# Integrated intelligent LEARNing environment for Reading and Writing

D5.1 – Game Scenarios

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| **Abstract** | This deliverable describes the process and final outcome of the game design. That includes the specification of game scenarios, the description of the play and adventure modes and the details about the visualization of the user profile. |





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# Table of Content

# 1. Introduction

The ILearnRW system integrates several software components to help children with dyslexia to improve their literacy skills. From the point of view of the user, the system implements two main components: a reader and a game. In this document, we describe work conducted towards achieving the design of the latter. The objectives of this deliverable as described in the description of work are as follows:

1. To design game scenarios which induce effective learning for children with dyslexia/ dysorthographia.

2. To design game interfaces and interactions.

For this project we define game scenarios as the parts of the game that explicitly integrate a learning activity. Thus, the design of the game scenarios draws directly from the activities that Dyslexia Action, EPIRUS and Institute of Education have already defined (D3.5), with the design serving as a cohesive, motivational game "skin". This connection assures that the game scenarios present effective learning exercises identified by dyslexia experts. Note that the scope of the game will be limited to the dyslexia difficulties identified in D3.2 and D3.5, as the learning activities underlying the game were established with those difficulties in mind.

We point out that our design is based on the principle that in order to be successful, a learning (or serious) game should present a game world that is sufficiently engaging as to motivate players/ students to continue playing, while simultaneously deeply embedding learning activities within game mechanics. In other words, one of the goals of the design is that students should decide to play because they find the game world engaging and not only because they want to work on their reading and writing skills. Following this principle, as opposed to bundling together the learning activities presented in D3.5 with an umbrella theme, our design begins from the premise of an interesting game world, and then re-orients the activities defined by experts accordingly. As such, this deliverable describes the design of the overall game as well as the adaptation of the learning activities into the interfaces and interactions of appropriate game scenarios. Note that this document covers only the design of the game and its related components, and the final details of each game element will be later described in the Serious Game deliverable (D5.3).

Alongside the learning activities, the design of the game is constrained by other user requirements. First of all, the updated user requirements (D3.5) specified two complementary game modes for the ILearnRW system: the *Adventure* mode, in which a complete game integrates learning activities, and the *Play* mode, in which the learning activities can be accessed by directly bypassing the game world. In order to create a cohesive system, both modes have been designed together, achieving a maximal integration between them. A third component that has been coupled with the game modes is the visualization of the learning progress stored within the user model (D4.1). The design of both modes and the visualization system are described in this document as they both feed into a unified system which in addition extends a connection to the *Reader*.

Two more user requirements have a direct impact on the game design: the need for extensibility, and for re-playability. The former includes both the possibility of adding more literary content as well as additional learning activities to the ones considered in the user requirements. The latter refers to the

ability of the system to engage users after subsequent playing sessions over months or even years. We detail how the design accommodates these requirements and how the game could potentially be extended in the section on future work.

To explain the design process, inclusion of constraints, user research insights, and final detailed design, this document is structured as follows: Section 2 surveys the most relevant work on dyslexia and games outside this project, Section 3 describes the user studies and participatory design work we have conducted thus far, Section 4 describes the iterations of the design of the game modes, the game scenarios, and our reasons for drawing the *Play* and *Adventure* modes closer together, Section 5 and Section 6 detail the integration among modes and the visualisation, and the specification of the final game scenarios, respectively, Section 7 describes the initial progress of the development, and Section 8 lays out plans for future work.

# 2. Related Work

The State of the Art and User Requirements deliverable (D3.1) contains a survey of software systems used to diagnose learning difficulties or to assist learners with special needs. These are mostly systems that assist reading and writing such as *Clicker 6* (Crick software, 2012) and *Read & Write Gold* (Texthelp Ltd, 1996) or meta-cognition skills such as visual memory in *Memory Booster* (Lucid research Ltd, 1995). We extend that survey with a list of dyslexia-related games which are more directly related to the work described in this document. We focus on games which have been formally evaluated with studies published on peer-reviewed studies. There exists a larger number of commercial games, some of which have been evaluated by Dyslexia Action as part of the collection of user requirements. However, none of these games present distinctive features which are not represented in the following survey, for instance having a story-plot (e.g. *WordTreasure* (I-imagine Interactive, 2011)) or only mini-games (e.g. *MonkeyWord* (THUP Games LLC, 2013) and *Letter Attack* (Hefty Apps, 2013)), or featuring one type of activity as (e.g. *Spellwood* (SEGA, 2013)) or several (e.g. *Dyseggxia* (Rello, Bayarri and Gorriz, 2012) and *Phonics Town* (BluePinCon Co. Ltd., 2013)).

Before delving into the work on digital systems, it is worth mentioning that there exists a large number of non-digital games targeting learners with dyslexia in the form of card or board games. These games are often used by teachers in the classrooms during dyslexia interventions. For instance, Smart Kids Ltd[1]. offers a large catalogue of games targeting among other skills spelling and phonological awareness. We have decided to limit our review to digital games as these implement the same ideas found on these non-digital games, and they are closer to our work.

Arguably, the first popular digital games for children with dyslexia are *Daisy Quest & Daisy's Castle,* which were developed by Instructional Fair in the early 90s. These games are designed to work on phonological awareness. They feature a fairytale story in which the student has to discover clues that guide her towards finding a dragon. The clues are awarded by successfully solving language-related exercises. Several studies from different authors (e.g (Barker and Torgersen, 1995)) have validated that this approach is effective in serving as a great motivation for game-supported dyslexia interventions. Our game follows a similar principle of using learning activities as a means to discover the game world; the main difference with our design is that we have to support extensive re-playability, in which a linear story-plot poses problems. Another substantial difference is that our game allows students to work on a wide variety of skills including and beyond phonological awareness.

*Nessy Learning Programme* (Nessy, 2007) is an interactive literacy development suite that includes a substantial number of game activities targeting different skills such as spelling and segmentation. All activities are framed within a general theme centred around a friendly Loch Ness monster. The game features a structured literacy program which recommends a progression of lessons and also keeps track of students' mistakes; however, the system is designed to be used under supervision, and a teacher is required to program which activities will be played. *WordShark* (White Space Ltd, 1998) is an alternative game-like application that is often used by special-needs teachers. This suite contains a large number of literacy-related activities weakly connected through an overarching fish/sharks theme. Although it presents bulky graphics, this suite contains a rich resource pool with pictures and words,

[1] http://www.smartkids.co.uk

and provides a multi-sensory interface that includes text-to-speech. It is enjoyable for students and appears to aid literacy development (Singleton and Simmons, 2001). Similarly to these systems, the game designed as part of ILearnRW implements the principles of multi-sensory teaching and integrates a number of learning activities that potentially utilise a large amount of literacy resources. On the other hand, our design differs significantly from these tools as it not only ties together a set of activities within a common theme, but describes a rich virtual world which users can engage with not only as students, but also as players. That is, the main goal for users is to explore and engage with the world and its characters, as opposed to solving individual learning activities. In addition, our game will implement an autonomous lesson planning system to reduce teacher dependency; this part of the system is described in the Interface and Game-scenario Adaptation Mechanisms deliverable (D4.3).

*Tradislexia* is a game developed to diagnose dyslexia-related literacy difficulties targeted towards Spanish students. The game is described as an adventure game and integrates activities to develop several literacy skills. This system tailors the content of the activities to the particular dyslexia profile and difficulty diagnosed by the system (Moreno et al., 2002), (Jiménez et al., 2009). An empirical evaluation showed that the game improves phonological awareness (Jiménez and Rojas, 2008). Despite its success in classrooms, the public information available about this game indicates that it does not include features to follow up the progression throughout the game, which is a key feature in our system to maintain interest across subsequent game sessions, i.e. to support re-playability.

All the games mentioned above have a common denominator: they integrate activities which are directly related to literacy skills. *Fast forWord* (Scientific Learning,1996) explores an alternative approach in which activities mainly target non-literacy skills such as memory and temporal discrimination. Following results reported in two *Science* articles (Tallal et al., 1996), (Merzenich, 1993), such activities and skills indirectly improve skills that contribute to better reading. While the media coverage of this line of research has been wide, many experts are skeptical of these results given the small size of the evaluation groups, and thus, this project focuses on more traditional and widely-accepted methods to work on dyslexia. In a similar line of research, and surrounded by even more skepticism, some studies (McGraw, 2005), (Franceschini et al., 2013) claim that the use of commercial entertainment games such as *Dance Dance Revolution* (Nintendo, 1998) and *Raynman Raving Rabbids* (Ubisoft, 2006) can help children with dyslexia or attention disorders[2] to improve their reading skills. Similar criticisms related to the size of the evaluation groups argue against the generality of the reported effects, thus these approaches have not been considered in the design of the ILearnRW game.

In summary, we can conclude that games can be a useful tool to aid the development of literacy skills of students with dyslexia. Our design features several aspects of other successful games, for example, combining different kinds of activities and contents to exercise different skills, monitoring students' progress, presenting an engaging game world to the students, and being suitable for use in a classroom. At the same time, our design has several differences to, and innovates above what is currently available. These differences are summarised as follows:

[2]Attention disorders are also very common among students with dyslexia (Rose, 2009).

- We seek to create an engaging game that integrates a wide variety of learning activities as actions meaningful within the game world (rather than a suite of activities that share a common theme).
- Our game will support unbounded re-playability, which, in turn, will not disrupt the game narrative.
- The game will present a view of the game progress that also reflects on learning progress.
- The game can be used in the classroom or at home, either for short play sessions or for longer durations.
- The game will automatically propose suitable activities and content tailored to the student, and will not be reliant on the teacher to provide an activity progression plan.
- Game content can be drawn from other material the user is currently working with in the broader ILearnRW system.
- The game world and narrative will be designed to appeal to an audience older than that targeted by most of the currently available games.

# 3. User Studies

In this section, we detail how we have involved users in the game design process to date. In many facets of ILearnRW so far, we have adopted a participatory design approach. The game design task also seemed like a process that would significantly benefit from a participatory approach, thus we conducted user studies with children from the target age group to shed insight into viable design directions as the game design evolved. Here we report on the two forms of studies with children, namely, focus groups and design workshops. It is important to note that prior to the commencement of these studies the appropriate university ethics procedures were followed and ethical approval for the proposed studies was given the University of Birmingham ethics committee (with this approval successfully transferred to the Institute of Education).

## 3.1. Focus Groups

The focus groups took place before we had developed an initial game concept. In this early phase, we focused more generally on finding out about the computer games children within our target age group (9-11) were currently playing and why. Additionally we wanted to know what children of this age group defined as a 'good' game to ensure we use the right building blocks within our game. It was important that our game had a general appeal within this age group because otherwise this could cause issues for children with dyslexia not wanting to be seen playing the game by their peers, thus reducing their motivation to use the system. As a child matures and increasingly seeks to establish his or her independence, their peer group starts to play a more important role within this process and has a greater impact on that child's behaviour and decisions. Fine (1987) describes the development of an 'idioculture' within these peer groups, which can encompass a system of jokes, fashion, artifacts etc. Ownership of modern day artifacts such as mobile devices and computer games often hold great importance within young people's peer groups. Ling (2001) explored the role of mobile phone ownership in relation to young peoples' sense of identity within this peer culture, stating that the mobile phone is "not simply functional device used for communication but rather is an element in the very presentation of self". He found that aspects such as the age, size, model number, facade, colour, and accessories as well as the specific functions available on the mobile phone were all important consideration within this peer culture. Within the context of computer games Fromme (2003) explored the social context of children's gaming cultures and found that children's friends were the "most important advisors and mediators in game-related matters" and that computer gaming appeared to be fully integrated into existing peer relationships. With this in mind within the context of this project we wanted to explore the following high-level research question:

> *How are computer games representative of identity and peer culture and what aspects of computer games are particularly important to consider for children within our target age group (ages 9-11 years)?*

Through our investigations of children's game play, we wanted to focus on a number of specific questions that relate to our high-level research question, which included:

1. What is the typical context of children's computer game play within our target group?
2. What types of graphical styles are most appealing to children within our target group?

3. What kinds of game scenarios are most appealing to children within our target group?

### 3.1.1. Participants

In order to explore this we undertook four separate focus groups at two UK primary schools, both in London, with children within this age group. School A was located in an affluent area of London and School B was located in a more socially deprived area. The focus groups took place at the children's school in a separate classroom, at each of the schools. One focus group included six girls and one focus group included six boys from either year 5 or 6 (ages 9-10 or 10-11 years), with a total of 24 children taking part, i.e. 12 children from each school. The groups were split by gender due to existing guidelines for undertaking focus groups with this age group (Vaughn et al., 1996). Between the ages of 4 and 12 years children spend increasing amounts of their time outside the classroom socialising in single sex groups (Maccoby, 2002), which result in the formation of gendered subcultures. Therefore splitting the group by gender was important considering our research question and the fact that within our target age group children are more likely to belong to the same gender friend networks.

### 3.1.2. Procedure

Each focus group lasted approximately one hour and was audio recorded and later transcribed. The purpose and plan for the focus group was shared with the children at the start, and they were given the opportunity to not participate and go back to class if they wished. All of the children stated that they wanted to continue with the session and completed a consent form to indicate this (see appendix 1.1). The consent form used was designed specifically for children, including picture representations of the statements, with simplified text that was read aloud by a researcher to ensure the children understood what the form contained. The children's parents were also provided with information about the project and asked to provide their consent for their child's participation in the project and for the session to be audio recorded (see appendix 1.2).

In each focus group, we wanted to gain insight into the following themes, guided by the specific research questions stated above:

1. The types of computer games the children play and on what platforms (RQ1)
2. How often they play games and who with (RQ1)
3. How playing computer games makes them feel (RQ1)
4. Preferences for graphical styles (RQ2)
5. Preferences for existing games aimed at target age group (RQ3)
6. Thoughts and ideas based on initial game concepts for ILearnRW game (RQ3)

We used a range of techniques to elicit this information during the session including verbal discussions supported by relevant images of different computer platforms displayed on a laptop computer as well as employing a survey toolkit developed for use with children in conjunction with existing children's computer game images and videos. Having some activities that involved the children noting down their preferences for styles and types of computer game without having to verbally express their


**Figure 1 – Smileyometer Rating Scale**

opinion allowed all children to contribute to the session even if they did not want to say anything out loud.

