the results of a short term participatory design initiative within Code RED to co-design new location-based gaming applications with participating IVET students (aged 14+) to address these issues. In the UK, participating students were successful in formulating a game concept suitable for transfer into LBG surrounding lifestyle choices such as alcohol and drug abuse which may contribute to ESL. In Greece, participating students with learning disabilities were successful in creating a fictional 'solve the mystery' LBG using the ARIS platform. Students decided to focus the game's narrative on the issue of exclusion from school and jumping into fast conclusions during schooling years. In Italy, participating children were successful in designing an orienteering-based LBG to promote cultural heritage via exploration of an ancient castle. This process also enabled participants to research and learn more about this local landmark. The paper will discuss the application of the participatory design methodology between project partners and will document the LBG output from this process. Finally, the paper will identify how these products will be positioned as part of future work to address ESL.

Keywords: location-based games, participatory design, employability, early school leaving, ARIS

1. Introduction

Early School Leaving (ESL) and drop-out from initial Vocational Education and Training (IVET) comprise major challenges in EU education systems, especially in relation to meeting employment targets. In response to these concerns, Code RED project (http://www.codered-project.eu) has been created to address the high proportion of drop out from IVET and ESL in the UK, Greece, Italy and Cyprus.

Preliminary work has involved an analysis of stakeholder needs to identify the major characteristics of ESL and disengagement from education. This process was conducted with key stakeholders in the four partner-countries representing the relevant categories of i) school principals, ii) teachers and trainers, iii) support staff including those responsible for ICT development iv) employment representatives, v) government representatives vi) youth and social centre workers, vii) university departments, as well as, viii) students themselves. The information was collected using pre-defined tools and instruments, with regard to the preferred and most effective ones for each stakeholder including one-to-one interviews, focus groups, email exchange were the main tools adopted to gather relevant information (Ariana et al., 2014).

1.1 Factors contributing to ESL in Greece

According to qualitative data drawn from interviews with educators, school directors and administrative staff in private and public secondary education schools in Athens, the main educational issues affecting the early dropping out of School and/or VET are family and teachers indifference towards the student, lack of specialized staff and experts in the school premises, old and de-motivational educational systems based on exams as well as the highly stressful workload for the students. The majority of the interviewees highlighted the inadequacy of the educational system to successfully integrate and motivate students with emotional, psychological and behavioural difficulties as additional contributing factors. Both in focus groups, interviews and questionnaires it was highlighted that students with educational difficulties or cognitive disabilities are not easily or promptly assessed and diagnosed, leading most of them away from the educational and vocational training process, while adding extra psychological pressure and lack of self-esteem. Students with intellectual and learning difficulties stated that they sometimes feel they would like to abandon school because of bullying and feelings of inadequacy.

In summary, there is no single policy framework on ESL in Greece. Instead, the ESL agenda is being taken forward within government programmes where three axes are devoted to 'upgrading the quality of education and promotion of social inclusion' in each Greek region. The programme encourages access to and participation in the educational system for all individuals and aims to combat ESL.

1.2 Factors contributing to ESL in the UK

Based on interviews with development officers working within community trust organisations that provides employability workshops and advice for young people classed as 'Not in Education, Employment or Training' (NEET), it was confirmed that lack of confidence, financial reasons, lack of work experience, language issues, communication/social skills, disability, lack of motivation, historic/generational (parents dropped out) cultural expectations, teenage pregnancy, drugs and gangs are all reasons why young people become disengaged from education. Based on discussion with such vulnerable adults, contributing factors to an individual's status as NEET include peer pressure, poor educational experiences, living circumstances (relating to transient nature of students in supported living accommodation), pressure from family to acquire work and earn money and a general lack of interest in education and schooling.

Regional strategies identified to combat ESL in the UK include 'Studio Schools' (a new type of state school model that has been developed in partnership with local and national employers, leading education agencies and government) designed to equip young people with the knowledge, skills and experiences they need to succeed in life and work. Such initiatives offer alternative curriculum programmes which work with pupils that are identified as being most at risk of leaving school with few qualifications and becoming NEET and aim to target young people before they drop out of the system to help them in realising their potential. These initiatives often use environments outside of the traditional classroom context to help re-engage pupils. Alternative curricula and innovative initiatives offered by different providers are all considered to be beneficial by both the young people and UK stakeholders with high levels of positivity being displayed towards the Code RED project and its aims.

