

Adapting Exercise Selection to Learner Self-Esteem and Performance

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1 Introduction

Adapting tasks to learner characteristics is essential when selecting appropriate tasks for learners [5]. This paper investigates how humans adapt exercise selection to learner self-esteem (SE) and performance, to allow a future Intelligent Tutoring System (ITS) to use these adaptations. Self esteem is an important factor in learning as it is a significant predictor of academic performance [4]. Previous research adapts task selection to other characteristics e.g. past performance [1], but little work focuses on task selection based on learner personality.

2 Design of Studies

In two *User-as Wizard* studies, where participants play the role of the system [3], we showed a validated story conveying the self esteem of a fictional learner ('Kate', developed using a similar method to [2]) and an indication of her past performance. In a 2x4 between-subjects design, participants were asked to select the next exercise for Kate, given her self-esteem (high or low) and prior performance at a 10 item 1×1 digit multiplication exercise (perfect, good, just passing or fail). Participants selected one exercise from a range (with varied difficulty levels) for Kate to attempt next.

In study 1, five multiplication exercise types were shown that the participants could select for Kate to try next. These were either the same type as before (1×1 digit), a slow-easy method of 1×2 digits, a fast-difficult method of 1×2 digits, a slow-easy method of 2×2 digits or a fast-difficult method of 2×2 digits. In study 2, we reduced the number of exercises from five to three, and made the choices easier to understand with explicit difficulty (1×1 digit – *same as before*; 1×2 digits – *more difficult*; 2×2 digits – *much more difficult*).

Overall, we hypothesized that participants would select a more challenging exercise for learners who performed well than for learners who performed poorly (H1), and participants would select a more challenging exercise for High SE learners than for Low SE learners (H2). We hypothesized that for each performance level, participants would select a different exercise depending on SE level and performance (H3): for the fail condition, we expect participants to select the same exercise again for both levels of self-esteem (H3a); for the 'just passed' and

‘high’ performance condition, we expect participants to select a more challenging exercise for learners with high self esteem than learners with low self esteem (H3b); and for the ‘perfect’ performance condition, we expect participants to select a more difficult exercise for low self esteem and a much more difficult exercise for high self esteem (H3c).

The studies were administered as questionnaires on Amazon Mechanical Turk, with US Participants who passed a Cloze test for English fluency and had an acceptance rate of over 90%. In study 1, there were 242 participants (≥ 30 per condition; 125 Female, 116 Male), 39 were aged 16–25, 139 aged 26–40, 60 aged 41–65, 4 over 65. 30 were students and 19 teachers. In study 2, there were 241 participants (122 Female, 117 Male). 46 were aged 16–25, 129 aged 26–40, 61 aged 41–65, 3 over 65. 34 were students and 9 were teachers.

3 Results and Conclusion

In study 1 and study 2, H1 is supported (χ^2 of Performance \times Exercise Selected with SE level as layer variable: $\chi^2(12, 242) = 86.65$, $p < 0.001$; $\chi^2(6, 241) = 155.76$, $p < 0.01$, respectively). For H2, a χ^2 test of SE level \times Exercise Selected with Performance as a layer variable was not significant in either study. H3a is supported in both studies, with learners who failed receiving an exercise of the same difficulty. There is no evidence to support H3b, however for the ‘just passed’ condition, more participants did give the low SE learner an exercise of the same difficulty than for high SE. H3c was not supported.

In conclusion, we did not find robust evidence for SE being taken into account for exercise selection. There may be a trend for low SE learners who ‘just passed’ to receive an exercise of the same difficulty more frequently than high SE learners. On reflection, it could be that the exercise difficulty we chose was too coarse-grained and we will investigate SE again where more gradual changes in difficulty are possible. Future findings should be evaluated by real teachers before encapsulation in an algorithm for use by an ITS.

References

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