For activities 4 and 5 (above) the children were provided with a paper-based survey to complete. Each survey included a *smileyometer* rating scale (see Figure 1), a survey instrument developed by Read and MacFarlane (2006) specifically for children, which the children completed to indicate their liking for that particular computer game or game idea (i.e. from Awful to Brilliant). For activity 4 the children rated each of the 10 existing computer game screenshots on a paper-based survey, rating them based on the style/graphics of the game (see appendix 2). For activity 5 the children were shown a video clip of 5 existing children's computer games and then asked to complete a paper-based survey containing screenshots of each of the computer games, rating each of the games based on their overall appeal (see appendix 2). While there exist a number of well-known limitations of ratings related among others to order effects and the subjective interpretation of the scale (Yannakakis and Hallam, 2011), they were used in combination with verbal discussions which help us extract more reliable conclusions.

### 3.1.3. Analysis

The transcriptions from each focus group were analysed using a thematic analysis (Braun and Clarke, 2006) alongside the results of the paper-based preference surveys (completed by the children during the focus group sessions) to establish the key themes that would be important to take into account in the game design. The findings from this analysis are presented below, structured by the high-level themes.

### 3.1.4. Findings

***Previous computer game experiences***

The majority of the children across the focus groups appeared to have extensive previous experience of playing computer games and owned or had access to multiple devices including desktop/laptop computers, tablets (e.g. iPad, Kindle, Kurio), handheld game consoles and mobile devices (e.g. Nintendo DS, iPod, smartphones, PlayStation Portable (PSP)), as well as other game consoles (e.g. Nintendo Wii, xBox, PlayStation 3). Many of the children reported spending a significant amount of their time playing on computer games, e.g. "I usually play for about 3 hours [a day]", "Three times a week", "9.5 hours a week". However, some of the children mentioned that their game play time was restricted by their parents to moderate access to certain devices between siblings or to ensure that the game play didn't impact their schoolwork, e.g. "my parents got a bit fed up with me playing them [computer games] because I was on the computer every day and they said I had to start doing more work". The children also discussed playing computer games as a way of socialising with others such as friends, family (mainly siblings), and other online players they did not know as well as playing by themselves.

These findings indicate that many of the children in our target age group would potentially be familiar with typical game mechanics and be comfortable playing games on a range of platforms. They would also be happy to play both single player and multiplayer games. However, this extensive experience may bring with it high expectations for any new game meeting the high quality appearance and professional standards of the typical games they interact with on a daily or weekly basis. Furthermore given parents' reservations about extensive computer game play impacting their children's schoolwork integrating learning within this game play may be something that is welcomed by both parents and children.

***Age appropriateness***

When the children were asked about their favourite games many of the children, particularly the boys, revealed that they liked playing games targeted at much older gamers (e.g. 18+). In all of the focus groups a dislike for babyish or childish platforms, games or graphics was expressed, e.g. "What's a Kurio? It's a boring kiddie tablet", "It doesn't really look like a fun game it just looks like plants, it looks like tiny things for babies". One of the girls also said "I like sad stories and mysterious stories, but maybe some people who are a bit younger or who are immature for their age would get a bit upset". This suggests that some children may be actively using their choice of specific games to appear older and more mature than others within their peer group. It is also possible that it could be linked to children's increasing desire to be seen as more independent as they get older. As many of their activities are often regulated by parents or teachers, choosing to play a computer game that would not typically be allowed by a parent/teacher may be a way of expressing this independence (Kernan and Devine, 2010).

These findings indicate the importance of a game avoiding any graphics or references that may appear childish to this age group and for the game to be designed in such a way that would also appeal to children older than 11 whilst still incorporating age appropriate content.

***Gender differences***

As previously mentioned, children within our target age group are more likely to socialise within peer groups of the same gender, resulting in the formation of gendered subcultures (Maccoby, 2002). These gender differences in relation to computer games were clearly observed between the girls and boys focus groups. The boys typically expressed preferences for games that were violence-based (e.g. *Call of Duty*) or sports-themed (e.g. *Fifa*), whereas some of the girls (but not all) expressed a specific dislike for violence within games "Awful, looks awful, not very good actually because it has violence" or a concern for a game containing violence being inappropriate for use in school. The girls expressed preferences for games that incorporated themes linked to fashion, dance and recent animated movies (e.g. Oz the Great and Powerful, Brave). The girls in both groups also expressed preferences for specific games, particularly *Temple Run* and *Subway Surfers*, which are endless running games underpinned by a basic narrative. During the general game discussions some of the children also made comments that reinforced these gender specific views of games, e.g. one girl saying "I'm going to say ok for boys" and one boy saying "I don't like fantasy, no offence, but it seems like a girls thing fantasy". However, there were also commonalities between the two genders, both the boys and the girls expressed a liking for the *Super Mario* style games and also a desire for a particular game style or specific game elements, which are discussed in more detail below.

| | School A | | School B | | Total |
|---|---|---|---|---|---|
| **Game Images** | **Boys** | **Girls** | **Boys** | **Girls** | |
|  Super Mario Land 3D | 5 | 4 | 2 | 3 | 14 |
|  Legend of Zelda | 1 | 3 | 5 | 2 | 11 |
| Beat Sneak Bandit | 0 | 1 | 1 | 2 | 4 |
| Triple Town | 1 | 1 | 1 | 1 | 4 |
| Botanicula | 0 | 0 | 0 | 3 | 3 |
| Mikey Shorts | 1 | 0 | 1 | 1 | 3 |
| Reus | 1 | 0 | 1 | 0 | 2 |
| Professor Layton | 0 | 1 | 0 | 0 | 1 |
| Pikmin | 0 | 0 | 0 | 1 | 1 |

**Table 1 – Number of children giving top ranking for game style (Brilliant)**

These findings indicate a need to carefully consider and avoid certain game themes, styles and elements that could be associated with a specific gender, to ensure that the game has a wider appeal across the target age group. Although gender differences within this age group do tend to be quite distinct, the focus groups have revealed there are some games that appeal to both boys and girls, such as *Super Mario*, demonstrating the possibility of designing a gender inclusive game.

### *Game appearance*

During the focus groups it emerged that the game appearance was really important to the children and poor quality graphics were unacceptable "[I don't like it] because they are pixelated and not very good, it looks like they had £1 to make the animation". Children in three of the groups also mentioned the importance of the game graphics looking realistic e.g. "It looks good because it looks really realistic and it looks like old times" and "[I don't like it because] I think it looks really really unreal". There was a split of opinion over whether games should be 3D or not, some children thought that 3D games were good, e.g. "The way they just like show it in 3D is very bold and eye-catching", in contrast to others who didn't see the point, "If you were playing that you wouldn't be focusing on the 3D you would just be focusing on getting to the end, so the 3D is just a waste of time and a waste of money".

The surveys intended to establish preferences for game style/graphics revealed two clear favourites amongst the children (see Table 1). Within School A both the boys and the girls indicated a preference for *Super Mario Land 3D*, with 5 boys and 4 girls giving it the top ranking. At School B this was also a favourably liked game by some of the children with 2 boys and 3 girls ranking it as Brilliant. The second game that was preferred was the *Legend of Zelda*, with 1 boy and 3 girls at School A as well as 5 boys and 2 girls at School B ranked it top. These games had the greatest number of children giving them the top ranking, however there were some children (3 children for *Super Mario Land 3D* and 6 children for *Legend of Zelda*) that ranked these games as Awful or Not Very Good. This highlights some differences in preferences between individual children in the groups and indicates the difficulty in designing a game that has a wide appeal amongst this age group.

These findings indicate that the game graphics should be high quality, realistic and colourful in order to appeal to children within the target age group.

### *Game type*

The importance of games having a narrative was raised repeatedly in the focus groups and also reflected in the children's game preferences, e.g. "I like something to have a background story like Mario", "For the mini games I think that's not very good because you need the storyline behind it or some kind of basis". Although the children did play mini games with no narrative, they were rarely engaged in them for any extended periods of time, e.g. "there's this website called A game [mini game website], I play one game and I get really bored of it". Part of the reason for the appeal of a narrative is to provide a reason for certain events happening within a game, which was important for the children's motivation, e.g. ""All I see is the house sinking and I don't know why and then when they come fighting these things I don't know why they are fighting it". However, it may not be necessary for the narrative to be highly complex, for instance the endless running games that were favoured by the girls only incorporated a basic narrative to set up the game. This also supports the desire for the game world to have no specific ending, having "endless levels", with one boy suggesting "like my uncle has this game called *Animal Crossing* [community simulation video game with open-ended gameplay], so you never finish it, it's literally impossible…so I think it should be like that" and it should also be open, e.g. "games like you could just do whatever you want and there's no one telling you what to do". Children in both the girls and boys groups were also keen on missions or quests being incorporated into the game, e.g. "You can actually use missions with spelling" and "The quest

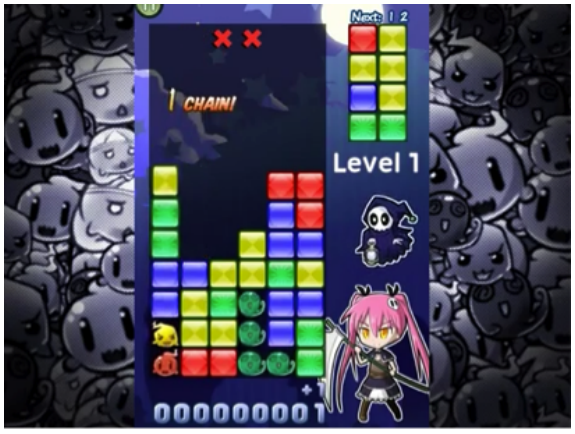
| | School A | | School B | | Total |
|---|---|---|---|---|---|
| **Game Videos** | **Boys** | **Girls** | **Boys** | **Girls** | **Total** |
|  Max and the Magic Marker | 6 | 5 | 0 | 5 | 16 |
|  Beat Sneak Bandit | 0 | 4 | 0 | 2 | 6 |
| Ghost Puzzle | 0 | 0 | 5 | 0 | 5 |
| Professor Layton and the Miracle Mask | 1 | 1 | 0 | 1 | 3 |
| Puzzle Agent 2 | 0 | 2 | 0 | 1 | 3 |

**Table 2 – Number of children giving top ranking for overall game (Brilliant)**

would be about the learning game and like you can read the quest and then after you need to write to complete your quest".

After being shown the example computer game videos, there was a clear favourite amongst three of the focus groups (see Table 2), with 6 boys (from School A) and 10 girls across the two schools giving *Max and the Magic Marker*, a platform game, the top rating. Within the boys group from School B, 5 out of the 6 boys rated *Ghost Puzzle*, a Tetris-style puzzle game, as Brilliant. One girl said she liked *Max and the Magic Marker* because it was "like a puzzle" and one boy said he liked *Ghost Puzzle* because "because you get to level up and it's getting more harder, like you have to use your brain".

The appeal of puzzles was also highlighted in other groups, "I thought of puzzles and stuff like that. I thought of MI6 or MI5 or something like that because they are spies and they deal with cases and I like it as well because it's fun", but the children also wanted the games they played to be action-

packed "I like this one because…it's kind of like action and it's kind of fun because you're going on quests" and fast-paced "I hate everything to do with mysteries, it takes too long".

Lastly the children also talked about how they thought a game should reward them for doing well. Children from both the girls and boys groups discussed the possibility of unlocking further levels or unlocking particular items such as gadgets or potions. The girls also mentioned earning money and the boys spoke about being awarded trophies. Within School B there was a strong certificate-based reward culture and it became clear that receiving certificates was really important for these children as both groups from this school suggested the game could award certificates, but this was not discussed in the School A groups.

These findings indicate a need for the game to include at least a basic narrative, for it to be set in an extendable and open world, and for the learning activities within the game to potentially take the form of missions or quests, which are puzzle-based and fast-paced. It is also possible that the particular school culture could impact on what children at that school place value on in terms of reward and this feature may need to be customisable by the teachers/parents.

### 3.1.5. Methodological insights from focus groups

One point that was frequently raised as a reason for liking particular games was that it was similar to another game they had played previously and liked e.g. "[I liked it because] it reminded me of *Tetris* and the graphics". Many of the children recognised and had previously played both *Super Mario Land 3D* and *Legend of Zelda* therefore this may have had an impact on their ratings. The children had played some of the existing games shown during the focus groups and not others, and this varied from group to group, however widely popular games such as *Super Mario Land 3D* and *Legend of Zelda* were familiar to all of the children. Therefore it is important to note that this familiarity may have had a significant impact on the results of the focus groups. Familiarity did not automatically mean the children liked the game as some games they had played before they did not like and would not play again, but if the children were both familiar with and liked a game they typically liked these game styles more than those games that they liked the graphics of but were not familiar with.

Some of the children's preferences were clearly influenced by the opinions of their peers, with many of the children interested in what ratings other children in the group had given the games, commenting on what others had written as well as discussing their opinion with other children in the group. These discussions sometimes resulted in children changing their ratings, but some children did have the confidence to defend their choice and go against the rest of the group. In terms of the research question that this study was exploring we were interested in the preferences of the peer group rather than the individual child, considering our earlier discussion and the findings from these focus groups it is clear that this peer influence would also occur in relation to the new game and therefore it is not a concern that this peer influence occurred during the focus groups. These peer group preferences are something that needs to be taken into account during the game design, with the important game design aspects raised during the focus groups summarised below.

### 3.1.6. Key considerations for game design from focus groups

- The graphical styling of the game should be non-childish and gender inclusive.
- The graphics should be high quality, realistic and colourful.

- The game should include a basic narrative.
- The game world should be extendable and open.
- The learning activities could be represented as missions/quests, as well as be puzzle-based and fast-paced.
- The rewards should have some element of customisation or choice.

## 3.2. Design Workshops

In addition to the focus groups, at a later design stage we undertook a series of design workshops to explore our games ideas in more detail. Within the User Requirements (see D3.5) through our examination of best dyslexia teaching practices, the importance of incorporating appropriate strategies to increase the children's motivation and bolster their self confidence was identified. Self-confidence is also referred to within the education literature as self-efficacy (Linnenbrink and Pintrich, 2003), which is an individual's perception of their ability to undertake a given task within a specific situation (Bandura, 1986). Self-efficacy is seen as a key motivational construct (Linnenbrink and Pintrich, 2003). A learner's motivational engagement in a learning activity is typically influenced by two key considerations:

- Am I able to do this task? i.e. a learner's self efficacy in relation to the specific task/context.
- Why should I do this task? i.e a learner's interest in the task, belief that the task is both useful and important, affective experience in relation to the task.

