Visualizing knowledge in the era of instructional software and gamification – Challenges in design, method, and practical use

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Summary

The study examined behavioral and metacognitive effects of visualizing acquired knowledge in instructional software. This was done by letting 117 Swedish primary school students use two varieties of an educational game – one with and one without a tool where tokens with knowledge related content were received as proofs of achievement. In sum, the following conclusions were drawn:

- The visualized achievements were attended to, but not sufficiently and not in the intended way.
- No significant motivational impact of the tool was found. The children who had access to the tokens did not play the game at home for more time than the children without it.
- This kind of visual support in learning applications requires thorough design, testing, and evaluation. Most importantly, the tool needs to be properly introduced, free of parallel tasks and should be mandatory and meaningful to use.

Introduction

THE ROLE OF METACOGNITION IN LEARNING has been a hot topic during the last decades. Research findings on the subject also reveal that regular visualizations and reviews of student achievements versus goals and sub-goals can have a significant impact on learning outcomes.

IN LEARNING APPLICATIONS AND GAMES, however, learners generally solve tasks without saving any substantial traces of them, and the possibility of reviewing or evaluating the obtained know-how is very limited. Hence, the aim of the present study has been to design and evaluate a function that preserves and presents achievements in an educational game. The following hypotheses were formulated:

- Visualizations of the student's acquired knowledge will catch the student's attention, and they will be interacted with during play.
- Such representations will serve as motivational tokens and will affect self-regulatory aspects, e.g. endurance at voluntary play.
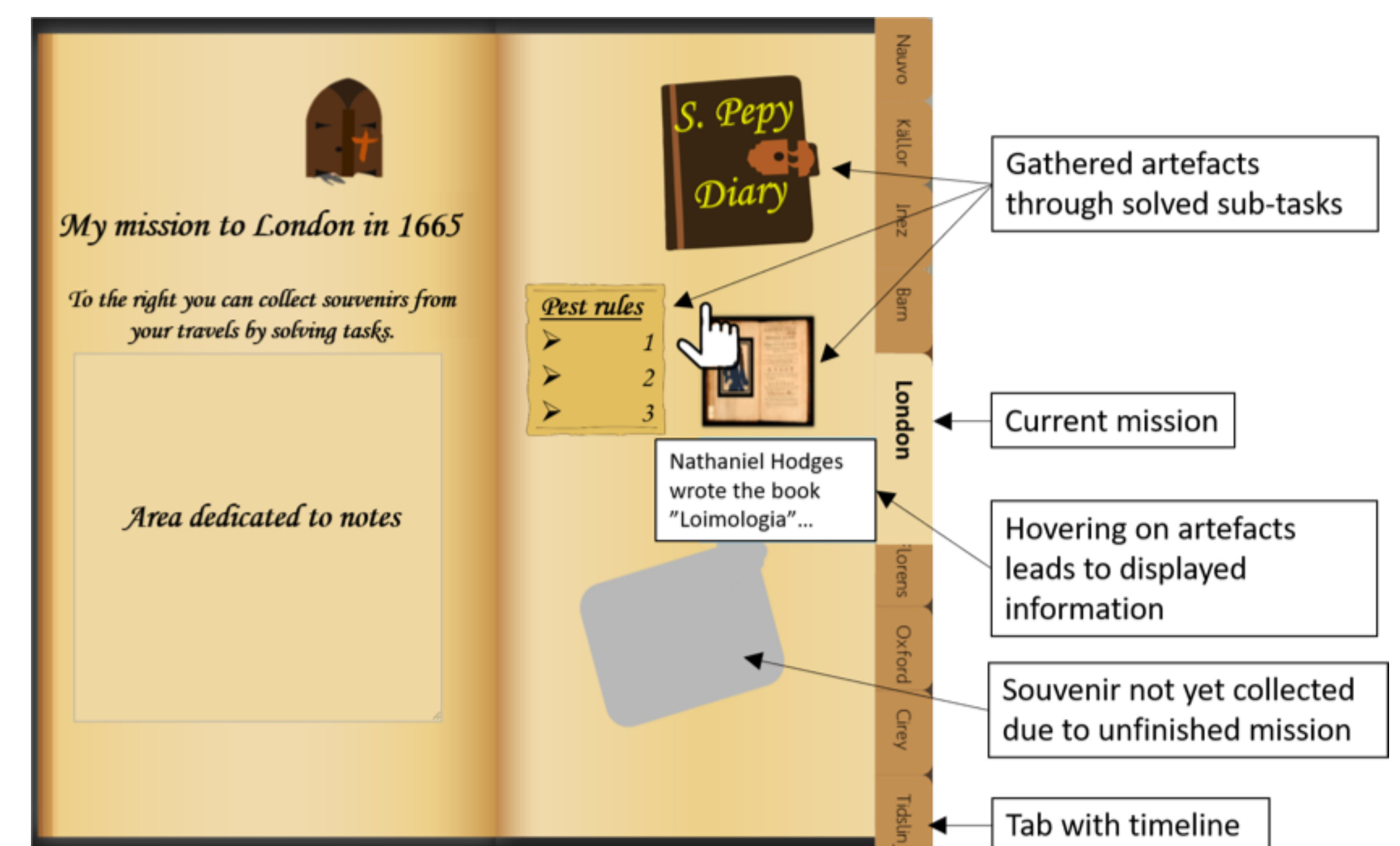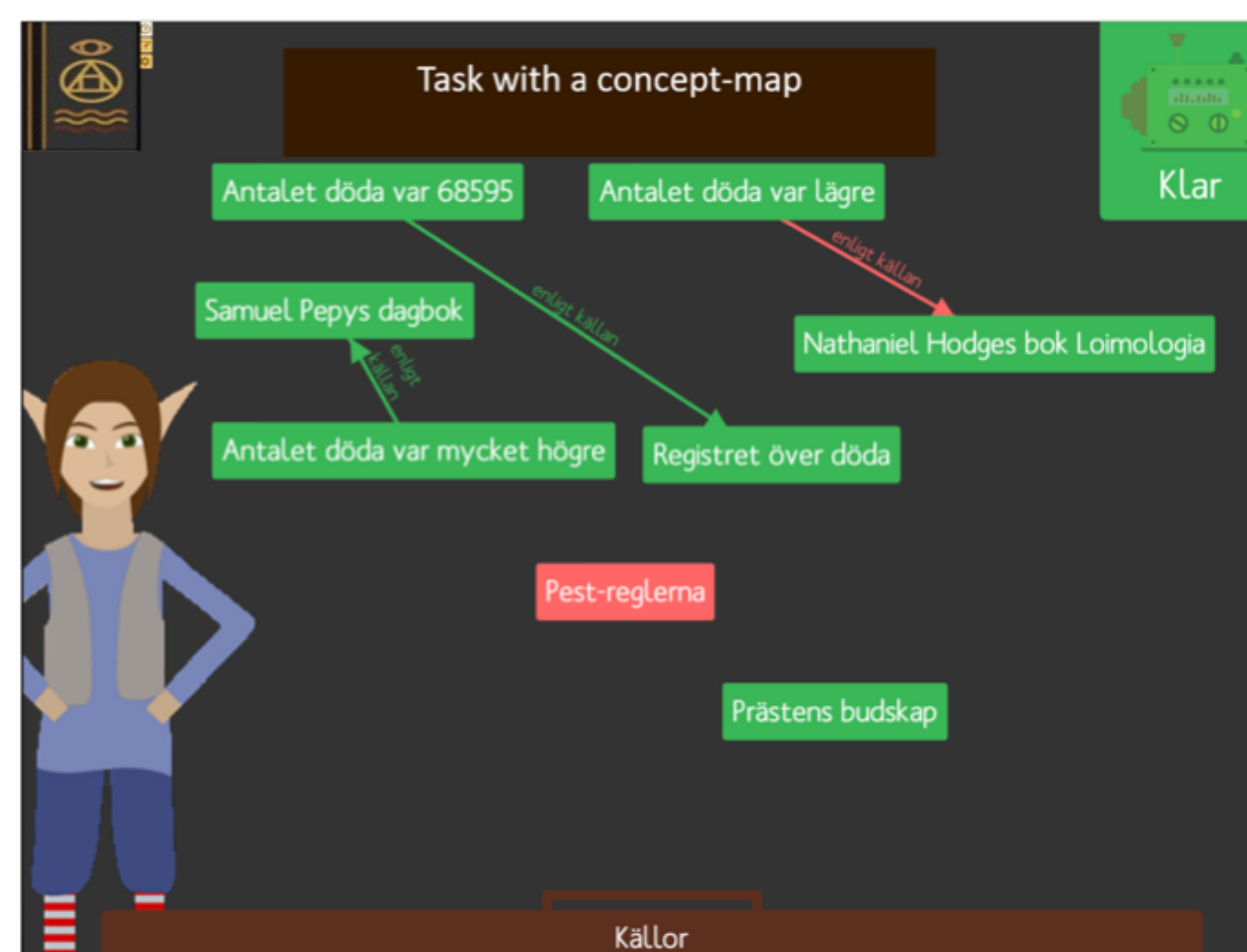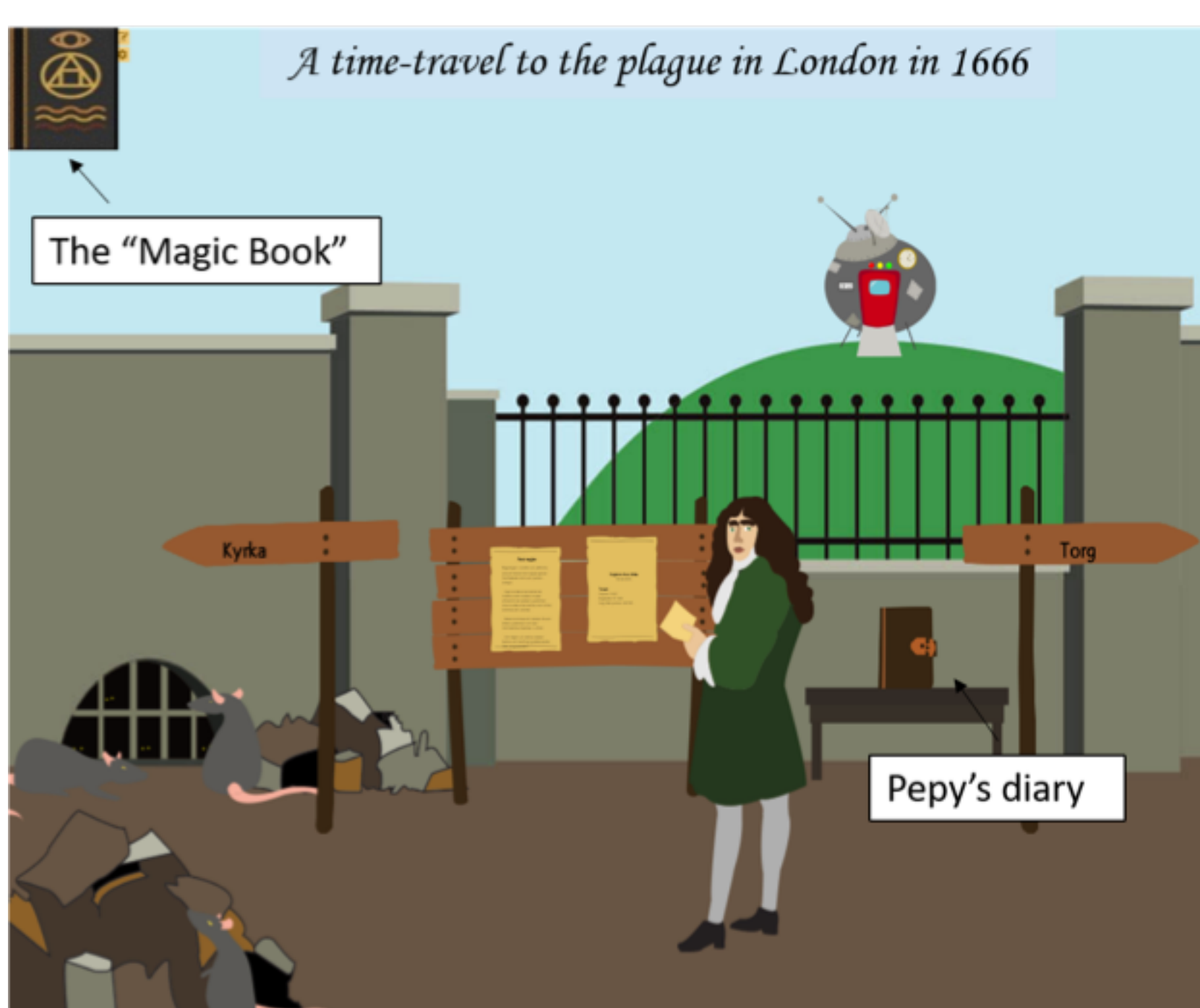
Experiment

