

# Designing a gamified reading app with pupils in elementary school

Bassant El Naggar<sup>1</sup> and Kay Berkling<sup>2</sup>

**Abstract.** Playing games on mobile devices has become an integral part of younger generations' lives. Mobile games foster, among other things, deep concentration. This paper reports on design guidelines derived from observations of six elementary school pupils' engagement over a six-week period during an after-school reading club program. Each meeting consisted of three activities as well as reading text on the Microsoft immersive reader on an iPad, and playing a competitive reading game app, 'Henry rennt', which are both designed to support reading. Pupils were engaged in informal conversation with the researchers about both applications, and the authors informally observed the pupils' engagement with the apps and each other. Patterns of engagement and comments from pupils informed the design of a new reading app. This work reports these general patterns and concludes with new research areas to pursue as a result, including the impact of: social setting on playing, in-game teaching with avatars on engagement, and speed as a measurement of skill mastery. Finally, the applicability of children's engagement patterns is validated with adult students of German as a second language who used the app.

**Keywords:** serious games, literacy games, elementary educational games, child-centered design.

## 1. Introduction

The motivational power of games was discovered by educational systems in the 1960s by a teaching movement known as *Back to the Basics*, when pupils were getting poor scores in exams. The movement highlighted that reading and writing skills are the basics of communication, and should be taught through

---

1. German University in Cairo, Cairo, Egypt; belnaggar16@gmail.com

2. Cooperative State University, Karlsruhe, Germany; berkling@dhbw-karlsruhe.de; <https://orcid.org/0000-0003-1186-5678>

**How to cite:** El Naggar, B., & Berkling, K. (2020). Designing a gamified reading app with pupils in elementary school. In K.-M. Frederiksen, S. Larsen, L. Bradley & S. Thouésny (Eds), *CALL for widening participation: short papers from EUROCALL 2020* (pp. 63-68). Research-publishing.net. <https://doi.org/10.14705/rpnet.2020.48.1166>

interaction rather than memorization (Hankin & Sachs, 2002). Integration of mobile devices into educational systems is reported to have a positive impact on pupils' learning curves (Major, Hassler, & Hennessy, 2017). Since digital games are based on interactivity and decision making to achieve various goals, they have an additional edge over educational books (Yannakakis & Togelius, 2018). According to the LEO (Level-One) study 2018 held by the Ministry of Education in the Federal Republic of Germany, 6.2 million German speakers could not read or write, representing more than 12% of the German population (Davis, 2019). This group of people is left behind by traditional schooling and could be supported by serious games encouraging motivation and practice. Creating effective learning games for elementary schools may be one solution. In games, fun in its varied facets is a strong motivator (Ismail & Ibrahim, 2018), and best explored by involving pupils during the design phase (Langridge, Smith, Smithers, & Southgate, 2017; Nettet & Large, 2004; Sykes & Federoff, 2006). By integrating observations of elementary school pupils' engagement with good apps, insights into motivating factors can result in design guidelines for more effective games across different age groups.

## 2. Observing elementary school pupils' engagement with reading apps

A reading club was established in an elementary day-school one afternoon per week for 2 hours. Six pupils of different genders between ages 8-9 in second grade with elementary German language reading skills participated for 6 weeks<sup>3</sup>. Each session included reading with the immersive reader<sup>4</sup> and playing the literacy game 'Henry rennt' (Berkling, Fawaz, Zundel, & Abdennadher, 2019). The immersive reader provides customization options for fonts, sizes, and colors, as well as live focus, pictionary, and part-of-speech highlighting. The game provides the task of finding words to be capitalized in a running game with an emotional avatar. Together, the apps cover a wide spectrum of approaches to the presentation of text material to students for reading practice. Both applications were well received by the pupils. Based on the observations, the authors compiled the following design guidelines for engaging game design specifically for reading games:

- formatting reading texts should be customizable to provide freedom while reading;

---

3. Parental permission required for biometrical data collection resulted in few volunteers.

4. <https://azure.microsoft.com/en-us/services/cognitive-services/immersive-reader/>

---

- supporting reading comprehension with pictures is an important facilitator;
- sentences should be kept short to support beginning readers;
- games need a simple, short tutorial;
- an accompanying emotional avatar is an important factor for engagement;
- rewards are expected and are not replaceable by the emotional avatar; and
- customization of the character is important to connect the user with the game.