1.3 Factors contributing to ESL in Italy

While confirming the key problem with ESL and drop out (Italy showed in 2014 the highest percentage at EU level), the needs analysis process conducted with the major Stakeholders (Professional Higher School Principal, Teachers and Trainers, those Responsible for Student dialogue and ICT development of local Minister of Education, Employment representatives, the Emilia-Romagna Region Responsible for School-VET joint policies

devoted to ESL and drop-outs, the head of the major local NGO working in education sector in many schools, youth and social Centers, community-based projects) led to the following further considerations, based on the experience of addressing ESL and dropping-out in the Provincia di Parma local area within Emilia-Romagna Region. Based on this analysis, three main issues emerged. The first issue involves the need for renewed tools and instruments in favor of Teachers/Trainers and NGOs to face a growing and multifaceted ESL and dropping out risk, linked to the effects of the multi-year crisis. The second involves the need for providing at the same time skills valuable for employers and children themselves (e.g. soft skills, ICT and digital skills). The third involves learning by doing and that effective learning could be positively recognized and possibly certified. That single experiences have a widespread diffusion, so that more and more teachers and trainers can appreciate and apply them. Experimentations in the form of design-based workshops may also help showing how to include the new tools into the school curricula, supporting students at risk of disengagement with devoted extra activities.

2. Location-based games

A location-based game (LBG) is defined as a form of play that is designed to be played on a device in motion and changes the game experience based on the location (Lehman, 2012). In recent years, location-based services have become more popular due to advanced mobile devices that make the use of these services very convenient. With the rise of location-based services location-based games will also gain popularity and become more wide spread. Location-based Services (LBSs) are IT services for providing information that has been created, compiled, selected, or filtered taking into consideration the current locations of the users or those of other persons or mobile devices. Many applications for modern smart phones incorporate LBSs to provide location-based information. This information can be used to give location-based recommendations, provide navigation information, track movement, conveniently communicate the current location to friends, etc. However, it can also be used in the area of entertainment and learning, to create a new kind of games that makes the position of the player an essential part of the game.

Video games are, by their very nature, built around interaction and participation. Jenkins (2006) refers to 'play' as a process of exploration and experimentation, and positions games as 'problem sets' which require iterative approaches to forming solutions. Due to their fundamental difference from traditional video games, LBGs and their associated play have the potential to change the way gaming is perceived by encouraging players to experiment with locations and identities outside of the transitional confines of the classroom. LBGs may also be viewed as contemporary experiments in storytelling which mobilise players by offering new immersive experiences. As defined by Thorburn and Jenkins (2006), this form of 'media transition' seeks to exploit the immersive nature of games and web-based environments to draw upon the player's familiarity with narrative and themes from more traditional forms of media (books, film and television). Due to the fuzzy border between a game and the real world, LBGs may provide an opportunity for players to establish more meaningful connections between story and location via interaction and play in the physical world.

2.1 Game patterns relating to LBG

According to Lehmann (2012), combinations of game patters can be used to utilise player location within a location-based game A popular pattern according to Lehmann is the one referred to in his classification as *Search-and-Find*. The basic concept here is that the player has to reach a destination. This destination is always a fixed point in the game world, meaning that the geolocation for this specific destination does not change. This is also the case if no specific geolocation is given, since the player has then to choose from a range of locations which are fixed. The most famous LBG genre using this pattern is geocaching. In this type of games the player has to find an object which is hidden at certain GPS coordinates. This object is usually a real world box containing various items with the aim of the game to locate the box using the GPS coordinates.

A similar game pattern to Search-and-Find is classified by Lehman as *Follow-the- Path*. In this game pattern the player has to reach a destination; however, the focus is not on the destination itself but on the way the player reaches it. It typically involves comparison with a predefined route similar to a suggestion coming from a navigation system. Finally, *Chase-and-Catch*, is another popular pattern for LBGs which requires the player to hunt a moving object in the game world. This object can be another player, making the game very similar to the traditional children's game tag, or a virtual thing only existing within the game world. Usually the player has to reach the object he is chasing or he has to get to know its current location in order to successfully catch it. The basic concept here is that the destination is frequently changing.

