

How critical engagements with design can identify gaps and create new evidence: A case study of the iRead project



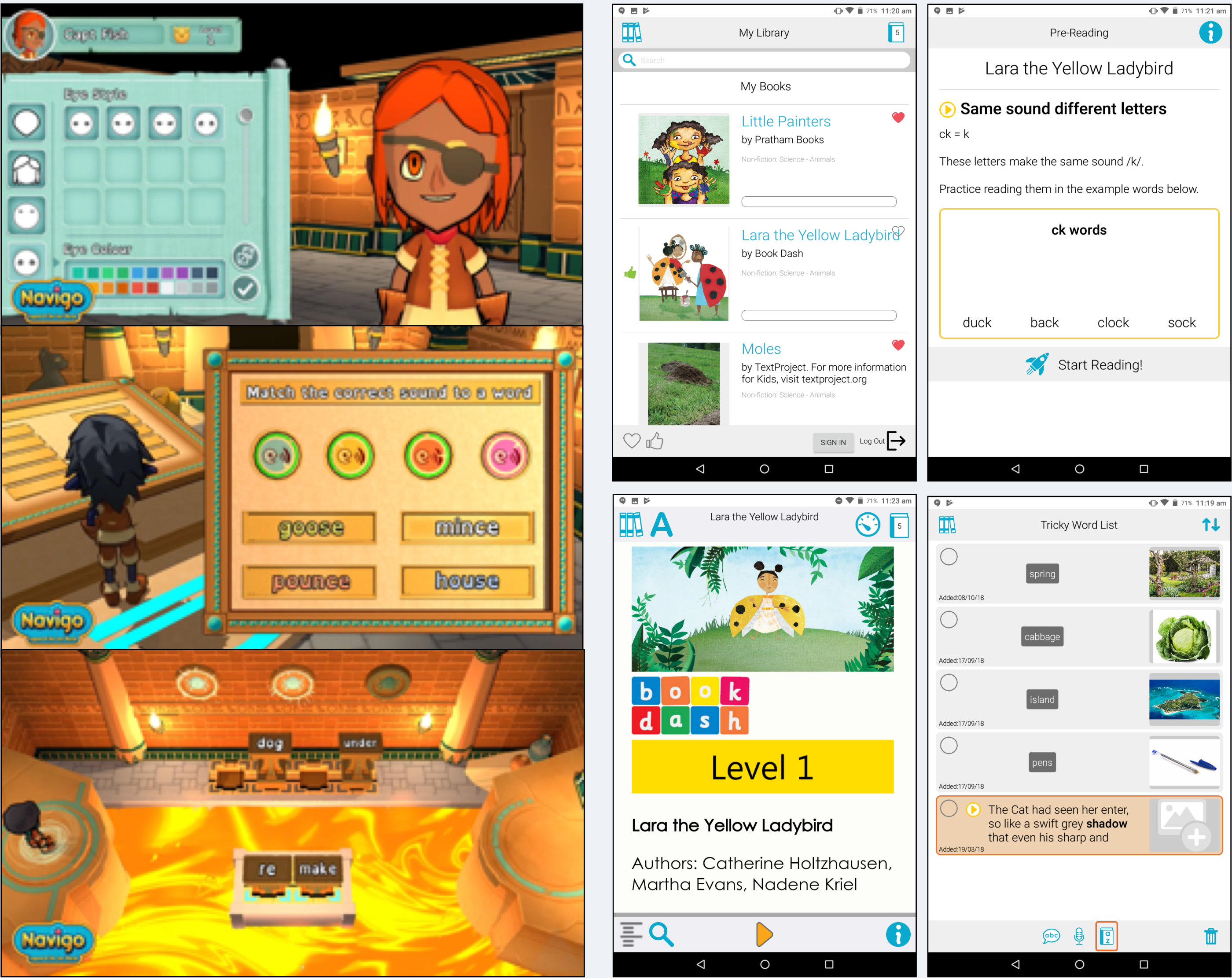
Emma Sumner, Elisabeth Herbert, Laura Benton, Nelly Joye, Manolis Mavrikis, Mina Vasalou



Background

iRead is an EU-funded H2020 Innovation project comprising 15 partners from across industry and education in 9 European countries. The project aims to develop a software infrastructure for personalised learning technologies with a diverse set of learning apps and teaching tools that foster the **learning, teaching and assessment of reading skills**, including a personalised and adaptive literacy Game (Navigo) and a Reader app (Amigo Reader).

- The technology is being designed for use with the following groups:
- Children learning to read in English, Spanish, Greek and German
 - Children with dyslexia in English and Greek
 - Children learning English as a foreign language (EFL) outside of UK



Our journey: defining the game content

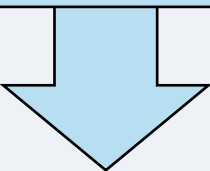
Content and order of presentation: What to teach?