GUARDIANS OF HISTORY is an educational game for students in the 4th to 6th grade that has been used as a research instrument by ETG in Sweden since 2014. In the game, students are given missions for which they perform time-travels to historical persons and events, explore these environments, and solve tasks.

AS METACOGNITIVE SUPPORT, a diary-like tool, *the Magic Book,* was designed and added to the game, saving tokens - in the shape of souvenirs from the time-travels - after successful tasks and sub-tasks. By visualizing knowledge-related content in this way, we hoped to attract the students' interest to their own learning and verify the stated hypotheses .

THE MAGIC BOOK WAS TESTED by letting 117 students (11- to 12-years-old) play the game during two class-room sessions in spring 2017. Half of the children used a variety of the book with a help-section and no collected souvenirs, while the other half used the full version of it. After the second session, half an hour (or longer, depending on the students' interest) was designated to play-time at home. A third session contained inquiries and discussions on the users' experiences. As dependent variables, the total time spent in the tool and the students' play-time at home were selected.

Results

- The time spent in the Magic Book differed between conditions, revealing that if the tool visualized acquired knowledge, the players dedicated more time to it during play (Mann-Whitney U-test: $W = 286$, $p < 0.001$).
- No significant differences between conditions were found regarding self-regulation in terms of total play-time at home. In both groups, some children did not do their home-work at all.
- The main part of the time spent in the Magic Book was in the very beginning of the game, and consisted of scanning through the content.
- Very little time was spent on hovering the souvenirs for displaying textual information, and very few students took digital notes.
- Several well-performing students commented on the possibility of storing books and historical inventions from the time-travels. Interestingly, these players mainly came from the condition without the knowledge-related visualizations.

Discussion

THE LIMITED USE AND EFFECT OF THE TOOL MIGHT BE DUE TO:
- The specific design, appearance, and implementation of the Magic Book.
- The sequential nature of screen-based applications and games in general.
- The experimental setup and lack of instructions to the students.

AN ALTERNATIVE DESIGN would be to relate the content of the tool to meta-tasks and assignments that reflect earlier achievements, and thereby make the use of the book more mandatory and meaningful. It is also very likely that the book – and it's purpose – need to be introduced more thoroughly to the users.
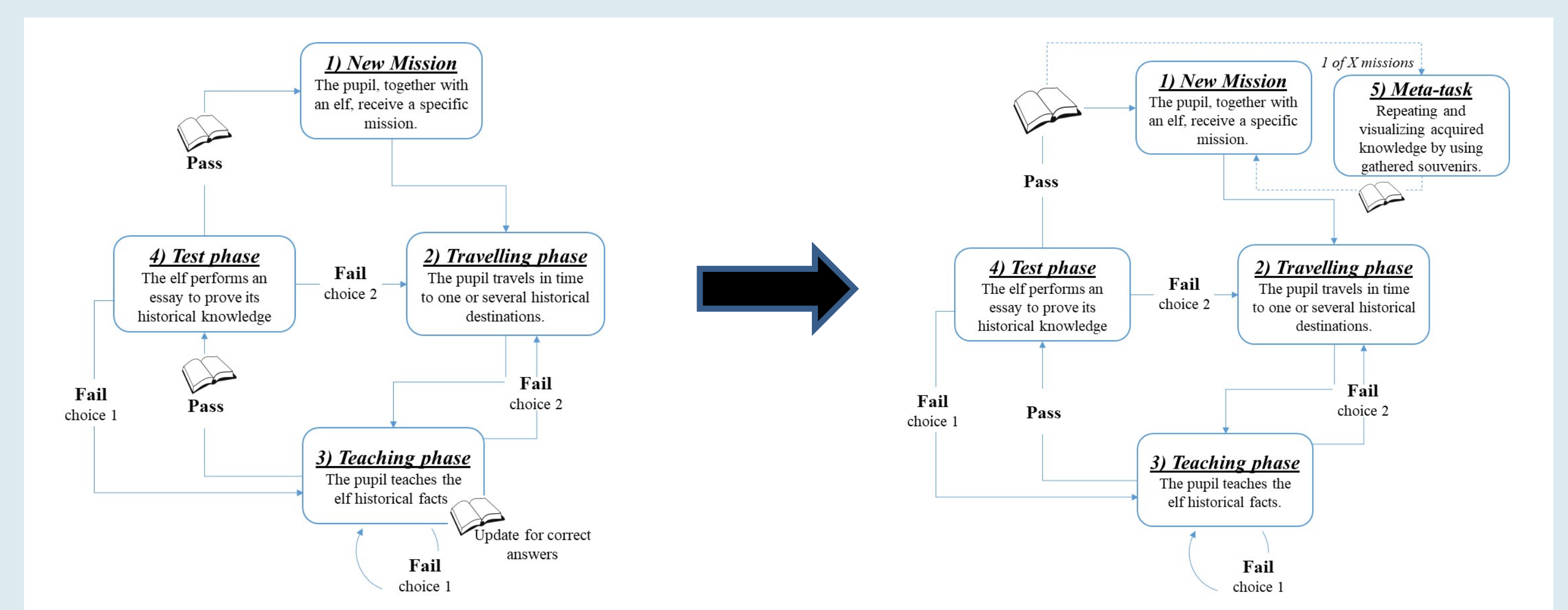
Further reading

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