2.2 Challenges relating to LBG

According to Lehmann (2012), LBGs have several challenges to development including battery life, storage capacity, processing power and the problem of telling a story in a location-based environment. Papageorgiou and Kolovou (2015) present an overview of these challenges and suggestions for managing them. According to the authors, the very nature of LBGs, being placed in the physical world and using actual locations and places as their backdrop, poses several challenges to both designers and players, such as energy consumption, network coverage or GPS accuracy. Using GPS on a mobile device while being connected to a wireless Internet at the same time results to high-energy consumption in most devices. Shorter game sessions and offline intervals or content introduced through QR codes can reduce the energy demands of an LBG. Poor reception of GPS signal or inaccuracy of positioning systems can cause interferences to the player's experience. A strategy that may efficiently address this problem is to increase the range of the geolocated virtual objects so that a non-accurate location would have fewer possibilities to interfere with the gameplay. Inadequate wireless internet reception and low cellular coverage. is not unusual in natural areas and in some urban areas as well. Testing the signal of different providers on-site with mobile devices before starting the game could prove useful for two reasons: firstly, to define the field of action for the game more precisely; and secondly to choose a provider that offers the best coverage. Portable hotspots can also be utilised for data sharing in such cases.

3. Design process

Design projects like Code RED reply on input from samples of end-learners who are viewed as participants. However, the multidisciplinary nature of these projects mean that input may be gathered from a variety of participants including teachers, classroom assistants, design consultants, managers, technicians and students. An alternative classification for end-users in these projects is to view them as 'design informants' (Bates et al., 2010) with emphasis on facilitation of design activities with participants whilst minimising input from their educators.

3.1 Design workshop overview

Workshop activities applied the shared design facilitation method of 'Adult-initiated, shared decisions' within Hart's Ladder model of participation (Hart, 1992) where activities are initiated by adults but roles and responsibilities are shared with the young people. Adults may have the initial idea but are willing to share the decision making with informants, viewing it as a collaborative interaction. An initial process of 'co-operative enquiry' (Druin, 2002) allowed informants to explore new design ideas using low-tech prototyping tools including pen-and paper drawings. A subsequent process of 'participatory design' allowed participants to build upon these design using digital design tools such as game authoring software and focused, formal workshop discussions. Finally, a post investigation presentation of work by informants to collaborators is used as an opportunity for participants to reflect on the design process and verify the authenticity of the design documentation produced.

A summary of key objectives for undertaking a short term participatory design project with design informants as part of a wider project can be found in **Error! Reference source not found.**. This template of activities was undertaken as weekly meetings (positioned as workshops) between project participants and investigators (functioning as facilitators to the design process). This template has served as a model of good practice which could be modified by facilitators as required to maximise the potential output based on the characteristics and expectations of the local participant group.

Table 1: Key objectives of a short-term participatory design project

#	Objective	Activities
1	Familiarisation	Introduction of digital tools, examples of previous work, set expectations, discuss deliverables
2	Conceptualisation	Process of co-operative enquiry into game concept, brainstorming and low tech prototyping of ideas
3	Creation	Specify design ideas using template, convert ideas into digital resources
4	Modification	Share resources via play-testing, discuss progress, challenge ideas, revise objectives
5	Presentation	Reflect on design process and discuss role, present results to investigators and educators

3.2 Considerations for LBG development

Mobile games may be particularly suited for creating educational experiences in informal settings. Mobile media and augmented reality has a unique ability to unite the advantages of educational video games with place-based learning (Squire et al., 2007). Participants were encouraged to focus on a story, setting and narrative for their products. This resulted in the production of design artefacts including illustrations, storyboards and design descriptions in the form of computer presentations. Participants were encouraged to keep their idea specific and to consider the tools that will be used for the game, where it will be played, the meaning and message they will convey (e.g. overcoming difficulties in school) together with the media (text, photos, audio, video) they would use.

An important outcome from this process included design documentation used to convey and describe the intentions of participants. This output was considered to be living documents, that is, a piece of work which is continuously improved upon throughout the implementation of the project. Emphasis on intergenerational storytelling and core concepts of location-based game-design employed in other projects (Saridaki and Kolovou, 2014). These design documents were intended to be made of text, images, diagrams, concept art, or any applicable media to better illustrate design decisions. According to Gagnon (2012), the steady adoption of activities such as social networking, micro-blogging and video sharing amongst students represent great value in pursuit of better curricular design. Facilitation of such activities was also a consideration of the design team when designing workshop activities.

