An Investigation of Successful Self-Regulated-Learning in a Technology-Enhanced Learning Environment

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Abstract. Self-regulated learning (SRL) and metacognition are key in the context of 21st century education, adult training, and lifelong learning. For instructional strategies to foster metacognition and self-regulation it is crucial to know what are good metacognitive and SRL behaviors. We investigated this question in the context of a training simulator in a curriculum setting with 152 medical students. Learning behavior and personal attributes were examined in relation to metacognitive awareness. The results on characteristics of successful SRL confirm findings from traditional learning settings for a TEL context.

Keywords: self-regulation, metacognition, expert learner, training simulator.

1 Introduction

Broad interest in metacognition and self-regulated learning (SRL) can be identified in current research, as well as educational practice [1]. Often used synonymously, they are considered as mutual core components of learning. Learners highly skilled in those aspects are often referred to as ‘expert learners’ [2][3]. Given the demands of 21st century education, adult training, and lifelong learning; taking responsibility for one’s own planning, performing, monitoring, and regulating learning is crucial. In particular, for technology-enhanced learning (TEL), SRL and metacognition are recognized as having a key role [4]. It is acknowledged that SRL and metacognitive processes require the availability of appropriate knowledge and strategies. Learners need support in acquiring and applying these skills; accordingly, this area and related intervention programs are intensely investigated [5]. For sound instructional and scaffolding strategies an in-depth understanding of *good* metacognitive and SRL behaviors is crucial [3]. This paper investigates characteristics of successful SRL in the scope of learning episodes with an immersive experiential training simulator.

2 What is Good SRL Behavior?

Successful (and less successful) learning is not about the question of whether self-regulation and metacognition occur – all learners think about and try to regulate their learning in some way, but there are dramatic differences in how they approach it. A high quality and quantity of self-regulatory and metacognitive processes goes along with better learning performance and achievements [6][7]. Research has attempted to identify the differences between lower and higher achieving learners to draw implications for SRL and metacognitive scaffolding and strategy training [3][8]. Expert learners know, and successfully employ, more and better cognitive and metacognitive strategies [2][6]. A variety of personal attributes were found to characterize and distinguish students with high versus low metacognitive and SRL abilities (see *e.g.* [1][8] for an overview). Effective learning is related to higher levels of motivation and self-motivational beliefs [6]; whereas underachievers are known to be less efficacious about their learning and to have a lower self-esteem, to be more impulsive, and to give up earlier and more easily. In particular, they are also more anxious and fear failure [8]. The research aiming at explaining why some learners are more successful than others so far has been concentrated on traditional learning situations. TEL environments, such as web-based courses, impose additional demands on learners [9]. It is therefore important to examine the characteristics of effective metacognition and SRL more directly in a TEL context, to see whether the results confirm the state of the art from traditional learning settings and to identify whether there are any peculiarities for TEL. This paper presents an empirical investigation pursuing that goal. One main objective was to investigate SRL behavior and learner characteristics in relation to learners' general metacognitive awareness.

3 An Empirical Study in an Experiential Learning Environment

3.1 Method

Augmented Training Simulator. ETU's[1] RolePlay Simulation Platform offers simulation scenarios teaching student doctors about effective doctor-patient communication (see Figure 1). Users' main task is to select appropriate dialogues for clinical interviews with patients diagnosed with either mania or depression. The TEL environment embeds a range of features to support self-regulation. More specifically, the simulator provides learning triggers for delivering targeted in-context coaching, behavioral feedback and strategic reflections to reinforce learning and aid transfer to the job. The platform also doubles as a psychometric profiling, behavioral measurement and skill assessment tool. Metacognitive scaffolding was provided to learners within the ETU simulator using calls to a RESTful service developed as part of the ImREAL project[2]. The service utilizes a cognitive model to support self-reflection and presents items from the Metacognitive Awareness Inventory (MAI) [7],

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[1] www.etu.ie
[2] www.imreal-project.eu

e.g. “Have you focused your attention on the important information?”. It has previously been shown that providing this scaffolding within the ETU platform is beneficial [10]. Alongside the scaffolding thinking prompt is an open text box for collecting reflection notes which is consistently prefaced with a short text: “Reflect now on your learning: Was this last part of the simulation useful for you?” In addition, there is a place to reflect in the simulator’s note-taking tool, where learners can record and share notes.

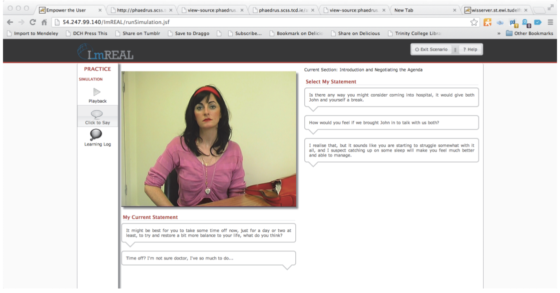

Figure 1. Screenshot of the ETU RolePlay Simulation Platform.