### 3. Application toward game design

‘Phingu and the magic book’, was designed as an example of how to implement these guidelines in a game (see [Figure 1](#)). The game presents a maze to be navigated by Phingu with the help of three tutorial skill-dependent avatars. The student has to read, understand, and complete sentences in order to progress through the maze and levels with increasing difficulty. [Table 1](#) summarizes the game features developed.

Table 1. Guideline and design decisions

Guideline	Adaptation
Customizable text format	This is left to future work to display the magic books that will be unlocked with each level.
Picture-supported reading comprehension	The answers of the passwords are presented as pictures above each sentence.
Short sentences	Riddle sentences contain a maximum of six words.
Simple, short tutorial	Three distinct skill-based avatars/monsters were added to the game, are associated with by the user, and explain the concept of each of the three types of orthographic principles.
Emotional avatar as company	After each victory, celebratory music is played and Avatars always show reactions after each user’s entry.
Rewards	Correct passwords result in prizes in each of the three categories and are displayed with diamonds of the same color-coding as the skill-based avatars.
Avatar customization	The users can change the customs of the main Avatar before starting the game.

---

Figure 1. Scenes from ‘Phingu and the magic book’, including the login page, the maze, the interactive reading and comprehension quiz that can open the gate if correct but also provides a teaching opportunity in case of problems related to the use of the avatar, and the personalization of the avatar



#### 4. Applicability of design guidelines for adult students

To evaluate the engagement for adults, ten exchange pupils from the German University in Cairo evaluated the game from the perspective of German as a second language for level A2 on the Common European Framework of Reference for languages (CEFR) scale, which level is somewhat comparable to elementary pupils’ reading and writing skills. The average time of guessing the correct words was approximately equal to 34.07 seconds. The average score was 65, which meant the average number of words solved was 13 out of 24. 70 % of the students used the one hint offered in-game to help with spelling rules. Table 2 below explores the speed of answering for repeated words. Students tended to get faster during the game, indicating a memorization process.

Table 2. Time taken to submit correct words by trial for example repeating words

User	Repeated words	Times	1st visit (seconds)	2nd visit (seconds)	3rd visit (seconds)	Average time (seconds)
1	Suppe	2	11	5	-	8
	Wasser	2	7	5	-	7
	Lieder	3	8	15	9	11
2	Wiese	3	8	5	3	6
	Waffel	2	6	7	-	6
	Messer	2	6	3	-	5

In addition to the game analytics, results from informal interviews with the students can be summarized as follows:

- the avatar tutorials provided a learning event;
- the skill-based avatars supported pattern acquisition of orthographic principles;
- playing the game in a social environment resulted in longer time engagement<sup>5</sup>; and
- the game seems to support understanding and memorizing of new words.

## 5. Conclusions and future work

The presented work showed that a number of guidelines developed based on elementary school pupils' engagement observations can be applied to literacy game design and is generalizable across age groups. Observing pupils' engagement with digital reading material and literacy games informed design decisions for a new application in a structured manner and resulted in new leads for further research.

For adult language learners, a qualitative evaluation indicates that playing multiple times improves skill, which supports previous findings for children in similar applications (Berkling et al., 2019). Observations motivate further need to study how social environments during play can boost engagement time, and the effect of emotional bonds with avatars in learning environments. Avatars as teachers seemed to be effective in teaching adult learners' new concepts.

## 6. Acknowledgments

iRead is part of a project that has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 731724. The results presented reflect only the authors' views and the Agency is not responsible for any use that may be made of the information it contains.

---

5. Social environment for playing games as a major engagement factor has been observed in classroom setting, for children and with adults.