Careful considerations were also made for selection of a suitable development platform for the LBG output related to the project. ARIS (Augmented Reality and Interactive Storytelling) is an authoring tool as well as an iPhone application that work together to create mobile, locative, narrative-centric, interactive experiences. ARIS has been chosen as a reference tool among other open-source platform because it offers a multimedia basis of demonstration for the principles of location- based game's design. ARIS platform demonstration covers a broad field of complex game design components, such as geolocation data, fictional non-player characters, location sensitive informational objects, interactive dialogues between players and non-player characters, QR code input and multimedia input. At the same time it offers a solid framework of an active on-line community on issues of educational game design which offers valuable information resources for the participants.

4. Workshop output

4.1 UK workshops

In the UK, workshops worked with Junior college students aged 16 and over as part of scheduled school sessions. Workshops started with 3 groups and were deemed to fit-in with normal school life and activities. Participating students were successful in formulating a game concept suitable for LBG transfer surrounding lifestyle choices such as alcohol and drug abuse which may contribute to ESL. Facilitators acknowledged the high quality of artwork which was created as part of this process and sought to preserve the representation of this artwork in the final game. Some of the themes identified by participants as contributing to ESL include death, relationships, drug and alcohol abuse, family issues (such as divorce) and self-harm. Participants focussed their learning material on drawing connections between such issues and available support services which help young adults overcome such barriers.

4.2 Dora's Box

The above project brief was implemented as a location-based game by Greek partners using the ARIS platform. Dora's Box is a location-based game for the Code RED project. It is based on non-textual content and is intended to be accessible for people with intellectual disabilities. The game uses material scoped from the Code RED design workshops in the UK and is designed to complement curriculum content relating the identification and removal of barriers to employment amongst young adults. The game focuses on the presentation of positive and negative factors which are associated with ESL. Positive factors which are presented within the game include recognizing skills and abilities, coping with stress and keeping healthy, personal hygiene, language skills and commitment. Negative factors which the game addresses include the consequences of a loss of self-esteem, understanding anger and aggression, problems relating to stress and advice relating to bullying and abuse. The game is designed in ARIS 1.0 editor for iOS devices using the ARIS app.

The game is inspired by the myth of Pandora and curiosity to learn more about a topic of interest. These themes are adapted as part of the game design to focus on 'good' and 'evil' collectables released from a box (Dora) which are then concealed within identical vessels for collection by the player. The player must approach the location where each of these are stored (within the virtual space) to open them and learn more about their contents. The game is set in physical space while the setting is defined by the player's location. This makes the game playable anywhere and it is not dependent the environmental properties of any particular location or country. The genre of the game is defined as a collection game using speed and strategy to complete the tasks. The player aim is therefore to approach the physical location of virtual objects using a game map interface before they disappear. The player must identify positive themes which these objects represent (and collect them) whilst separating their negatively themed counterpart for disposal.

The game allows items to appear on the map gradually using a predefined algorithm for positioning content using principles relating to Lehman's (2012) Chase-and-Catch game classification. Negative items can be ignored when found and viewed by the player without reappearing on the virtual map. The game is completed when the player has collected and assembled all of the positively themed objects relating to ESL and dropout. After the game has concluded, a player may access an inventory of items for review and reflection. This can be extended into discussions with physical teachers using the visual imagery displayed in the game window. Other learning themes which may be addressed by this game include familiarization with mobile technology, using a map and orientation around a physical space, separation of content based on selection criteria and the ability to make choices in real time. A visual overview of key tasks within the game can be found in Figure 1.

Figure 1: Example of interface design for key tasks within Dora's Box location-based game

4.3 Greek and Italian workshops

Greek game design workshops took place in a welfare, non-profit, non-governmental organization supervised by the Ministry of Labour Social Security and Welfare. This Foundation offers services to children and young people with intellectual disability and other developmental disorders as well as giving support to their families. The participating workshop group was formed by students 14-18 years, teachers and members of the scientific staff of the foundation. Students would design location based games using open web platforms and smartphones. A location-based game (or location-enabled game) is one in which the gameplay somehow evolves and progresses via a player's location. Thus, location-based games almost always support some kind of localization technology. The participating school formed a game design team, they discussed about games and game design.

The ideas for implementation as a final product were combined with output from Italian partners within the Code RED project involving six children (four males and two females) and six adults (the researcher, the digital facilitator, the relational facilitator, two participants from local Job Centres dealing with young adults at risk of become NEET, one participant from VET Centres not directly engaged with children courses and classes). Italian

participants were successful in designing an orienteering-based LBG to promote cultural heritage via exploration of local landmark in the form of an ancient castle. Participants selected a game based on a journey in stages to get the exit through the reconstruction of a map of a local landmark. The idea enabled players to assemble pieces of a map and information relating to the different environments in which the character interacts whilst being directed by a non-playable character within a fictional setting.