Focusing on these motivational constructs within the game design could potentially help promote a child's engagement and success within their learning, which in turn can boost self esteem (an individual's sense of self-worth), one of the learning goals of the project (see D3.1). Therefore the research question that we wanted to explore was:

> *When designing a learning game for children with reading/writing difficulties what are the important aspects that should be considered in order to promote their motivation within the game?*

### 3.2.1. Methodology: the development of a new PD framework

An existing participatory design (PD) method called IDEAS, tailored for use with children with autism, was used as a basis for planning the design workshops (see Benton et al. 2012). This method was chosen due to the overlaps between autism and dyslexia such as the fact it was partly designed to capitalise on the visual-spatial strengths of children with autism, which are also typically found within the population with dyslexia and also that the additional structure/supportive elements the method incorporated could be adapted to the specific needs of the child participants with other neurological conditions.

Our intention within this project was to adapt the IDEAS method into a more general design framework that could be used with children with a range of neurological conditions including autism, dyslexia and attention deficit hyperactivity disorder (ADHD). These conditions all come under the heading of 'neurodiversity', which is a movement that seeks to reframe the perception of these

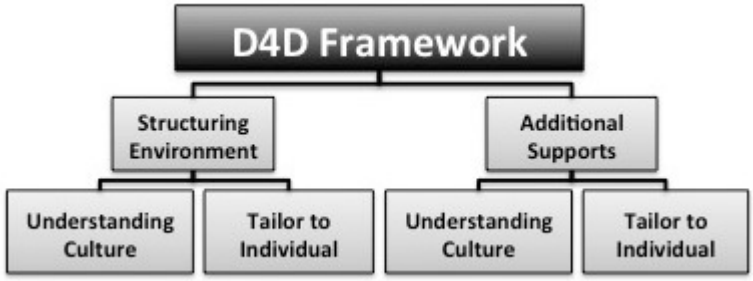



**Figure 2 – Diversity for Design (D4D) framework**

conditions as alternative cognitive processing styles and to highlight the multiple strengths associated with these conditions. For instance dyslexia is often linked to strengths in divergent/innovative thinking, creativity and visual-spatial skills (amongst others) (Armstrong, 2010). The IDEAS method was based on TEACCH (Treatment and Education of Autistic and related Communication handicapped CHildren), which is an educational program for children with autism that emphasises the children's strengths and incorporates a number of teaching or treatment principles which form the basis of the method (Mesibov et al. 2007). These principles include:

1. *Understanding Culture* - i.e. responding to the neurological condition as a culture, taking into account characteristic thought patterns and behaviours
2. *Tailoring to the Individual* - i.e. creating flexible and individualised concepts and methods
3. *Structuring the Environment* - i.e. making situational modifications based on an individual's ability level and approach to understanding/learning
4. *Providing Supports* - i.e. incorporating activity-specific supports to increase understanding

Based on these principles a new PD framework for Neurodiversity was proposed, which we call Diversity for Design (D4D) - see Figure 2. In abstracting the main TEACCH principles, we claim that the program's philosophy can be generalised to apply to a wider neurodiverse population, including dyslexia. Moreover, as Mesibov et al. (2007) highlight, characteristics of ASD can also exist in conditions such as ADHD and Obsessive Compulsive Disorder (OCD), as well as in typically developing children, for instance the attention to detail in ASD and OCD. This suggests structuring the environment or incorporating supports that capitalize on typical ASD strengths could benefit children with other neurodiverse conditions associated with similar strengths (or difficulties).

In order to adapt the above framework for use during design workshops involving children with dyslexia we first undertook a review of relevant literature, in particular looking at a recent review of dyslexia (Rose, 2009). This resulted in an initial version of a dyslexia specific D4D framework (Figure 3 - white boxes). We then undertook a series of design workshops using this initial framework to inform the approach, which are described below, and updated the framework based on the outcomes of these sessions (Figure 3 - grey boxes). This work has been published in Benton et al. (in press) which provides more information about the D4D framework and the process of its development.

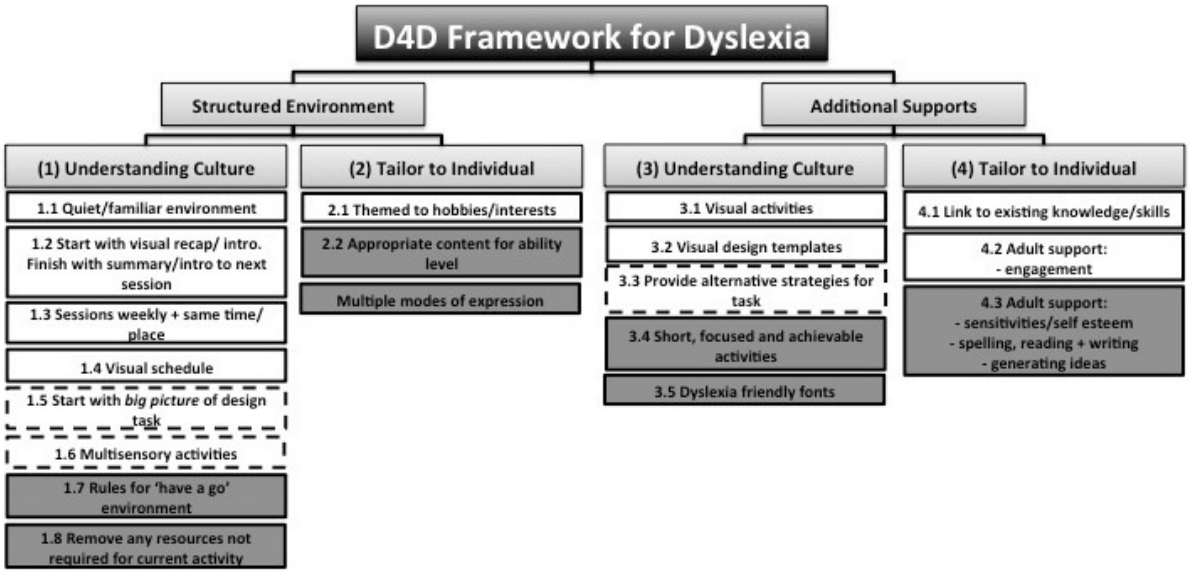



**Figure 3 – D4D framework applied to the development of PD features for a dyslexic population**

The design workshops are described below with the corresponding numbered component of the D4D framework referenced in brackets. The workshops only incorporated components in the white boxes as the grey boxes were identified as a result of the workshops held.

### 3.2.2. Participants

Four children aged 9-10 with reading/writing difficulties and who were currently undergoing assessment for dyslexia by the school took part in each of the workshops along with a teaching assistant from the school and one researcher from the ILearnRW project. All participants were from the same UK primary school in London. Prior to the commencement of the first workshop, project information and consent forms were given to school, who then adapted these for the participant children's parents, who gave their consent for their children to participate in the workshop (see appendix 1.5). The purpose of the project and workshops was explained to both the children and teaching assistant at the start of the first workshop as well as the fact that the workshops would be video recorded, and all participants were given the opportunity to withdraw from the workshops. All participants agreed to take part and completed consent forms to confirm this (see appendix 1.3 for the children's consent form and appendix 1.4 for the teacher's consent form). As with the focus groups, the consent form for children was designed specifically for children, including picture representations of the statements, with simplified text that was read aloud by a researcher to ensure the children understood what the form contained. All workshops were video recorded for later transcription and analysis.

### 3.2.3. Procedure

The children and teaching assistant all participated in three workshops which were undertaken at their school, and were guided by the D4D framework described above. The teaching assistant had previously worked with each of the children and so was aware of their current skills/abilities as well as previous experiences in school and therefore was in a position to be able to link to these, where


**Figure 4 - Visual schedule**

appropriate (4.1). Having two adults (i.e. teaching assistant and researcher) also ensured that there was sufficient support available if any of the children became disengaged from the activities (4.2).

Each workshop lasted approximately 1 hour and took place in a separate classroom at the school (1.1) for 3 weeks on a Friday afternoon (1.3). The first workshop began with an visual overview of the project and aim of the design workshops on a laptop computer (1.5), and the second and third workshops began with a visual introduction and recap of the previous workshop using on a series of Powerpoint slides displayed on a laptop computer and at the end of the workshop it was explained to the children what would happen the next week (1.2). During the introduction to the workshop the research referenced a visual schedule of the workshop (see Figure 4), which displayed a checklist of the activities that would be undertaken during the workshop in both text and visually, with one child volunteering to be responsible for checking off activities once completed (1.4). Additionally as each activity was introduced, where appropriate the researcher suggested to the children a number of possible approaches for undertaking the task (3.3).

Each of the workshops was intended to be multi-sensory, with activities incorporating a range of senses, e.g. sight (showing pictures of existing games), sound (group discussions), touch (using art materials), action (Lego bridge building) (1.6). All of the activities had a visual element whether this was images displayed on a laptop as a prompt for discussion or a drawing activity to help support children in expressing their design ideas (3.1). It was not possible to find out any information about the children in advance of the sessions, so the activities could not be specifically tailored to the hobbies and interests, however it became clear from the start that all of the children enjoyed playing computer games in their spare time and therefore found the design task appealing and engaging (2.1). Each of workshops had a specific theme, as follows:

**Figure 5 – Screenshot from Monsters Invade: Oz**

***Workshop 1: Positive experiences***

The aim of this workshop was to gradually build the children's confidence in working as part of the team and explore what types of previous experience they associate with positive emotions. This was important in terms of how the game could reward the player for doing well.

This workshop began with an introduction to the project and was then followed by some initial team building activities to ensure all team members felt comfortable with one another. Next all team members undertook a game badge design activity. Each participant was provided with a paper template containing five blank badges and asked to design one or more game badges, which would be something that could be won within the game and that would make them feel good about themselves, e.g. happy, confident or proud. Each participant then presented their designs back to the rest of the team and explained why the badge would make them feel good.

***Workshop 2: Gameworld exploration***

The aim of this workshop was to establish the children's preferences for the presentation and navigation of the iLearnRW game world. This was important for how the various learning activities were connected within the game.

This workshop began with an explanation of our initial ideas from the ILearnRW game, with the game narrative read aloud by the researcher and with supporting example images displayed on the laptop. The children were then shown and encouraged to interact with an example game on the iPad called *Monsters Invade: Oz*, which incorporated multiple levels of game-world navigation (see Figure 5) to provide a concrete example to help the children think about how they would prefer to explore the game.

Next the children were shown a number of different screenshots of maps from other existing computer games (see Figure 6) and using these as a prompt asked to discuss what made it easy or difficult to explore a game.

Lastly the children were provided with a large blank piece of paper and a selection of art materials and asked to design (as a team) an entry screen for enabling the exploration of the ILearnRW game.

***Workshop 3: Overcoming failure***

The aim of this workshop was to investigate how the children experienced, reacted to and overcame failure within their everyday lives. This was important for how the game deals with a child being unable to complete a particular learning activity.


**Figure 6 – Screenshots of maps from existing computer games**

The last workshop focused on how the children deal with failure both within the classroom and when playing computer games. The first activity was a discussion activity where the children were asked the following questions:

1. How do you feel when you are doing well/badly at school?
2. How do you feel when you are doing well/badly at computer games?

The children could contribute to the discussion if they wanted to share something with the group that was related to one of these questions, but were not required to say anything if they did not feel comfortable doing so.

Next the children were introduced to two personas – 'Ryan' who had been playing a game to improve his reading/writing but frequently got answers wrong and 'Zoe' who had been playing a similar game but only occasionally got answers wrong, and sometimes found it a bit too easy. A mock-up of one potential learning activity to be included within the ILearnRW game was also demonstrated and the children were asked to design the feedback for a getting an answer correct/incorrect, what could happen at the end of the game, and to consider whether this should be different for Ryan and Zoe. The children were provided with visual paper templates with screenshots of the learning activity on which

to document their designs (3.2). The resulting designs were then discussed as a group at the end of the session.

### 3.2.4. Analysis

After the last workshop each of the video recordings were transcribed and analysed alongside the paper-based game designs that were produced during the sessions using a theoretic thematic analysis approach (Braun and Clarke, 2006), guided by the research question and the specific constructs of motivation specified in the educational literature (Linnenbrink and Pintrich, 2003). Additionally a content analysis was undertaken on the design ideas generated by the children for the feedback and rewards within the game, which was guided by the eight forms of game reward proposed by Sun and Wang (2011).

### 3.2.5. Findings

The findings from the analysis highlighted aspects of three of the four key constructs of the children's motivational engagement within a learning game context, which would be important to consider during the game design. These included affect, self efficacy, value and interest. The usefulness/ importance of the game design was not explicitly discussed during the workshops, which may be due to the fact that the specific content of the learning activities was not focused upon. The remaining constructs are discussed in more detail below.

#### *Affective experience*

During the discussion activities within the workshop from the children's comments it became clear that many of the children found it difficult to maintain concentration, and could become easily distracted when they did not understand something or when others were making noise around them. Having a difficulty with concentration has been identified as a common co-occurring difficulty in dyslexia (Rose, 2009). These difficulties could often result in negative feelings of frustration and anger:

> *"I feel when like I said I get distracted easily if I don't understand it I just do this to my hair [pulls hair]".*

> *"I like to do my work silent because then I get more things done and I get my work done quicker".*

During the workshops whenever the children talked about their emotional reactions within the classroom environment as well as when playing computer games, the emotions expressed tended to be at the extreme ends of the spectrum, particularly with regard to negative emotions. If the children did not understand something in class or were struggling to concentrate on their work, they tended to become frustrated which often escalated into angry outbursts:

> *"It's meant to be quiet and [my friend] is whispering and then everybody just talking or they are not quiet and I feel like to shout, but if I shout, I done that once, and I got in trouble".*

> *"We work together and maybe we don't get something right yeah we get in a mood yeah we sulk and then when a teacher comes over we're like ignoring them and then I get angry and I get angrier and angrier and angrier and angrier and then I get sent out".*

These reactions were mirrored in their response to losing a computer game, where they confessed to breaking the device they were playing on, messing up their bedrooms, or switching off the games of friends who were beating them:

> *"When I lose a game I just feel like the dumbest person because some games you've got everything and then you have to start all the way from the beginning and then I get so angry".*

> *"When you lose it's not fair on you because you think the other team is cheating and when I lose I get really angry and I just leave the game on and I throw it and when I throw it yeah I go up to my room and I rip my room".*

In contrast, when they were winning the children reported feeling happy and excited, with one child describing how she was so excited that she talked about it in her sleep.