## References

- Berkling, K., Fawaz, E., Zundel, A., & Abdennadher, S. (2019). Designing an emotive avatar for a grammar game – a case study of engagement and performance development. In J. Arnedo-Moreno, C. S. González, A. Mora (Eds), Proceedings of the 3rd International Symposium on Gamification and Games for Learning (GamiLearn'19), Barcelona, Spain, 22-10-2019.
- Davis, A. (2019). Millions in Germany can't read or write properly. Deutsche Welle <https://www.dw.com/en/millions-of-germans-have-trouble-reading-and-writing/a-48633267>
- Hankin, C. G., & Sachs, R. T.. (2002). Education Update. *Back to Basics*.
- Ismail, R., & Ibrahim, R. (2018). Fun elements in educational game design to boost students. In *New Academia Learning Innovation (NALI) 2018 Symposium*. [https://www.researchgate.net/publication/326492187\\_NALI\\_Symposium\\_Fun\\_Elements\\_in\\_Educational\\_Game\\_Design\\_To\\_Boost\\_Students\\_Learning\\_Experience](https://www.researchgate.net/publication/326492187_NALI_Symposium_Fun_Elements_in_Educational_Game_Design_To_Boost_Students_Learning_Experience)
- Langridge, R., Smith, S., Smithers, K., & Southgate, E. (2017). Participatory design with children and young people: an annotated bibliography. *DICE Report Series, 5*. The University of Newcastle. [https://dice.newcastle.edu.au/DRS\\_5\\_2017.pdf](https://dice.newcastle.edu.au/DRS_5_2017.pdf)
- Major, L., Hassler, B., & Hennessy, S. (2017). Tablet use in schools: impact, affordances and recommendations. In A. Marcus-Quinn & T. Hourigan (Eds), *Handbook on digital learning for K-12 schools* (pp. 115-128). Springer. [https://doi.org/10.1007/978-3-319-33808-8\\_8](https://doi.org/10.1007/978-3-319-33808-8_8)
- Nesset, V., & Large, A. (2004). Children in the information technology design process. A review of theories and their applications. *Library & Information Science Research, 26*(2), 140-161. <https://doi.org/10.1016/j.lisr.2003.12.002>
- Sykes, J., & Federoff, M. (2006). Player-centred game design. *Extended Abstracts Proceedings of the 2006 Conference on Human Factors in Computing Systems* (pp. 1731-1734). <https://doi.org/10.1145/1125451.1125774>
- Yannakakis, G., & Togelius, J. (2018). *Artificial intelligence and games*. Springer. <https://doi.org/10.1007/978-3-319-63519-4>

Published by Research-publishing.net, a not-for-profit association  
Contact: [info@research-publishing.net](mailto:info@research-publishing.net)

© 2020 by Editors (collective work)  
© 2020 by Authors (individual work)

**CALL for widening participation: short papers from EUROCALL 2020**  
Edited by Karen-Margrete Frederiksen, Sanne Larsen, Linda Bradley, and Sylvie Thouéšny

**Publication date: 2020/12/14**

**Rights:** the whole volume is published under the Attribution-NonCommercial-NoDerivatives International (CC BY-NC-ND) licence; **individual articles may have a different licence.** Under the CC BY-NC-ND licence, the volume is freely available online (<https://doi.org/10.14705/rpnet.2020.48.9782490057818>) for anybody to read, download, copy, and redistribute provided that the author(s), editorial team, and publisher are properly cited. Commercial use and derivative works are, however, not permitted.

**Disclaimer:** Research-publishing.net does not take any responsibility for the content of the pages written by the authors of this book. The authors have recognised that the work described was not published before, or that it was not under consideration for publication elsewhere. While the information in this book is believed to be true and accurate on the date of its going to press, neither the editorial team nor the publisher can accept any legal responsibility for any errors or omissions. The publisher makes no warranty, expressed or implied, with respect to the material contained herein. While Research-publishing.net is committed to publishing works of integrity, the words are the authors' alone.

**Trademark notice:** product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

**Copyrighted material:** every effort has been made by the editorial team to trace copyright holders and to obtain their permission for the use of copyrighted material in this book. In the event of errors or omissions, please notify the publisher of any corrections that will need to be incorporated in future editions of this book.

Typeset by Research-publishing.net

Cover theme by © 2020 Marie Flensburg ([frw831@hum.ku.dk](mailto:frw831@hum.ku.dk)), based on illustration from freepik.com  
Cover layout by © 2020 Raphaël Savina ([raphael@savina.net](mailto:raphael@savina.net))

ISBN13: 978-2-490057-81-8 (Ebook, PDF, colour)

British Library Cataloguing-in-Publication Data.

A cataloguing record for this book is available from the British Library.

**Legal deposit, France:** Bibliothèque Nationale de France - Dépôt légal: décembre 2020.