4.4 Eve's World

The key themes from this concept were mapped into a design document by project investigators to create an LBG to target educational de-motivation and dropout from IVET. This process was guided by workshop output and game design principles relating to the 'Hero's Journey' as described by Campbell (1949). Other considerations were made for embedding exploration, humour, popular cultural references, text, video, emoticons all to draw a connection with real life situations.

The player is asked to participate in an adventure role playing game as the main character of the game. The setting is a game-design workshop which the player decides to skip due to lack of interest. The character's mobile phone is used as a 'gimmick' in this scenario for communicating with a fictional virtual character belonging to an old fictional videogame. The virtual character (Eve) asks the player to create a new game world for her to live in. In order to achieve that the player is introduced to the basic notions of the CODE Red Curriculum such as building language skills, taking responsibilities managing tasks while being introduced to the game design platform of ARIS. During the game the player meets more virtual characters which add to the plot such as classmates, a group of older children bullying one of the player's companions, and the workshop facilitator. The player is rewarded throughout the game by collecting points of leadership, charisma, commitment and self-esteem for achieving each task asked by the game, while losing boredom points that initially made the player to abandon the classroom.

The learning value of the game focuses in the positive turnout of the everyday decision-making routine of a teenager who lacks interest in school. The players are introduced to the value of developing their skills in an engaging playful context. Moreover, an introduction to the basics of LBG design is made using the interactive content of the LBG as guidelines. A visual overview of key tasks within the game can be found in Figure 2.

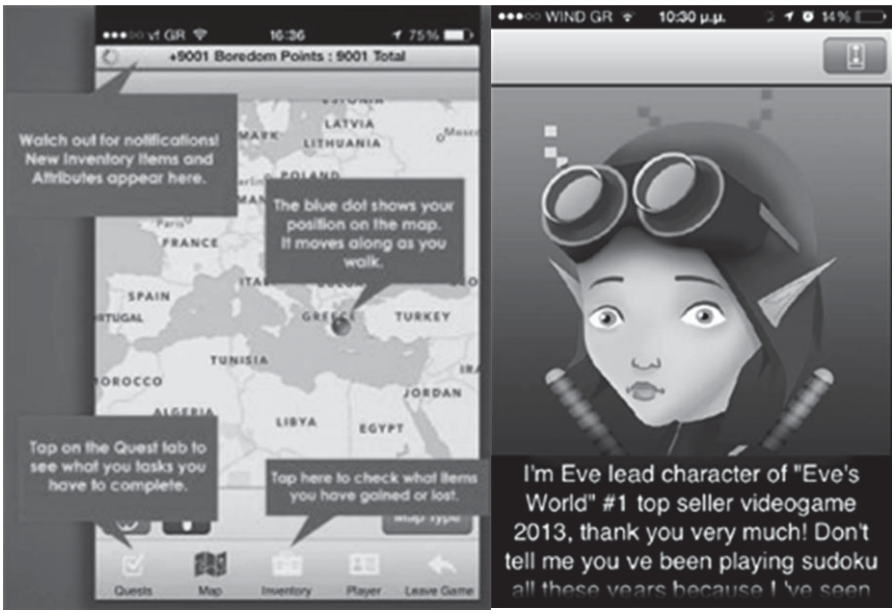

Figure 2: Example of interface design for key tasks within Eve's World location-based game

5. Closing comments

The Code RED project has successfully made use of the ARIS platform to implement location-based-gaming solutions which attempt to tackle the issues contributing to ESL within the EU. These products have been co-designed with target users who were able to reflect upon the importance of education and its relevance to them as young adults as part of the associated design activities. This result will inform future project output which

seeks to extend existing employability curriculums to enable teachers and trainers to deliver co-design activities in the form of an open standards and accessible e-Learning environment.

The LBG output from the Code RED is scheduled to be piloted with end-users in 2015 to assess the effectiveness of these tools in addressing dropout from IVET and ESL in the EU. These 'proof-of-concept' materials may also be used to address factors contributing to ESL in the EU (in particular low self-esteem) by valuing all contributions made by young adults via the collaborative construction of new educational materials.

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