> *"I feel the best, the best person playing".*

> *"When I win a game I get so excited sometimes I sleep talk".*

These more extreme reactions indicate the emotional investment the children put into games and the importance they place on the outcome of games. The children appear to be extremely sensitive to failing even in entertainment games, making failure a pertinent design consideration for learning games. Rose (2009) recognises the emotional barriers, stress, and frustration that can be associated with dyslexia, exemplified in the comments the children made in relation to their experiences in the classroom.

These findings indicate that it is important to ensure the number of potentially distracting game features e.g. sound effects, are limited during the reading/writing activities to help children to concentrate. Also, if a child appears to be struggling with an activity, the difficulty level should quickly adapt accordingly, alternatively additional help should be provided to support the child's continued engagement within the game. The potential emotional stress of not understanding how to do something in addition to the emotional investment put into computer games highlights a need to carefully consider how failure is dealt with within the ILearnRW game. In particular, it should not be possible to 'lose': either the player should have repeated opportunities to overcome an activity until success is experienced, or they should be redirected to an alternative activity.

***Self efficacy***

The children's motivation to work appeared to be closely linked to the opinions of their teachers and parents. Small consistent gestures such as a thumbs up or a smile from a teacher/parent that were expressed when a child had produced good work made the children feel good about themselves and their ability to be successful in their work, which motivated them to keep trying hard.

> *"Because most of the time I always get thumbs up from [my teacher] and that makes me feel confident".*

**Figure 7 – Game badge design**

> *This [badge] represents happy because when I get up in the morning if my mum's in a good mood she'll smile at me".* (see Figure 7)

The children talked also about the importance of friends and family helping them to feel more confident and happy. Children with dyslexia can particularly suffer from low self-confidence and 'learned helplessness' (Rose, 2009) and therefore finding ways to build their confidence and positive feelings in relation to their ability to succeed with their reading/writing is particularly important. It was also important for the children to become independent learners and they felt proud of being able to do the work by themselves.

> *"I used to get help a lot, but since I've got in year five I've got more mature of doing things by myself".*

This findings indicate a need to provide suitable help features that could enable a child to become an independent learner, by allowing them to access the help themselves and determine when they require it. It would be valuable to provide a teacher/parent view of the child's achievements within the game so they can help to maintain the child's motivation and also to allow the child to show off their achievements, potentially providing the opportunity to build confidence and self esteem.

***Value***

The ideas that the children generated during the final workshop indicated the types of feedback and reward that the children would find motivating within the game and that would help to reinforce the value in undertaking the learning activity i.e. by providing them with a reward they would find motivating. These ideas have been classified using the eight forms of reward proposed by Sun and Wang (2011) (Table 3). To encompass the ideas the children generated for doing something incorrectly, we added an additional category of 'penalties' for negative events that would occur as a result.

| Reward Form | No. of ideas (for positive progress within the game) | No. of ideas (for negative progress within the game) |
|---|---|---|
| Score systems e.g. points | 2 | 0 |
| Experience point reward systems e.g. gain new skills | 0 | 0 |
| Item granting system rewards e.g. game equipment | 3 | 0 |
| Resources e.g. new lives | 5 | 0 |
| Achievement systems e.g. titles | 1 | 0 |
| Feedback messages e.g. pictures, sound effects | 7 | 16 |
| Plot animations and pictures e.g. advance game story | 0 | 0 |
| Unlocking mechanisms e.g. bonus level | 6 | 0 |
| Penalties e.g. restart game | 0 | 6 |

**Table 3 – Classification of children's ideas for feedback and rewards within the game**

For both positive and negative feedback the most common ideas were feedback messages, which were predominantly verbal/written statements such as "*Well done <name of player>*" or "*Never give up when you lose*", but for negative feedback this also included tactile feedback such as the tablet vibrating as well as sound effects. None of the ideas considered how to provide feedback to the player to help them correct their error, but this could potentially be because the example question was intentionally kept simple (step on the 'b' tiles and not the 'd' tiles) so little explanation would be required to correct this error. Aside from feedback messages, the children suggested unlocking mechanisms such as bonus levels, quizzes, or missions, earning resources like money, lives or tips to help with answering questions within the game, being granted items such as prizes, achievements such as trophies and score systems such as points/tokens. As penalties, the children suggested restarting the game, losing a life or having to defeat a monster.

In terms of rewards and feedback many of the children's ideas integrated common aspects of existing computer games. Feedback messages appeared to be the most preferred form of feedback, but it is difficult to determine whether this is in fact the most preferred or the easiest to generate ideas for. Additionally the children's previous experiences of playing computer games appear to have heavily informed the ideas that they generated with all ideas being common features found in many games played by children in our target age group, making it difficult to establish which ones the children would place most value on and therefore find more motivating.

***Interests***

During the sessions the children also generated a number of ideas related to specific features of the game that would help to increase their interest in playing the game, thereby supporting their


**Figure 8 – Group game world design**

motivation and engagement in the learning activities. To kickstart their ideation, we shared a game idea with the children set in a fantasy world, yet when generating ideas for the places that would be included within the world the children chose 'real-world' places, such as a school, home, library, shop and prison, where the activities could be based. With regards to the game layout, they wanted two views: one larger overview of the game world and one smaller view, indicating which activity to complete next. The children wanted the view to be customisable and suggested that the most important thing should be placed at the centre of the screen: in this instance, the school. Figure 8 shows the children's collective ideas for their game world.

*The importance of colour and preference for bright colours was also repeatedly raised throughout the different sessions.*

> *"My favourite colour and it makes me feel happy". [game badge design activity]*
>
> *"I don't think that the game looks interesting…because I think it just doesn't have loads of colour, it's not really bright, but like children who like exciting things".*
>
> *"Yeah so make it even colourful colourful colourful".*

Lastly the children spent a large amount of their time discussing and designing the characters to be incorporated within the game. They wanted some element of control over the selection and customization of the characters. The discussions around the characters also highlighted the clear distinction between the girls and boys that was initially identified within the focus groups, with the children preferring to play as a character the same gender as themselves and the children designing the characters to clearly be either a boy or a girl, i.e. through discussions about clothing.

*These findings indicate that there should be a way of focusing the child on the current area of the game world which requires their attention, i.e. the next learning activity. It may also be preferable to incorporate realistic elements that the children are familiar with from their everyday life and to make sure the interface design is sufficiently colourful to be appealing to the target age group. The inclusion of characters may also be appealing to the children, but it would be preferable to incorporate characters that are not clearly associated with one gender, e.g. an alien, monster, animal; to ensure that the game has a wider appeal across both boys and girls.*

### 3.2.6. Methodological insights from design workshops

The findings discussed above highlighted the fact that the children generated ideas that were relatively simple, for example in terms of the game feedback for incorrect actions, providing simple feedback messages, and not considering how to support the player in recovering from errors. In addition, the ideas were heavily informed by the children's previous experience of playing computer games. This demonstrates a potential lack of quality (although the ideas did fulfil the original design brief) and novelty in the ideas the children generated, which may be due to the specific methods chosen. The activities chosen within the design workshops were typical design activities used in PD sessions for children, however these may not have been the best activities for helping the children to 'think outside the box', especially given their existing familiarity with games and resulting potential preconceptions concerning design output. Additionally, many of the previous projects that have incorporated similar methods and activities have failed to evaluate the quality and novelty of the children's design ideas, making it difficult to establish the success of these methods in terms of the ideation process. However, these workshops have still generated a number of useful insights into designing a learning game for children with reading/writing difficulties within our target age group. These insights are summarised below.

### 3.2.7. Key considerations for game design from design workshops

- The game should provide repeated chances to overcome difficulties with a specific literacy concept to avoid 'failure' within the game e.g. by reducing difficulty or providing an alternative activity.
- The game interface should support the player in focusing on the current game task by reducing unnecessary distractions.
- The graphics should be gender inclusive, realistic, and colourful (reinforcing the findings from the focus groups).
- The game should integrate help features to support the child's independent learning.
- The game could incorporate a teacher/parent view of the child's achievements within the learning activities.

# 4. Design Process

In this section, we address the development of the game for the *Adventure* mode, we overview the activities developed for *Play* mode, and we outline the reasoning process behind the design decision to bring the two modes closer together. Note that much of this work was carried out while the user studies were underway, with the user studies findings continuously feeding into, and informing the design work.

## 4.1. Early Adventure mode concept

In December 2012 (month 3 of the project), we initiated our game design activities by hosting a two day workshop at the University of Malta for consortium partners working on project aspects related to dyslexia education, game design, and user modelling. Some of our objectives included exploration of issues relating to context of use, system requirements, target users, preferred dyslexia education philosophies, and existing games, as all of these concerned how the game could be designed. We began by reviewing and analysing some existing games targeted at players with dyslexia. The general consensus was that the currently available games were targeted at rather young readers (under the age of 7), with age inappropriate content for anyone older. In addition, they frequently presented learning activities in decontextualised ways that did not assist learners in connecting the skills in question with a larger learning agenda. On the second day, the dyslexia education experts stepped us through an intervention program, and we discussed and brainstormed possible learning activities, stemming from popular casual games such as *Ruzzle* (MAG Interactivo, 2012). Some rough general design objectives that developed out of this workshop included:

- Provide natural reading situations.
- Provide a larger context to the outcome of a learning activity, e.g. what you can usefully do with the skills gained? Why might you want to strengthen a particular skill?
- Provide multi-sensory learning approaches.
- Provide constructive negative feedback.
- Skills ought to be broken up and introduced one by one.
- Assemble/provide learning materials and situations that address a learner's specific needs.

For the game specifically:

- As dyslexia is a personal issue, multi-player aspects should be approached carefully.
- The player should experience a sense of journey and progress through the game.
- Learning activities should be presented within a context.
- The content from the reader should be related to the content of the game somehow.
- As a kind of mirroring, success within the game should somehow influence the learner's experience with the reader (e.g. unlocking special content).

- Sometimes the player should need to make informed choices about how to proceed in the game, involving comprehension.

Alongside these design objectives, we had several design research questions we sought to answer through design exploration and experiments:

> *How can we meaningfully incorporate literacy activities into a cohesive and compelling game world?*
>
> *How can we design a self-esteem boosting play experience for players from a population who traditionally have low self esteem, especially with regards to literacy-related activity?*
>
> *Will game challenges that exercise skills in tandem with dyslexia-related literacy skills serve to further engage players or will such challenges prove to be too cognitively taxing?*

On the basis of the above objectives and research questions, a brainstorming session at the ILearnRW project meeting in Birmingham in January 2013, findings from the literature review, and insights from the focus groups, we began establishing the following game concept, which we will refer to in the rest of this document as *Mystery World*. We point out that at this stage, we were still considering *Play* mode and *Adventure* mode as two related yet separate modes of use, with *Play* presenting independent learning activities, and *Adventure* referring to the game.

In *Mystery World*, the player is presented with the following premise on beginning the game:

> *You wake up in a strange bed, in a strange house... outside the town looks very unfamiliar. You try to find your school, and get directed to an imposing building with fancy gates. You go inside and talk to someone and gradually it becomes apparent that you're nowhere near home, and most likely, no longer in the world you know. For example, the buildings and shops have writing on them in a language you don't understand at all - it looks nothing like English.*
>
> *How did you get there?*
>
> *How will you get home?*

As the story proceeds, it is revealed to the player that they are somehow stuck in this strange town and world. Other mysterious things start happening around the town: important people are disappearing, and strange notes that the locals cannot make sense of are appearing. The notes turn out to be messages and partial messages written in English (or Greek, depending on the play context), which only the player can solve, as none of the locals have the necessary language skills. A magician with dastardly plans somehow seems to be central to all of the mysterious events. The townspeople look to the player as the only one capable of solving what is going on. Solving the mystery requires taking on challenges, puzzles, and quests all based on dyslexia learning activities.

For example, the puzzle in Figure 9 concerning drawing a secret code on a brick wall to reveal a magic door is based on confusing letter recognition. In the sequence shown in Figure 10, the player

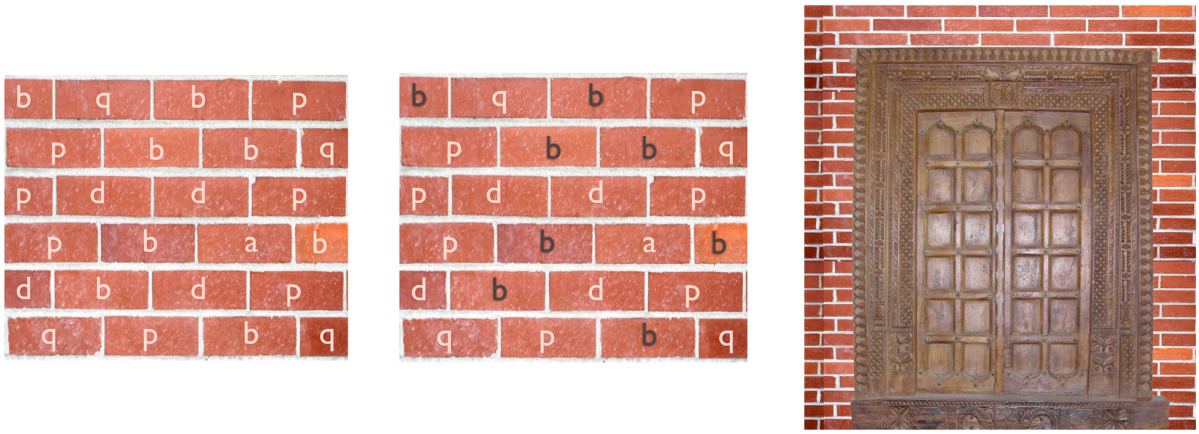



**Figure 9 – Secret door puzzle.**

bread
dread
break
present
pray
dry

**Figure 10 – Whispering busts incantation.**


**Figure 11 – Climbing a word blossom tree.**


**Figure 12 – The game world map showing some possible achievements.**

must listen to the voices of the busts in the *Hall of Whispers* to complete an incantation to activate a potion, involving matching between phonemes and graphemes. To scale the wall of a castle, as in Figure 11, the player needs to enlist the help of a "word blossom tree". Words feature as blossoms on these trees, and every correctly segmented word results in the tree growing a number of new brunches, corresponding in number to the number of syllables contained in the word blossom.