What do we start with? How do we grade difficulty of features? What prior knowledge do children need to access a feature?

Gaps identified: Current schemes in the UK (e.g. Letters and Sounds, Jolly Phonics) demonstrate a progression from single letter sounds to more complex digraphs. However, inconsistencies were found in the order of teaching GPCs, and a lack of evidence to confirm the teaching sequence.

Action: The Children's Printed Word Database¹ was checked to exclude less frequent GPCs and identify high frequency words for the teaching of irregular words. Progression was mapped to existing schemes and prerequisites were defined.

How technology can help: Data will be collected about children's gameplay and presented to the teacher (learning analytics). A progression can then be identified based on the features found to be easier or more challenging.



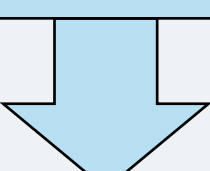
Mastery: When do we know when mastery has happened?

What cut-off? How many repetitions before moving on? Should this be differentiated for different learners?

Gaps identified: Lack of evidence for what would class as 'mastery', but existing literacy apps appear to use level of performance in the games to model successful learning (often 70-80% success rate).

Action: Mastery levels will be defined based on children's level, the games' learning objectives and other factors such as time taken and performance in the game in the first instance.

How technology can help: Mastery modelling will be fine-tuned based on the data collected from interaction with the system.



Feedback: How and when to provide feedback?

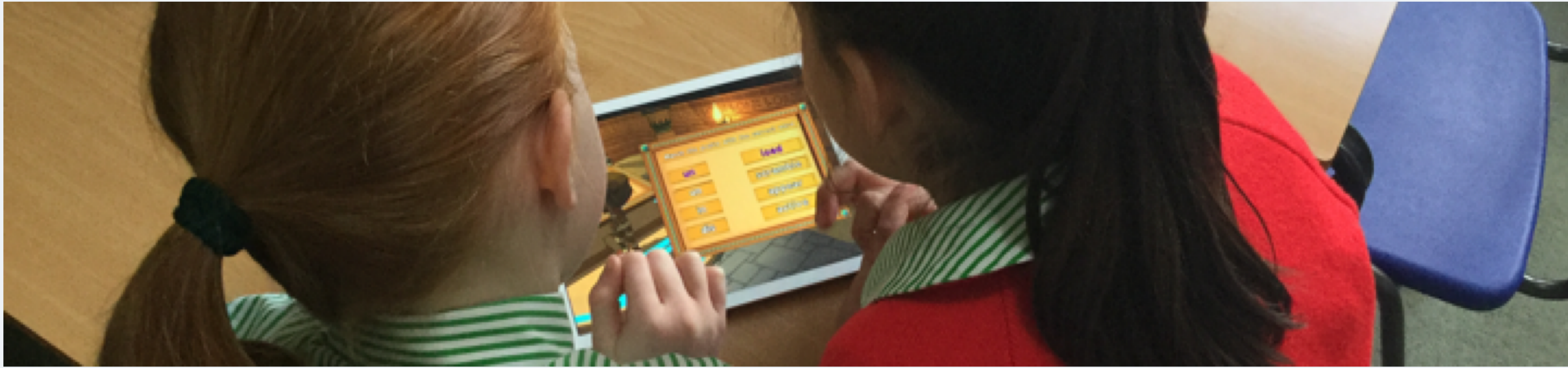
What type of feedback (e.g. outcome vs elaborative)?

Gaps identified: Feedback is most effective when elaborated.^{2,3} An analysis of existing commercial reading games revealed gaps in elaborative feedback use and inconsistencies in feedback design across mini-games.⁴

Action: We defined a consistent set of rules following examples of best practice (teacher focus groups and existing reading games) and the literature² to provide elaborative feedback:

- Audio hints for incorrect answers (dependent on game type)
- Reinforcement audio feedback for correct answers
- 'Helper' character provides implicit feedback after player inactivity