Participants, Instruments, and Procedure. In spring 2013, 152 third year medical students (M = 22.81 years old, SD = 3.79) from Trinity College Dublin participated in the study as part of their medical curriculum. A mixed-method approach capturing metacognition and SRL in terms of users’ general learning approach (self-report) and the actual activities during simulator usage (log data) was applied [11]. Students completed a cohort characterization survey before interacting with the simulator. Besides demographic questions and a personality questionnaire (SSP, Swedish Universities Scales of Personality [12]), a standard scale assessing metacognitive awareness (MAI [7]) was administered. Students could then use the simulator as long and often they wished. Interaction data and text entries from reflection notes and the note-taking tool were tracked by the simulator and served for investigating learning behavior. Self-predicted and objective learning performances based on an assessment of interview skills built into the simulator were also used. This trace methodology corresponded to the idea of examining SRL as a process [13]. After the learning episode students provided feedback on learning with the simulator in a survey covering the perception of reflection prompts, motivation, and SRL (QSRL, [14]).

3.2 Results

Log data from 152 students performing the training in the simulator was available, whereas subsamples of 76 (MAI) and 85 (SSP) filled out the *pre*-questionnaire and only 39 (prompts), 25 (QSRL) and 29 (motivation) students completed the *post*-survey. Samples sizes for filling out both the MAI (as grouping variable) and one of the other questionnaires (as dependent variable) were even smaller. To investigate differences with respect to learning activities and feedback on the simulator between users with high and lower metacognitive awareness (and thus SRL-abilities), the subsample that had completed the MAI *before* entering the simulator was split at the median into two groups. Focusing on SRL as a process [13], this was done using the regulation of cognition (ROC) subscales and scores ($Md_{MAI\text{-}ROC}$ =.69; $M_{low\text{-}ROC}$ =.56, SD=.13; $M_{high\text{-}ROC}$ =.83, SD=.08), which address the metacognitive strategies and subprocesses of learning [7].

Independent samples t-tests for high (high ROC) and low (low ROC) metacognitive awareness revealed significant differences (all p<.05) regarding participants' SRL-behavior, personality traits, motivation, as well the number of notes taken during the interview training (see Figure 2). More specifically, students with higher metacognitive awareness (as far as the regulation of knowledge is concerned) are also better in monitoring their own learning processes ($t_{(18)}$ = -2.15), have higher achievement motivation ($t_{(18)}$ = -2.26), attribute their successes more strongly to their abilities ($t_{(18)}$ = -2.88), and are more motivated regarding their current learning situation ($t_{(26)}$ = -2.83), especially to apply what they have just learned. Additionally they took more notes during the interview training (with N=14 and no equal variances: $t_{(9)}$ = -2.38), i.e. they reflected more explicitly on the decisions they made during the training. On the other hand, they show lower trait anxiety ($t_{(70)}$ = 2.04) and lower scores on lack of assertiveness ($t_{(70)}$ = 2.7). There was no difference regarding the perception of thinking prompts. Both groups rated them as helpful and appropriate on 5-pt scales (for 10 questions all Md = 4, overall M = 3.6, SD = .58).

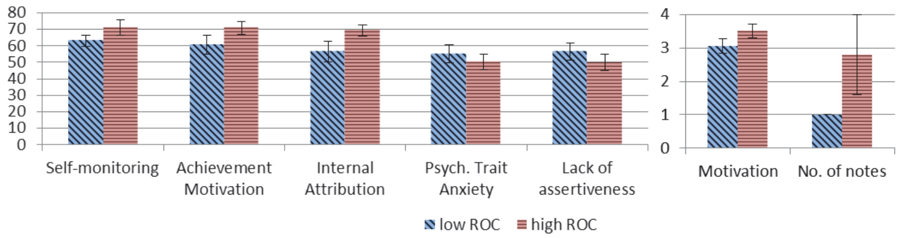

Figure 2. Mean SRL scores, personality traits, motivation, and number of notes for low and high metacognitive awareness.

4 Conclusion

The outcomes of the presented study argue for the transferability of known characteristics of good metacognition and SRL identified in traditional learning settings to a TEL context. Although comparisons are actually based on groups of high vs. medium metacognitive abilities, a range of distinguishing differences could be identified. In line with previous results that expert learners apply more metacognitive strategies, high ROC students were shown to more extensively monitor and evaluate their own learning and to take more notes in the simulator. Also a trend of higher learning performance (ETU score) being associated with higher SRL abilities was found: Results revealed higher SRL scores on all nine QSRL subscales for better performing students in the simulation (N = 25). However, since these differences are not statistically significant, further research with larger samples is necessary.

No difference was found in students' abilities of predicting their own performance. A general novelty effect of the learning setting might have mitigated an expected difference in persistence in terms of duration of simulator usage. Since achievement motivation refers to the desire to perform well on challenging tasks and is evidenced by effort and persistence, though, the higher scores identified for the high ROC group may be related to previous results on higher persistence of expert learners. This group also reported a higher motivation to transfer the just acquired skills to real world interviews. The lower internal attribution of success found for low ROC resembles existing results on lower self-efficacy for learners with low metacognitive abilities. In addition, low ROC students were shown to be more anxious, confirming previous results on higher anxiety for lower skilled learners. Follow-up investigations with samples featuring a higher range in metacognitive and SRL abilities are planned.

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