To provide players with a visual representation of where they had practiced (and obtained mastery over) learning difficulties, we envisaged the in-game world map doubling as an achievements display, as in Figure 12, with achievements being associated with the locations in which they had been unlocked.

As the game featured a clear narrative with a specific ending, we set out to create a game narrative featuring core plot point activities that all players would pass through, assuring that the basic game narrative would remain roughly the same for all players. At the same time, by drawing on the player's user model, the game challenges presented would be ones that would require practice of relevant difficulties, creating branches in the potential player experience, which would be brought back together when necessary to feed into another common plot point. Figure 13 is a conceptual diagram of game narrative and experience paths.

A concern with the *Mystery World* concept was replayability. While we had no doubt that it would be possible to replay the game with different activities injected throughout. Yet, as the overall narrative and core plot points would not change from one play-through to another, there would be less engagement value for the player after having completed the game once.

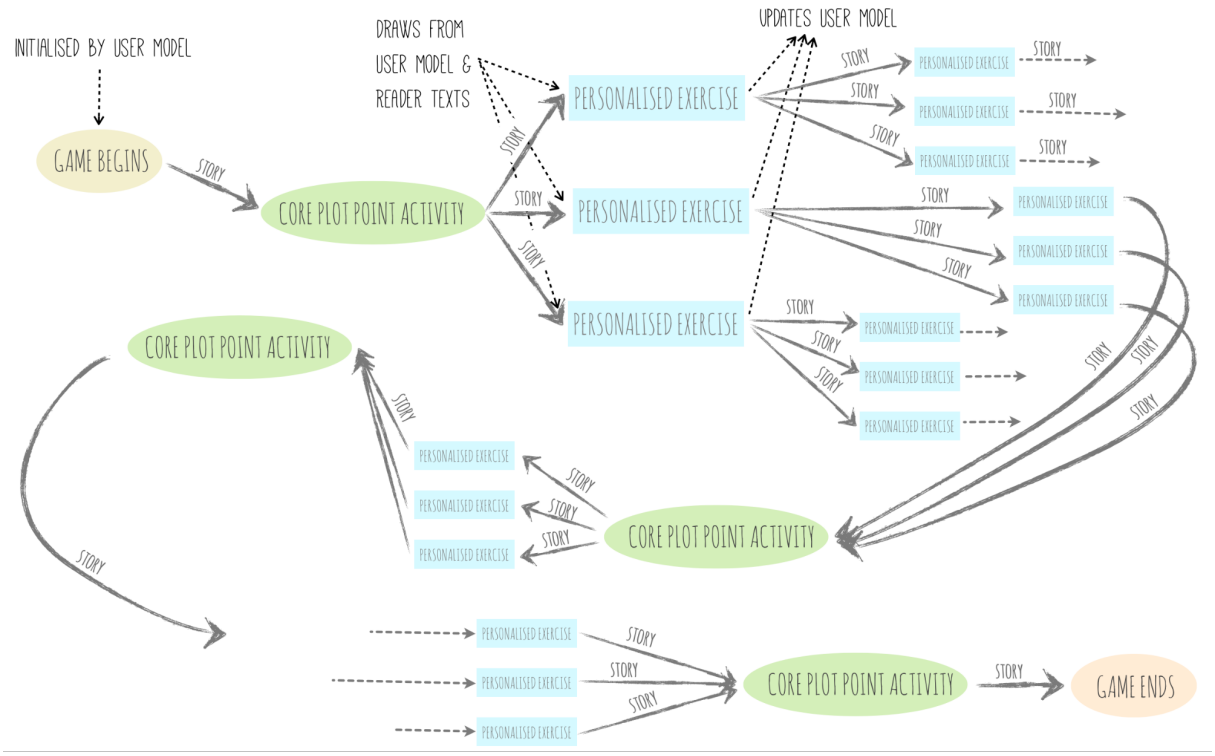



**Figure 13 – Game narrative and experience paths.**

## 4.2. Early Play mode activities

The ILearnRW system's *Play* mode consists of a set of learning activities designed to focus on target learning areas. The Epirus team had detailed a set of activities they use in class and in intervention sessions in deliverable D3.2. These were invaluable when it came to selecting those learning activities that would form part of the game.

There were two minor issue with these activities which meant that they could not be used "as is" for the project. The first is that they were based on existing teaching practices, meaning that some of the activities could not be easily converted into a system that would work on a tablet. For example, activity 13, "What happened?" (see page 37 of D3.2) involves a child reading and understanding a short narrative. In digitised form, such an activity can only work if the computer has pre-programmed knowledge of the narrative, thus the generalisability of the activity is limited with regards to new narratives. The second minor issue is that the activities were imagined in the context of traditional instructional situations, and thus could be considered as not fun enough for inclusion within a game.

Therefore, the IoE and DA teams took part in a two day workshop in order to turn these activities into ones which were more like mini-games. As part of this process, we were also thinking about the practicalities of implementing the activities, particularly with regards to the limitations of computers to process narratives, understand speech, and cope with some of the linguistic nuances of English.

The workshop ran as follows. For each difficulty listed in the English User Model (see deliverable D4.1), we consulted the Epirus set of activities to find the closet match. We then brainstormed ideas on

how to make the activities more game-like than how they were when normally used in class whilst ensuring that they retained their learning objectives. The emphasis was on selecting activities which would cover each difficulty. If the activity could cover more than one difficulty, that was deemed to be useful but not essential.

When refining this initial set of activities, it was important to ensure that as a group they covered a range of skills beyond the development of linguistic skills. For example, Pelmanism helps develop short-term memory skills whilst Whackamole helps with coordination. We also tried to ensure that there was a mix of games which compose and decompose words (such as Karate Chops or Fix the Footpath), alongside activities in which the word remains whole (such as Curling). There was also concern that a preponderance of activities involved recognising words. As a result of this, the Typing Train Dispatcher activity was created as it focused on writing words rather than recognising them.

It is important to recognise that these activities were never intended to be suitable for the final game. They were used as a means through which the learning activities identified in D3.2 could be gamified, identifying suitable game mechanics which could be further refined alongside the main game concept.

We present brief descriptions of the activities here. For a full description, please refer to D3.5.

### Pelmanism

The child is presented with a number of cards displayed on the screen in a grid. The child is instructed to tap on one card and then find a matching card in the grid (depending on specified rules). When two cards are matched they move to the bottom of the screen in a match and the child wins a point. The level is completed when all the cards have been matched and the child wins a star. The child also wins one, two or three stars depending on how fast he/she completes each level (three stars are assigned to fastest times, one star to slowest).

### WhackaMole

A pattern is presented on a prompt card (e.g. sound, letter, word or picture) and several moles pop up holding cards with letters or words either matching the pattern or not matching the pattern. The player has to hit the mole matching the pattern and not a mole not matching the pattern.

### Bridge Builder

The child is presented with a landscape he/she needs to cross with canyons or rivers presenting obstacles. The player clicks on the first obstacle (e.g. river or a canyon) that she needs to cross and is presented with a picture of the obstacle and blocks with words, word segments or letter patterns that the player needs to assemble into a bridge.

### Sorting Potions

The aim of the game is to help a young wizard cross a number of doors guarded by monsters inside a castle. In order to pass through each door, the wizard needs to prepare a potion to put the monster to sleep. The potion needs to be prepared in several cauldrons, each representing a category (e.g. words with long vowels or words with 2 syllables). The player needs to take the appropriate words (out of a pile or out of a text) and put them into right cauldrons. When he is ready, the wizard pours all the cauldrons together into a bowl and presents the potion to the monster. If the recipe is the right one, the

monster goes to sleep and the wizard passes through the door and on to the next one. If the recipe is wrong, the monster drinks it and becomes stronger by growing another head. The wizard has to try again.

The difficulty of the game can be increased by requiring a time for each cauldron. There could also be a required minimum. E.g. the player is required to put all words from a text matching a category into the cauldron, or at least 5.

Language difficulty is increased by presenting more options to choose from and more distractors.

### Fix the Footpath

The child is presented with a road they need to travel on to achieve a goal but the road is full of holes. To cross the road, the player needs to fill the holes. Each segment (step) of the road is represented by words or parts of words (forming sentences or words). The child has a pile of words or parts of words that fit in the holes. She needs to fill in the holes in order to pass over the road.

### MineField

A mine field appears as a grid of hexagonal tiles with each tile labeled with a word, letter, pattern. The player is given instructions to cross the minefield safely by tapping only the tiles that fit a rule/pattern. When the player taps the correct tile, a character (figure representing player) is placed on that tile. If the player taps the wrong tile, the figure explodes (and the player loses and life - one of three). The player can only jump to an adjacent field, a jump to a removed will simply give feedback that the jump is too far. The previously jumped tiles remain highlighted to create a route. There is only one correct path through the minefield.

### Curling

The students are presented with a curling sheet (official name for the ice track) and a number of curling stones. The curling sheet has words or sentences written on it. The player slides the stone but needs to brush the sheet in the right places to guide the stone along. The right places are determined by a pattern (either read out or presented in writing). The places where the player has brushed are highlighted. Brushing in the right places speeds up the stone and brushing in the wrong places slows it down. The place of the brush is also highlighted in blue when it speeds up the stone and sandy texture when it slows it down.

### Typing Train Dispatcher

The player is shown a train station and given the task of loading and dispatching trains from it as fast as possible to avoid collisions. To dispatch a train, the player has to load it with the appropriate cargo. To load the cargo, the player uses the keyboard to type the appropriate language into each carriage. For instance, if the player is presented with the word "syllable" (by voice, writing or both), they tap the first carriage and type in 'syl', then the second, type in 'la', etc. This same thing can be done with letters, sounds (i.e. all letters representing a sound would fit in the carriage), suffixes or whole words.

| | | 1. Pelmanism | 2. WhackaMole | 3. Bridge Builder | 4. Sorting Potions | 5. Fix the Footpath | 6. Minefield | 7. Curling | 8. Typing Train Dispatcher | 9. Syllable/Suffix Karate Chop |
|---|---|---|---|---|---|---|---|---|---|---|
| | **ENGLISH** | | | | | | | | | |
| 1 | Syllable Division | | | X | X | | X | X | X | X |
| 2 | Vowel Sounds | X | X | | X | | X | X | | |
| 3 | Suffixing | X | X | X | X | X | | X | X | X |
| 4 | Prefixing | X | X | X | X | X | | X | X | X |
| 5 | G-P Correspondence | X | X | | X | | X | | X | |
| 6 | Letter / Word Patterns | X | X | X | X | | X | | | |
| 7 | Letter Names | X | X | | X | | | | | |
| 8 | Irregular / Sight Words | X | X | | | | X | | X | |
| 9 | Confusing letter shapes | X | X | | X | X | X | X | X | |
| | **GREEK** | | | | | | | | | |
| 1 | Syllable Division | | | X | X | | X | X | X | X |
| 2 | Phonemes: Consonants | X | | | | | X | X | | |
| 3 | Phonemes: Vowels | | | | X | | X | X | | |
| 4 | Derivational Suffixing | X | X | X | X | X | | X | X | X |
| 5 | Inflectional Suffixing | X | X | X | X | X | | X | X | |
| 6 | Prefixing | X | | X | X | X | | X | X | X |
| 7 | G-P Correspondence | X | X | | X | | X | | | |
| 8 | Grammar: Function Words | | | | X | X | X | | X | |
| 9 | Word recognition: Sight / Irregular Words | X | X | | | | X | X | X | |
| 10 | Letter Visual Similarity | X | X | | | | X | | | |

**Table 4 -- Mapping language areas to learning activities**

### Karate Chops

A character dressed in Ninja/Judo costume appears. A word appears with a suffix or prefix or is two syllables. Player needs to swipe at the correct boundary. Ninja then does a karate chop to split the word. If the swipe was in the correct place, the word splits and Ninja bows and gets ninja shooting stars. The resulting word is read out. If the swipe was wrong, the word doesn't split and the Ninja starts jumping about holding is hand. A player gets 2 goes at each word (one with each hand), the word disappears and no points are awarded.

As the word difficulty progresses, the materials changes from wood, brick, concrete, marble to metal. Players can also get a higher colour belt as they get more points. Difficulty of game increases based on the amount of time ninja has to perform the chop.

The language areas addressed in each of these activities are summarised in Table 4. For further detail, please see D3.5.

## 4.3. Bringing the *Play* and *Adventure* modes closer together

Following the ILearnRW user requirements work conducted in schools, particularly interviews, observations, and surveys with dyslexia learning experts, we arrived at the conclusion that the system would be most beneficial to its users if it could be used equally well for short durations (i.e. 5 minutes) as for long durations (i.e. 10+ minutes). In addition, it became clearer that certain activities would need to be practiced a multitude of times. Both of these observations posed problems for the *Adventure* mode of the ILearnRW system, that is, the *Mystery World* concept described earlier. The *Mystery World* concept made more sense for situations involving longer durations of play. Furthermore, while allowing for some degree of activity replay, *Mystery World* would still essentially

present a solid narrative, in turn, confusing the notion of "going back" to replay activities that had already been played a few times. We also had concerns about how replayable the game would be overall: having played the game once and experiencing a specific game ending, would it remain sufficiently different and interesting such that the second (and third and fourth) time around it would still be an engaging experience? Another concern was extensibility: would it be possible to introduce new game activities into the game after its initial deployment?

At the same time, with regards to the *Play* activities, which had been much influenced by the original classroom learning activities on which they were based, we wondered whether we could introduce to them the same degree of game design that would be present in *Adventure* mode to increase their engagement factor. Secondly, the *Play* activities were slated to use a gamification-inspired dashboard of achievements, which had an ambiguously defined relationship to the achievements earned in game. It seemed clear that the achievements should be visible in a collective space, but establishing a way to do so in way that made sense across modes posed a problem. Finally, *Play* and *Adventure* were highly similar in terms of pedagogical content, and would essentially be duplicating one another in terms of learning objectives.