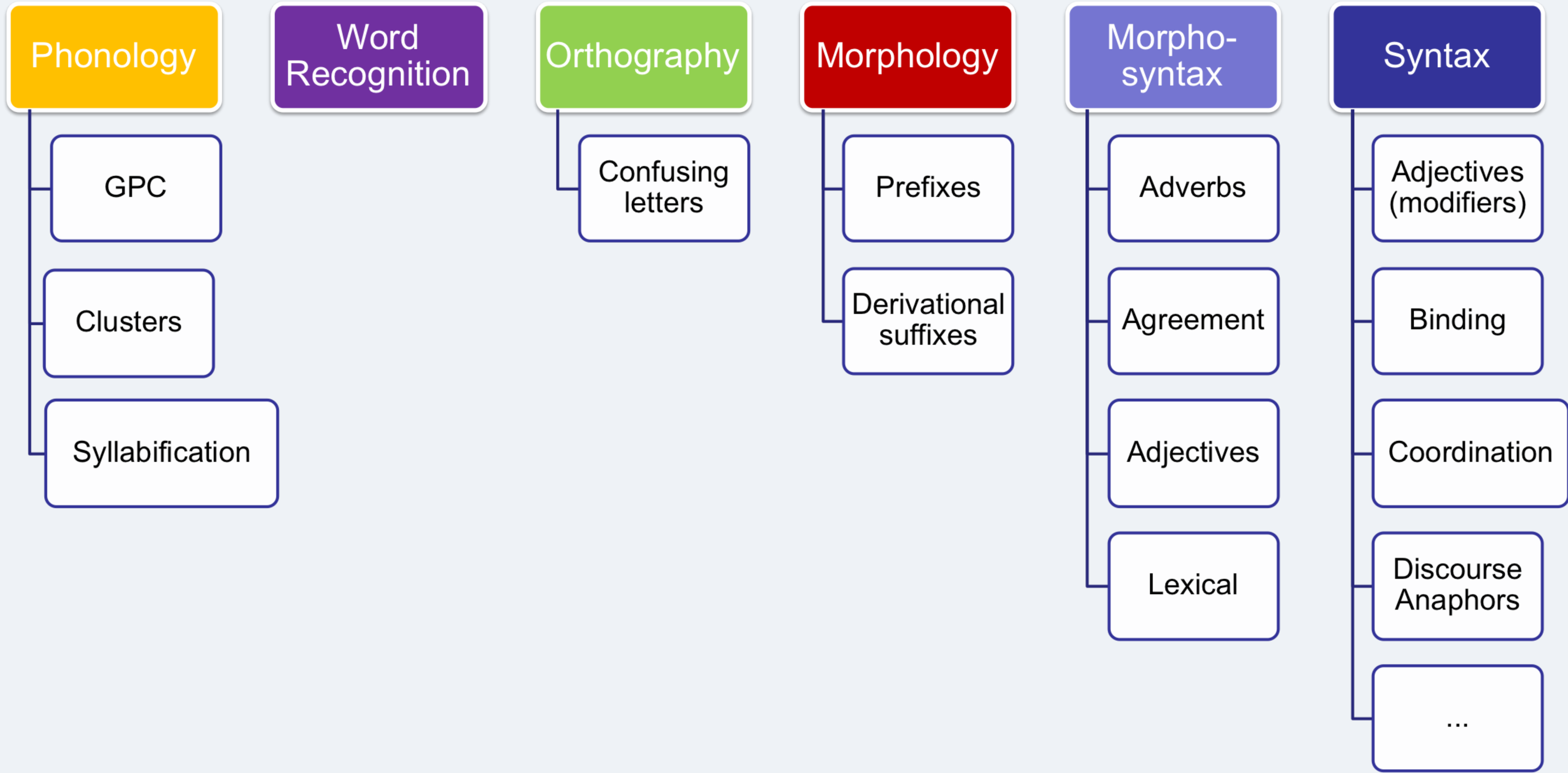
How technology can help: Through empirical work observing children's interaction with the game we will explore how the provision of elaborative feedback supports learning for the different learner groups.



Our theoretical approach

- The first aim was to develop a "domain model" of skills required for reading. The domain model is a comprehensive linguistic framework that:
- Specifies the linguistic structure that will constitute teaching material (Grapheme-Phoneme Correspondences [GPCs], word recognition, morphology, syntax, discourse)
 - Informs all subsystems: the game, reader, and text classification
 - Determines the individualised pedagogical design used for each child.

Key areas identified based on the literature and school curriculum:



Conclusion

- There is an emerging literature of which GPCs should be taught in relation to frequency⁵ and how feedback should be given.
- Yet, there is a lack of literature that has empirically tested progression, mastery and elaborative feedback within games.
- Learning analytics may provide a useful tool for empirically testing the above gaps in the literature and inform teaching practice. Technology can advance our understanding through extensive data collection and automatised processing.

Remaining questions

- Can mastery and feedback be personalised to the learner profile?
- How to implement interleaved practice into the games. Should practice alternate features (e.g. 'ee', 'ea'), linguistic structures (e.g. GPCs, morphology) and/or activity type (e.g. accuracy, blending, automaticity)?

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A 4-year EC Funded project (Jan 2017-Dec 2020). This project has received funding from the European Union's Horizon 2020 innovation programme under grant agreement No 731724.