A solution the consortium came up with to the following design problems was to bring the two modes of *Play* and *Adventure* closer together. *Play* mode now draws on the same set of activities as those involved in *Adventure* mode. Achievements earned in *Play* mode and *Adventure* mode are displayed in a shared view. For the *Adventure* mode, the ramifications of sharing activities with *Play* were that a narrative-focused game world such as *Mystery World* no longer made sense. Instead, it would be necessary to establish a new, more open game design concept with a player-constructed as opposed to designer-constructed narrative, that would enable short play sessions, feature no set ending point (thus enabling infinite play), account for future extensibility, and would gracefully accommodate and update changes in game state in relation to activity accesses from *Play* mode. For the *Play* mode, the ramifications of sharing activities with the *Adventure* mode meant that all of the activities would be themed, and set in the same world as the game world. In addition, *Play* mode would only be able to access activities that had already been played in *Adventure* mode.

# 5. A Unified Dashboard

In this section, we describe our plans for a unified dashboard that draws together ILearnRW's three modes of use -- *Read*, *Play*, and *Adventure* -- and provides a common interface and metaphor for the visualisation of learning progress according to a user model. The unified dashboard serves as an update to the gamification-oriented interface outlined in D3.1. We mostly focus on explaining how *Play* and *Adventure* interact with the dashboard and with each other, as these modes deal specifically with game content. *Play* concerns practicing specific literacy activities that have been already been unlocked within the game. *Adventure* concerns durational use of the larger game comprising the literacy activities, and will feature narrative events linking activities. *Play* and *Adventure* are highly inter-connected, in that *Play* concerns a highly stripped back version of *Adventure*, essentially serving as a direct way to access particular game world activities, that circumvents the need to navigate to these activities from within the game world.

## 5.1. A common interface

In order to interact with any component of the unified system, the user must use the unified dashboard. The dashboard will visualise and communicate a user's learning progress and achievements obtained within the ILearnRW system.

For the *Play* and *Adventure* modes, progress and achievements might include:

- specific difficulties the user has mastered (for example, segmentation of all 15 types of -ing)
- specific difficulties the user is in the process of mastering (for example, segmentation)
- perseverance achievements, for revisiting an activity over 15 times
- speed achievements, for mastering an activity in 5 attempts or under
- endurance achievements, for continuous use of the game or its activities for over an hour
- etc.

For the *Read* mode, progress and achievements might include:

- specific books the user has completed
- endurance achievements, for continuous use of the reader mode for over an hour
- new word achievements, for attempting texts with unfamiliar words
- etc.

In tying together the three modes and their achievements, and taking into consideration the close connection between *Play* and *Adventure*, we have opted to present most of the achievements (apart from "books completed" for *Read*) through reference to characters from the game world in lieu of the earlier concept in D3.1 of badges. The game world features Día de los Muertos-type characters, such as in Figure 14. These characters require the assistance of the user in various ways relating to literacy activities, in turn, characters will befriend the user in gratitude. For example, Grant the comedian may

**Figure 14 – Grant, an aspiring comedian who requires your help.**

be trying to come up with funny rhymes, and will ask for the user's help in in the game world in order to do this.

Each time a user initiates an activity task related to a particular character (or set of characters), she earns that character as a semi-unlocked friend, who is displayed on a dashboard display in a kind of "friend list". For example, when the user initiates a suffixing activity featuring Grant, Grant becomes her friend. See Figure 15.

The friend list on the dashboard (working title: *ghostbook*) therefore serves as a summary of the learning areas a user has attempted to tackle and has potentially mastered within the system. The larger the list, the wider a range of difficulties the user has attempted to tackle in the system.

In addition to listing friends, other achievements, and presenting upcoming game world events, ghostbook will supply a "social feed" of updates relating to the characters from the friend list, sometimes featuring the user. These will be generated procedurally, presenting locations (backgrounds), characters, and brief update stories consisting of simple sentences and potentially featuring a user's designated "tricky words". Note that a social feed is only present for characters who have been completely unlocked, as opposed to those who are semi-unlocked, for whom there are no social feed updates.

In adopting the ghostbook concept, we have moved away from the more traditional badge-centric interface described in D3.1. We have decided to do so for a number of reasons. Badges have become a familiar design trope in gamified apps, but it is not clear that they are effective motivators over the long term. In addition, the majority of gamified apps making use of badges harness competition between users to increase the motivational effects of badges.


**Figure 15 – The *ghostbook* friend list.**

As the ILearnRW system was neverintended to be competitive, the social competition aspect of comparing badges would not have been in effect. The friend list concept, on the other hand, effectively serves the same purpose as badges while also enabling us to draw on social media, maintaining friends, and collectible items, all of which are likely to appeal to our target group.

## 5.2. Initial interaction with the system

A user's initial interaction with the system will launch a tutorial that explains how the dashboard works in the context of the three modes of use, using the game world as a contextual backdrop. The user will be invited to initiate some very simple activities in the game, which will lead to some number of friends (e.g. 4) immediately being added to ghostbook. The user will then be returned to the dashboard view. From here, the user can then choose between the following:

- continued exploration of the game world, playing new activities that are tailored towards their user profile (*Adventure* mode)
- replaying familiar activities via friend access points on the dashboard (*Play* mode)
- loading and reading texts in the reader (*Read* mode)
- perusing dashboard achievements and updates

## 5.3. Making friends

While friends are initially encountered in the game world as live characters, the ghostbook display of each friend serves as a direct access point into the game world to the activity the character was related to, enabling the user to easily go back and access learning activities that have already been attempted, supporting a practice and over learning philosophy. When friends initially appear in ghostbook, they are added in a semi-unlocked mode, indicating that they are associated with an activity that has been attempted but not necessarily mastered. Through successive attempts, either from directly within the game world or from the ghostbook access point, the user is able to fully unlock characters.

Note that new friends (and correspondingly, activities) cannot be accessed directly through the dashboard, they can only be made as a result of game world exploration. In addition, the nature and complexity of activities that a user experiences in the game world are determined on the basis of a user's profile, with regards to his or her current mastery of difficulties, and what activities are therefore deemed most useful for her to do next. For example, a user who has mastered segmentation of -ing but is weak with identifying affixes may find that the game world contains the following upcoming activities that they can choose between: *Mail Sorter*, *Endless Runner*, or *Harvest* (see section 6 for details). If the user is currently viewing the dashboard, suggestions for what she could play next are communicated by event notifications, which provide approximations for where in the game world upcoming suitable activities will take place. Approximations as opposed to direct access points are provided, so that the user has the opportunity to experience game world narrative events that provide some context to the upcoming activity.

In this conceptualisation of the system and activity access, it is *not* possible for the user to access activities that have not yet been encountered within the game, that is, access activities that have not been suggested by the system. One reason motivating this decision concerns cohesion between the *Play* and *Adventure* modes in light of user progress, given that both modes rely on the same content. That is, it should not be possible to meet characters through *Play* who have not yet been met in the *Adventure*, because this would complicate what happens when they are eventually met in *Adventure* (both in terms of progress regarding difficulties and progress of the game narrative.) Another reason for adopting this route is because we imagine that the game and its activities will be a user's main avenue of practicing literacy activities, and that the activity progression will roughly take a stepwise, forward direction. This is necessary in order for rich and realistic profiles to be developed for the user model, and for capturing gradual, reasonable learning progression for each user.

Manually overriding the system's suggestions for activity progression is therefore not a core use case of our system. Should end-users (teachers, parents, or learners) want to directly control which new activities are encountered, we suggest they use the activities in their separate standalone mode. These will be made available within the tablet version of the software as well as online, and will support end-users in inputting desired word lists, or in reading from a user model. Note that the activities in standalone mode will not write out changes to the user model.

A potential downside to this design decision is that users may be more skilled than the system and their user profile initially determines them to be, and this may result in users spending some time completing activities that do not pose a challenge for them. To this end, many experts agree that *over*

*learning* is not problematic, indeed being able to initially rapidly progress through the game activities may serve as a beneficial confidence boost.

## 5.4. Maintaining friends

Just as in real life, friendships with game characters need maintenance to be kept alive. As characters are associated with particular activities, if a certain amount of time has lapsed since the user last demonstrated mastery over a certain activity, she will be notified by ghostbook that the friends associated with this activity require her help again. If the user chooses to re-attempt the activity, and manages to complete it to "mastery" level, the friends associated with the activity remain unlocked. Otherwise, these friends will transition back to a semi-unlocked state. Through the maintenance of friendships, the user is gently encouraged by the system to go back and replay activities she has previously mastered to keep those skills strong.

Alongside the friend list views of unlocked and semi-unlocked, we are considering adding a view that lists “extra difficult” semi-unlocked friends, i.e. learning areas that have repeatedly remained beyond the mastery of the player. We imagine that this will support the meta-cognition and self-reflection of users, in keeping with the teaching strategies proposed for our project in D3.5.

## 5.5. Map view and game world access

The dashboard will contain a map view of the game world and its various locations. As each friend (and activity) will have been encountered in a specific location from the game world, labelled pins in a map view will represent locations associated with friends. Upcoming game world events will also be represented by pins on the map. The map will serve as an entry point to the game world: the user can choose to jump to any point within the game world from the map view. For example, the user may choose to jump to the market and see whether anything is happening there. Note that certain locations in the game world might be closed when a user visits, as locations are made available based on whether they contain activities the user should be practicing. Continuing the previous example, the user might find that the market itself is closed, but during this encounter might run into a character requiring assistance near the market, who in turn summons the user to another location, "Mama Cass's Ribs House". To encourage exploration of the game world, the game will contain "easter eggs", i.e. hidden content, that is only accessible from within the game world and cannot be found with any other means. These Easter eggs may concern additional achievements, or special abilities that facilitate earning of achievements (for example, doubling the number of attempts required for obtaining a "fast achievement", thereby making it easier).

## 5.6. Character types and difficulties

Game character types will map approximately to difficulty types, while sub difficulties will map to unique characters. The degree of complexity may map to a character's physical size. For example, characters related to the segmentation difficulty may all be exclusively black and white. A small black and white character on the dashboard may indicate that a user has mastered segmentation involving two syllables, while a larger black and white character might indicate that the user has mastered segmentation involving three syllables. Mapping character types to difficulty types may be a way to

support the user's metacognitive understanding of literacy difficulties, particularly with regards to perceiving meta-organising principles between them.

Some difficulties cannot be easily classed in terms of complexity. For example, a sub-difficulty of suffixing might be cases involving -ant: truant, compliant, hesitant, and so on. In such instances, one character may represent mastery over 5 particular -ant patterns, such as Grant “Ant” Suffix in Figure 15. Note that as the ILearnRW system is being developed in two languages, namely, English and Greek, the type and number of friends across language versions will differ in accordance with language characteristics. As far as possible, however, the rationale and organisation principle across versions will remain constant.

## 5.7. Social aspects of the dashboard

Although the game, the reader, and the activities have all been conceived within an individual user paradigm, the system can support a degree of social awareness and comparison with other system users. Pending privacy considerations and discussion with our stakeholders, we are considering making it possible for a user to see which other users within an established user group have similarly achieved friend status with a game character, thereby shedding light on which difficulties a user's peers may have also mastered. This enables a soft form of social comparison, which has been shown to be very motivational in a gamification design context, while avoiding direct score comparisons, which are potentially less meaningful, helpful, or fruitful. It is also likely to support peer learning.

# 6. Game Scenarios Specification

Replacing the earlier *Mystery World* concept, the *Adventure* and *Play* modes take place in a world with a Mexican Día de los Muertos theme. The core premise is that the dead have unfinished business with the living, largely regarding communication. The player has been gifted the skill of being able to see, hear, and talk to the dead, unlike most other living characters in the game world. It is therefore up to the player to help characters Of The Dead. Much of this help takes place through game challenges, which require the practice and strengthening of literacy skills. Each challenge maps to a literacy activity, for example, the *Endless Runner* challenge is based on the *Bridge Builder* activity.

Literacy activities, or rather, game challenges, can be accessed via wandering around in the game world or through the dashboard, provided that the player is deemed to have an appropriate skill level to play the challenge. When wandering in the world, the player will also have encounters with characters that will not form a part of the game challenges, but may lead up them. Challenges that have been attempted and/or mastered are added to ghostbook via friend profiles, enabling future direct access. Whereas we view exploratory world play as falling under *Adventure* mode, direct access play via a ghostbook list character falls under *Play* mode. In *Play* mode, players are jumped directly to the appropriate game challenge, and need not wander in the game world.

Below we describe working ideas for the game challenges, which are redesigned versions of the literacy activities described in D3.5. They have been recontextualised to form a more cohesive fit with the Día de los Muertos world. Note that the first time players encounters each challenge, an animation will explain the goal of the challenge, and how to play. We also point out that we do not address the issue of game feedback in this deliverable: We are currently working with dyslexia experts in the consortium to establish ideas for how best to present “negative” feedback constructively, for example, by incorporating reflection on incorrect answers as a learning device. We will report on feedback in D5.3.

## 6.1. Mail Sorter (based on Pelmanism and WhackaMole)

In *Mail Sorter*, the player’s objective is to assist a mailroom clerk who has become overburdened with a surplus of Día de los Muertos mail from the living to their dead relatives. Letters and packages come out of a conveyer belt, and pass through an X-ray machine, which shows a fragment of their address. Nearby, postal delivery workers sit on a line of chairs, waiting for enough mail to collect up in their mailbags to go out and do a mailrun. Mailbags may be labelled with any of the following: vowel sounds, suffixes, prefixes, letter names, letter patterns, graphemes or phonemes (for grapheme-phoneme matching), irregular/sight words, confusing letter shapes. These patterns map to ones that can be seen on the packages and letters through the X-ray machine. If letters are not dispatched within a certain amount of time, they disappear - since they are unstable objects that exist between both worlds.

## 6.2. Endless Runner (based on Bridge Builder)

In *Endless Runner*, the player’s objective is to assist characters who have become stuck deep in a memoryscape - littered with letters, books, poems, jokes, songs, and words - to return to a stable version of the world of the dead. They do so by completing words featuring missing segments, thus creating a stable landscape for the characters to traverse. The character is always moving to the right,

so the player must continuously complete words to help the character to safety. Dropping incorrect segments into the words results in the segments dropping straight through. If the character moves onto a gap in the word, they fall through and can lose bones. The speed at which the character moves is tied to level progress. Like other platformers, the landscape may involve obstacles, enemies, and jumping. The player can collect special powers based on how far they've run (i.e. number of words completed) and the difficulty of the words they've tackled.

## 6.3. Harvest (based on Sorting Potions)

In *Harvest*, the player's objective is to extract all the possible goodness out of words that keep flowering out of the ground, in order to obtain as much "word essence" as possible. Word essence is a very important magical substance, essentially serving as the power supply of the world. Each flowered word can be characterised in different ways: for example, "happening" has 3 syllables, begins with h, has "ing" as a suffix, etc. The player has to identify characteristics of the word in accordance with the characteristics collected by various characters/machines surrounding the flowered word. These characters/machines are labelled with certain characteristics, including numbers of syllables, prefixes, affixes, and so on. For example, there may be 6 characters/machines surrounding the flowered word "happening", which in turn may be labelled with: "1 syllable", "2 syllables", "3 syllables", "ist", "ing", and "ism". The characters/machines can only extract word essence from correctly matching flowers, while any attempt to extract word essence from an incorrectly matching flower can incur damage on the character/machine - encouraging the player to not try and match words with every character/machine. Essence can only be extracted from a character/machine once per word. Once a player decides that none of the characters/machines surrounding the flower can perform further extractions, they can summon a next wave of characters/machines to perform different extractions. For example, a next wave for "happening" might include "begins with h", "begins with b", "contains ben", "contains "pen", "ends with d", "ends with g". The player has 60 seconds to extract as much essence as possible from a word before it wilts. Wilted flowers can no longer have extractions performed on them.

## 6.4. Serenade Hero (based on Fix the Footpath)

In *Serenade Hero*, the player's objective is to assist a character in singing a song to his sweetheart, who is still alive. The character and his band outside, below the window of the sweetheart. A line of text is on screen, with words missing. The player needs to fill in the missing parts from a selection of words visible at the bottom of the screen. The sentence keeps refreshing, with new words available. A musical pacer is slowly along the line, from left to right, and if the sentence is deemed correct, the character and his band will continue singing. The longer the chain of correctness, the more complex and interesting the music sounds, and the more interesting the animations. For example, along a chain of correctness, the game will result in: a drumbeat, an accompanying instrument, another accompanying instrument, back up dancers, back up singers, the sweetheart appearing in the window, bystanders gathering, and the sweetheart bobbing her head to the music. As the game gets harder, the speed of the pacer will increase.

## 6.5. Moving Pathways (based on Mine Field)

In *Moving Pathways*, the player's objective is to help two characters be reunited. The player is faced with a grid of hexagonal tiles, all of which contain a single letter, but many of which are letters that can be confused with one another (e.g. b, p, and q). The player must create a path of movement based on a particular letter (i.e. the target letter) to reunite the characters. But no contiguous line of tiles featuring the target letter exists. The player needs to perform rotations on some tiles in order to continue the path. Only blocks around target letters can be rotated.

## 6.6. Drop Chop (based on Karate Chops)

In *Drop Chop*, the player's objective is to perform segmentation on words that are dropping down the screen. When correctly segmented, words break up into groups of cubes. For example, "watermelon" when correctly segmented turns into: wa-ter-me-lon, which after a couple of seconds, turns into [][] [] [][] [][] [][] [][][]. When in block form, block groups can be shunted around. Incorrectly segmented words, and also unsegmented words, cannot be broken up and fall straight down. When a complete line is made (of blocks and unsuccessfully segmented words or word parts), the line clears. The round is over when the top of the screen is reached by a block, a word, or a word part.

## 6.7. WhackaMole (based on previous version of WhackaMole)

WhackaMole will be a version of the WhackaMole activity described in D3.5, but set in a carnival atmosphere in the Día de los Muertos world.

## 6.8. Eye Exam (based on Highlight Curling)

In Eye Exam, the player's objective is to help a doctor, who has lost his/her glasses, to run eye exams. The doctor has an eye chart that displays certain words. The doctor knows the eye charts well, but without glasses, cannot specify where on the chart patients should read from. The doctor gives a word pattern to the player to find, for example, "TH" in the word "THOUGHT", and the player needs to highlight the appropriate portion of the word for a patient. If the player highlights an incorrect portion, e.g. if the player highlights "HT", then the player is given feedback about incorrectness immediately. Otherwise, the patient takes heed of what the player has highlighted and reads something out, which is displayed as a speech bubble. In easier levels, the patient always reads the word portion correctly. In more advanced levels, the patient may get the word portion wrong, and the player judges the correctness of the patient's response.

## 6.9. Typing Train Dispatcher (based on previous version of Train Dispatcher)

We are still working on establishing a suitable fit between the Typing Train Dispatcher activity described in D3.5 and the Día de los Muertos world.

# 7. Learning Activities Prototype

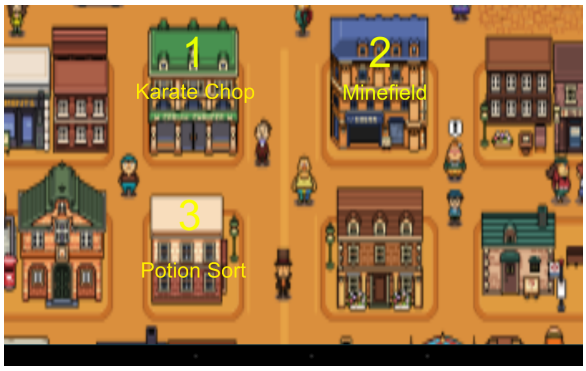
In parallel with the design activities, we initiated the development of the game challenges by way of an early game prototype. We point out that due to time constraints, we developed challenges based on the learning activities that were specified in D3.5. While the "skins" of the challenges have now changed considerably due to the Día de los Muertos concept, the main mechanics and interactions remain roughly the same, and the skins can be updated for the final game. Our prototype includes three activities with basic graphical assets joined together in a simple world view. The activities were selected to cover different learning difficulties and make use of various interfacing patterns.

The main screen of the prototype displays a part of a static image representing a city (see Figure 16.a). The player can traverse this city by scrolling the image on the tablet and enter predefined locations (i.e. houses) by taping on them. Entering a house will initiate an activity, and once this is over the player is back to the game world. Note that in the final game, this static view of the world will be replaced by a dynamic environment in which non player characters wander around. Nevertheless, the point of view will still offer a 2D view of the world, and thus the interaction between user and tablet will be similar.

The first activity implemented is *Karate Chops* (see Figure 16.d). The main mechanic in this activity consists of displaying on the screen one word that the player needs to divide on its basic components (e.g. syllables or prefix and suffix). In this prototype, the player can tap any part of the displayed word and upon touching a correct split point, the word is divided in two parts that remain on the screen until all split points have been discovered or a number of incorrect attempts is reached. This mechanic can be reused in any game scenario that involves segmentation of words; in particular, the refined version of this activity, namely *Drop Chop*, while incorporating new mechanics (i.e. words transform into blocks that can be shuffled around) it still relies on splitting words by tapping on them as core mechanic.

The second activity developed is *Minefield* (see Figure 16.b). In this prototype the player has to tap on the correct sequence of hexagons that contain a given pattern (i.e. a given letter). Selecting an incorrect tile leads to an explosion and resets the sequence; the game ends once the player completes the sequence or selects a given number of incorrect tiles. Just as with the previous activity, the refined version of *Minefield* (namely *Moving Pathways*) retains the basic mechanic while adding one alternative mechanic (rotating tiles) which will be incorporated in the final version of the game. *Endless Runner* and *Serenade Hero* will also make use of this mechanic as the player is asked to select (with different timing constrains) the correct pattern out of a set of possible choices.

The third activity featured in the prototype is *Sorting Potions* (see Figure 16.c). The basic underlying mechanic consists of dragging words or letters and dropping them into their correct target location, designated by a particular pattern. In the current prototype the objective for the player is to classify words by the number of syllables (i.e. target locations are marked by the number of syllables). The game ends once all the words have been dropped into a (correct or incorrect) location. In the refined version of this activity, *Harvest*, the roles between words and patterns are swapped as agents/machines representing the patterns have to be dropped onto flowers representing the words. However, this is a *semantic* difference and the developed interaction can be easily adapted for the refined version of the activity. This interaction will be also reused for the *Mail Sorter* game as the player has to drag packages representing particular sounds, graphemes, letters or words into the correct mail bag.




(a) Game world


(b) Minefield activity


(c) Sorting Potions activity


(d) Karate Chops activity

**Figure 16 – Prototype screenshots**

In sum, this first iteration of the game implementation yielded a prototype with a set of activities that differ from the final set of refined games scenarios, and make use of generic and unrelated graphical assets; on the other hand, it offers a set of playable activities whose mechanics and interactions will be present in the final game, which will accelerate the development as the design becomes finalised.

# 8. Future Work

The next step for the game related components of ILearnRW are framed within the deliverables related to game development (D5.3), scenario adaptation (D4.3), and integration (D6.2).

## 8.1. Upcoming game development efforts

Concerning game development activities, three main lines of work are defined: design of the world character events and interactions, alongside graphical and textual assets, implementation of the dynamic aspects of the game integrated with the teaching strategies, and play testing the final game.

We have established plausible game challenges based on learning activities that will be available in the Día de los Muertos world. What remains is to establish the interactions with characters that lead to participation in those game challenges, and the narrative events that occur that require the player to help characters. Our plan is to establish a working set of character story concepts, and then to further develop those in a series of art-based participatory game design workshops with children. We are keen for children to inform the design and back stories of characters directly. We are also interested in gauging which direction to pursue for the game aesthetics, as the Día de los Muertos concept may be scary to some, depending on how it is represented. Certainly, we hope to reach a balance narratively and aesthetically such that the game is age-appropriate, appealing, and non-creepy.

When the design has been sufficiently finalised, we will continue implementation, building on top of the existing prototype following the specifications of the refined game scenarios, game world and social network described in this document. In addition, we will work together with the dyslexia experts to assure that the implemented assets support fully the teaching strategies defined in D3.2 and D3.5 (namely multi-sensory learning and metacognitive and metalinguistic awareness).

As the assets, game challenges, and character interactions are gradually implemented, we plan to organise playtest sessions with children with dyslexia from the target age group and with teachers and experts on dyslexia, in order to identify issues related to the gameplay, feedback after the activities, tutorials and any other component of the game. Following these iterations of testing, we expect a couple of rounds of minor design changes and subsequent re-implementation. These playtest sessions will be conducted independently of, and prior to the evaluation stage.

## 8.2. Upcoming scenario adaptation efforts

Work on the adaptation of the scenarios will be focused on finding a model that will select the game scenario and personalised literary content to the current player based on her profile. Initial work on this component has drawn a crowdsourcing experiment to gather teachers' implicit knowledge about over-learning and motivation within dyslexia intervention lessons. Data collected with this experiment will aid in shaping a model that, instead of always using the current teaching point according to the profile, will also select content from unexpected language difficulties, difficulties already mastered by the student, or difficulties not visited for some time, serving to balance difficulty and also enhance learning based on expert knowledge.

## 8.3. Upcoming implementation efforts

The remaining activities related to integration have to do with the establishment of the connections between all the components within the game and the web services exposed by the server. Mainly, the game should be able to retrieve from the server the current progress of the player in the game and being able to log into the server new progress made on the game world and on the game scenarios. In turn, the adaptation mechanisms will have to be connected to the literacy profile and to the dictionaries or classified word lists hosted on the server, which will be required to populate the game scenarios.

# Appendix A: Sample Consent Form

## A.1. Children's Consent Form for Focus Groups

Research project title

ILearnRW: A computer program to help reading and writing

Description of the research

- At the University of Birmingham we are making a new computer program to help children with reading and writing
- As part of this we want to make an exciting new game that will make it fun for you to use the computer program
- We want to ask you about the computer games you like to use so we can make something that would be fun for you to play

Taking part in our research

- You have been chosen to take part in a discussion group
- We will be asking you some questions about computer games
- Please put up your hand if you have something you want to share with the group
- If you do not have anything to share then that is fine too you can just listen
- There are no right answers, will just want to know what you think
- Taking part in the discussion is your choice and if you do not want to take part or wish to leave during the session then just tell one of the researchers
- We will be audio recording the discussion so we don't miss any of your great ideas
- If you have any questions or problems during the session then please tell one of the researchers

Information from discussion

The information from this discussion may be shared with others, but no one will know who said the information

**[To also be read aloud by a researcher]**

## CONSENT FORM

Please read the statements and tick the boxes if you agree with them

| | | |
|---|---|---|
|  | I have read and understood the information sheet | |
|  | I have had time to think about the information | |
|  | I understand that I am volunteering to be involved and can leave the computer games discussion at any time without giving a reason | |
|   | I understand that the information I give may be shared with others, but that no-one other than the researcher and others in the discussion group will know what I have said. | |
|  | I agree to take part in the computer games discussion. | |

_____

(Please Print Your Full Name)

_____

(Please Sign Your Name)

_____

(Date)

## A.2. Parents' Consent Form for Focus Groups

Research project title
ILearnRW: An Integrated Intelligent Learning Environment for Reading and Writing

Description of the research
We are aiming to design a new type of learning software that will help support and improve specific reading and writing difficulties experienced by primary school pupils aged 9-11. Part of this software will include a learning game and in order to make this game appealing to children we want to ask children themselves about the type of computer games they like playing and why.

An invitation to participate in our research
We would like to invite your child to participate within our research project through a computer game discussion group. We will be running several small discussion groups with pupils in years 5 and 6 at your child's school, which will involve asking the children about reading, the computer games they play and what they like about these games as well as asking them for their opinions on a number of existing age-appropriate computer games. The discussion groups will last no longer than 1 hour, will take place at your child's school with a teaching staff member present at all times and will be timetabled in consultation with your child's teacher. Participation within the discussion groups is entirely voluntary and if you or your child is uncomfortable with this then your child is free to withdraw at any time. This will also be made clear to your child at the start of the discussion group.
The discussion group will be audio recorded to ensure all of the children's ideas and opinions are captured.

Confidentiality and data security
All data collected from the discussion groups will be treated as confidential. The audio recordings will be stored securely and only relevant research team members will be granted access to these videos. All data will be stored in accordance with the Data Protection act for 10 years, after which time it will be destroyed.

Results of the research
The results of this research will be written up for conference papers and peer-reviewed journal articles, and further information will also be made available on our website: http://www.ilearnrw.eu

Contact details
If you have any further questions about this research or concerns regarding your child's participation then please contact us:

**Laura Benton (primary contact)**
Research Fellow
University of Birmingham
Email: l.benton@cs.bham.ac.uk

**Dr Mina Vasalou**
Research Fellow
University of Birmingham
Email: a.vasalou@cs.bham.ac.uk

**Laura Benton**
Research Fellow
Telephone +44 7811 689980
E-mail: L.Benton@cs.bham.ac.uk

UNIVERSITY OF BIRMINGHAM

**School of Computer Science**
Edgbaston · Birmingham · B15 2TT · United Kingdom

Dear Parent/Guardian,

The University of Birmingham is currently running a research project in conjunction with Rye Oak Primary School that is aiming to develop software to support the learning of primary school children with reading and writing difficulties (at Key Stage 2). The software will incorporate an assistive reading tool as well as educational games aimed at encouraging children's engagement in both reading and writing. A current profile of the child's learning needs will also be integrated, enabling the software to present tailored content to best support each child's specific difficulties. It is hoped this will provide an engaging and complimentary role to traditional classroom teaching.

Your son or daughter has been asked to participate in this project. A participant information sheet is attached to this letter, which provides more information about what this participation would involve. The study already has full ethical approval from the university ethics committee and as such, if your son or daughter decides to participate, he/she is of course free to withdraw at any time and for any reason. All information collected from the session will be securely stored and kept completely confidential. The results of this research will be written up for publication in conference papers and peer-reviewed journals.

Of course, we completely understand the busy nature of school life, but we can assure you that we will do everything possible so as not to disrupt your son or daughter's usual classroom routines. For any further information about the project at all, please feel free to contact me by email or telephone, as per the header of this letter. If you are unhappy about your son or daughter's participation in this project please sign the slip below and return to your child's teacher or alternatively contact me directly to discuss further.

Yours sincerely,

Laura Benton

---

I do not consent to my child participating in the ILearnRW research project

Name of child…… Date…… Signature……..

## A.3. Children's Consent Form for Design Workshop

Research project title

ILearnRW: A computer program to help reading and writing

Description of the research

- At the University of Birmingham we are making a new computer program to help children with reading and writing
- As part of this we want to make an exciting new game that will make it fun for you to use the computer program
- We want to find out what your ideas for how to make this game fun, how the game can tell you if you are doing well or if you need to improve and what the best way to explore the game is

Taking part in our research

- You have been chosen to take part in three design workshops
- We will be showing you some existing computer games and asking about your opinions
- We will also be coming up with ideas as a team for how to build a better game
- We will be using art materials to show what this game will look like
- We will then use these ideas and a researcher in Malta will build your ideas into the game
- We hope to then come back to your school to show you the new game
- Taking part in the workshops is your choice and if you do not want to take part or wish to leave during the session then just tell the researcher or your teacher
- We will be video recording the discussion so we don't miss any of your great ideas
- If you have any questions or problems during the session then please tell one of the researchers

Information from discussion

- The information from this discussion may be shared with others, but no one will know who said the information

## CONSENT FORM

Please read the statements and tick the boxes if you agree with them

| | | |
|---|---|---|
|  | I have read and understood the information sheet | |
|  | I have had time to think about the information | |
|  | I understand that I am volunteering to be involved and can leave the computer games design workshop at any time without giving a reason | |
|   | I understand that the information I give may be shared with others, but that no-one other than the researcher and others in the design workshop will know what I have said. | |
|  | I agree to take part in the computer games design workshop. | |

_____

(Please Print Your Full Name)

_____

(Please Sign Your Name)

_____

(Date)

## A.4. Teachers' Consent Form for Design Workshops

**Design Workshops Consent Form for Teachers**

Research project title
ILearnRW: An Integrated Intelligent Learning Environment for Reading and Writing

Fair Processing Statement
This information is being collected as part of a research project concerned with designing learning software to support difficulties with reading/writing, undertaken by the School of Computer Science at the University of Birmingham (in collaboration with the National Technical University of Athens, University of Malta, Technological Institution of Epirus, Lucian Blaga University of Sibiu, Dolphin Computer Access and Dyslexia Institute). The information which you supply and that which may be collected as part of the research project will be entered into a filing system or database and will only be accessed by authorised personnel involved in the project. The information will be retained by the University of Birmingham and will only be used for the purpose of research, and statistical and audit purposes. By supplying this information you are consenting to the University storing your information for the purposes stated above. The information will be processed by the University of Birmingham in accordance with the provisions of the Data Protection Act 1998. No identifiable personal data will be published.

Statements of understanding/consent

- I confirm that I have read and understand the participant information leaflet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

- I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. If I withdraw their data will be removed from the study and will be destroyed.

- I understand that my personal data will be processed for the purposes detailed above, in accordance with the Data Protection Act 1998.

- Based upon the above, I agree to take part in this study.

Name, signature and date

Name of participant…… Date…… Signature……..

Name of researcher……..……... Date…… Signature……..

*A copy of the signed and dated consent form and the participant information leaflet should be given to the participant and retained by the researcher to be kept securely on file.*

Research project title
ILearnRW: An Integrated Intelligent Learning Environment for Reading and Writing

Description of the research
We are aiming to design a new type of learning software that will help support and improve specific reading and writing difficulties experienced by primary school pupils aged 9-11 years. In order to design software that is meets the educational needs of the children we would like to incorporate ideas from their teachers within the software design.

An invitation to participate in our research
We would like to invite you to participate in a design workshop because of your experience providing support with children's reading and writing difficulties. This would involve your participation in a three design workshops alongside three-four children and one researcher from the University of Birmingham. This workshop would last up to 1 hour and would take place in school. The workshops would involve looking at existing software and then thinking and developing ideas for how the new software could best support a child's reading and writing needs. Participation within the workshop is entirely voluntary and you are free to withdraw at any time without providing a reason.

The workshops will be video recorded to ensure all ideas from the sessions are captured.

Confidentiality and data security
All data collected from the workshops will be treated as confidential. The video recordings will be stored securely and only relevant research team members will be granted access to these videos. All data will be stored in accordance with the Data Protection act for 10 years, after which time it will be destroyed.

Results of the research
The results of this research will be written up for conference papers and peer-reviewed journal articles, and further information will also be made available on our website: http://www.ilearnrw.eu

Contact details
If you have any further questions about this research or concerns regarding your participation then please contact us:

**Laura Benton (primary contact)**
Research Fellow
University of Birmingham
Email: l.benton@cs.bham.ac.uk
Mobile: 07811689980

**Dr Mina Vasalou**
Research Fellow
University of Birmingham
**Email: a.vasalou@cs.bham.ac.uk**

## A.5. Parents' Consent Form for Design Workshops

**Game Design Workshops Participant Information Sheet for Parents**

Research project title

ILearnRW: An Integrated Intelligent Learning Environment for Reading and Writing

Description of the research

We are aiming to design a new type of learning software that will help support and improve specific reading and writing difficulties experienced by primary school pupils aged 9-11 years. This software incorporates two parts, one part is an assistive reader and the other part is a learning game. In order to design software that is appealing to this age group and also meets the specific needs of children with difficulties in reading and writing we would like to incorporate ideas from the children within the software design.

An invitation to participate in our research

Your child has been asked to participate within this research as he or she receives additional support for reading/writing and is within the age group specified above. This would involve your child participating within three game design workshops over a number of weeks alongside two or three other children from the school, one researcher from the University of Birmingham and a member of teaching staff from the school. These design workshops would last up to 1 hour each and would be appropriately timetabled in consultation with the school. The workshops will involve looking at and discussing existing literacy games as well as thinking of ideas about how our software could teach children about reading/writing in a fun way and how they could be given feedback/rewarded for their progress. The workshops are designed to be fun, engaging and creative experiences for the children. Participation within the workshops is entirely voluntary and if you or your child is uncomfortable with this then your child is free to withdraw at any time. This will also be made clear to your child at the start of the workshops. The workshops will be video recorded to ensure all ideas from the sessions are captured.

Confidentiality and data security

All data collected from the workshops will be treated as confidential. The video recordings will be stored securely and only relevant research team members will be granted access to these videos. The videos will be used solely for internal research purposes and will not be shown to any outside parties. All data will be stored in accordance with the Data Protection act for 10 years, after which time it will be destroyed.

Results of the research

The research of this research will be written up for conference papers and peer-reviewed journal articles, and further information will also be made available on our website: http://www.ilearnrw.eu

Contact details

If you have any further questions about this study or concerns regarding your child's participation within this research then please contact us:

**Laura Benton (primary contact)**
Research Fellow
University of Birmingham
Email: l.benton@cs.bham.ac.uk

**Dr Mina Vasalou**
Research Fellow
University of Birmingham
Email: a.vasalou@cs.bham.ac.uk

**Game Design Workshops Consent Form for Parents**

Research project title

ILearnRW: An Integrated Intelligent Learning Environment for Reading and Writing

Fair Processing Statement

This information is being collected as part of a research project concerned with designing learning software to support difficulties with reading/writing, undertaken by the School of Computer Science at the University of Birmingham (in collaboration with the National Technical University of Athens, University of Malta, Technological Institution of Epirus, Lucian Blaga University of Sibiu, Dolphin Computer Access and Dyslexia Institute). The information which you supply and that which may be collected as part of the research project will be entered into a filing system or database and will only be accessed by authorised personnel involved in the project. The information will be retained by the University of Birmingham and will only be used for the purpose of research, and statistical and audit purposes. By supplying this information you are consenting to the University storing your information for the purposes stated above. The information will be processed by the University of Birmingham in accordance with the provisions of the Data Protection Act 1998. No identifiable personal data will be published.

Statements of understanding/consent

As appropriate to the study, for example these may include:

- I confirm that I have read and understand the participant information leaflet for this study. I have had the opportunity to ask questions if necessary and have had these answered satisfactorily.

- I understand that my child's participation is voluntary and that I am free to withdraw them at any time without giving any reason. If I withdraw my child their data will be removed from the study and will be destroyed.

- I understand that my child's personal data will be processed for the purposes detailed above, in accordance with the Data Protection Act 1998.

- Based upon the above, I agree for my child to take part in this study.

Name, signature and date

| | | |
|---|---|---|
| Name of participant……..…… | Date……. | Signature…….. |
| Name of researcher…Laura Benton…... | Date 12/06/13 | Signature… |

*A copy of the signed and dated consent form and the participant information leaflet should be given to the participant and retained by the researcher to be kept securely on file.*

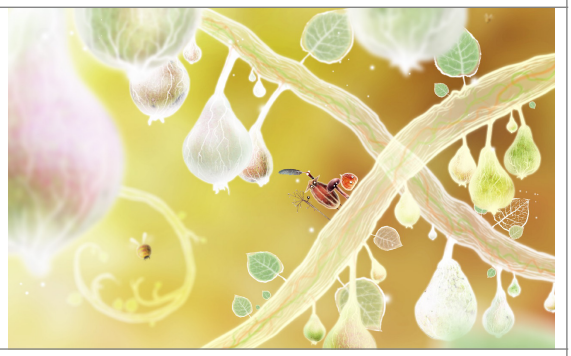
# Appendix B: Focus Groups Surveys


Awful Not very good OK Really good Brilliant

Tick if favourite ☐

Awful Not very good OK Really good Brilliant

Tick if favourite ☐

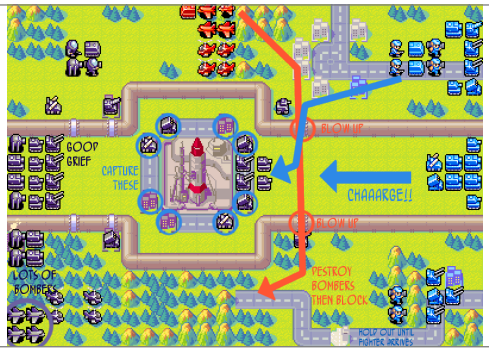



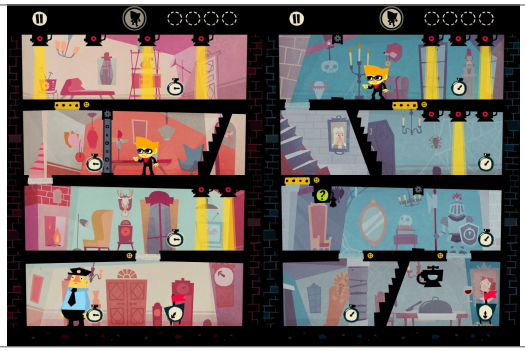
Awful Not very good OK Really good Brilliant

Tick if favourite ☐

Awful Not very good OK Really good Brilliant

Tick if favourite ☐



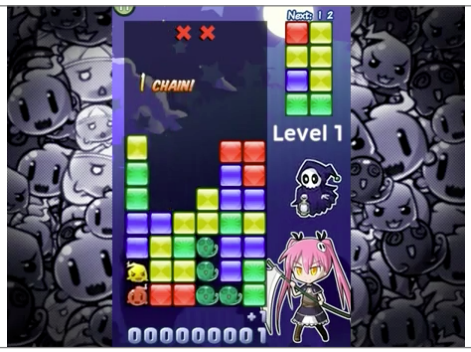



Awful Not very good OK Really good Brilliant

Tick if favourite ☐

Awful Not very good OK Really good Brilliant

Tick if favourite ☐






Tick if favourite ☐


Tick if favourite ☐



Tick if favourite ☐


Tick if favourite ☐



Tick if favourite ☐


Awful Not very good OK Really good Brilliant

Tick if favourite ☐

Awful Not very good OK Really good Brilliant

Tick if favourite ☐



Awful Not very good OK Really good Brilliant

Tick if favourite ☐

Awful Not very good OK Really good Brilliant

Tick if favourite ☐

# Bibliography

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