# Chapter 30
# Design and Implementation of Self-regulated Learning Achievement: Attracting Students to Perform More Practice with Educational Mobile Apps

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**Abstract** This study investigates the design and implementation of the self-regulated learning-based achievements. We aim to incorporate the SRL-based achievements in educational mobile apps to attract students to perform more practice with mobile applications. The review of SRL literature shows several research communities' efforts regarding assessment and improvement of human learning experience in a computer-assisted learning environment. Researchers in educational psychology have developed theories of human cognition. In addition, researchers in computer-based learning environment (CBLE) as well as researchers in machine learning (ML) seek ways to improve human–computer interactions. This research incorporates some of the designed features in a mobile application named Practi. The Practi app is a commercial product and is a mobile software application which allows students to perform math and science practice designed and provided by school teachers. To show that the designed SRL-based achievements are implementable, this research also develops a simulation program.

**Keywords** Cognition · Metacognition · Motivational constructs · Feedback · Scaffolding · Personalized · Reflection · Active learning

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## 30.1 Introduction

A shift from classroom-based learning environment to computer-supported learning mechanism requires students to regulate their learning. Self-regulated learners (SRL) take control of their own learning. They set goals and choose strategies to achieve those goals. They may need to modify their strategies when they find the preset goals far from reach. In some cases, they need to abandon their goals and set new sets of goals based on new conditions [1].

In the quest for a more effective education system and in the absence of teachers in computer-based learning environment, computers play a key role known to researchers as MetaTutors. MetaTutors record and trace student progress. The MetaTutor also provides students with timely and explicit feedback [2]. Researchers in educational psychology introduced new forms of feedback known as cognitive feedback that is provided to students during their task engagement in a timely manner as the task unfolds [3].

This research makes similar efforts to develop criteria to create implementable SRL-based achievements. These achievements provide students with required cognitive and metacognitive skills in learning rich-domain concepts. The developed criteria are bound to the indexes available to evaluate a student performance during the student's engagement with a learning task.

Section 30.2 demonstrates the SRL-based achievements this research designed. Section 30.2 also shows and explains the simulation program this research developed for proving that the SRL-based achievements are implementable into the Practi app. At the end, Sect. 30.3 makes a brief summary and discusses possible follow-up research that could be done in the near future.

## 30.2 Design of SRL-Based Achievements

This research aims to design achievements to encourage students to engage in performing more practice with the educational mobile app Practi. Nine self-regulated learning theory-based achievements are designed as summarized by Table 30.1.

- Self-regulated learning theories find that students become more engaged in a learning task when they see significance of skills they acquire for completing the learning tasks. In other words, students with an understanding of task objectives are more successful in terms of completing the task. This research designs a Task Significance achievement to reward students for paying attention to task objectives and penalizes them by deducting points when they ignore it.
- The theories also emphasize that students make consistent efforts in terms of accomplishing all task objectives. This research designs a Consistency achievement to award points proportionate to students' progress in doing a quiz.

**Table 30.1** The SRL-based achievements and the corresponding evaluation criteria

| Correspondent SRL theory | Achievement name | Criteria |
|---|---|---|
| Motivational constructs | Task significance | Skipped (Y/N)?<br>(2 pts ↓/x pts ↑) |
| Motivational constructs | Consistency | x pts ↑ for 25 % progress |
| Metacognition | Interest | x pts ↓ for % Qs skipped |
| Cognition | Technique | Q(t[ave]) > x(s) ↓ x pts |
| Feedback | Accessory | x tips seen ↔ x pts ↓ |
| Stress management and volitional strategies | Focus | [Qs(ans)/Qs(all)]<br>↑ x % ↔ x pts ↑ |
| Set, manage goals, and follow instructions | Compliance | [t(finished) ↔ t(preset)]<br>t(x sec.)↑ ↔ x pts ↓ |
| Metacognition | Knowledge | [Ans(correct)/Ans(total)]<br>25 % ↑ ↔ x pts ↑ |
| Reinforcement and expectancy value | Effort | [Ans(wrong)/Ans(total)]<br>x % ↑ ↔ x pts ↓ |

- This research also designs an Accessory achievement that allows students to see tips when they are stuck at a step of completing a task. Students, however, lose their score for seeing tips.
- The degree to which a task grasps a student's attention is relevant to the student's interest in the subject. This research achievement, namely Interest correlates with the number of questions a student skips while taking a quiz.
- The average time students spend on solving each question in a quiz is another measure of students' metacognitive skills. This research designs a Technique achievement to award or penalize students accordingly.
- A Focus achievement is used to measure the degree to which a student manages his or her stress level during a quiz and determines how well the student performs in the quiz.
- The Compliance achievement measures the commitment to the application of self-regulated learning skills, which define students' success in computer-assisted learning.
- A final achievement, namely Knowledge, simply evaluates students' knowledge of a subject based on the ratio of correct answers that students receive in a quiz.
- Reinforcement theory illustrates that a person's behavior is a product of the environment the person grows up in. We design the Effort achievement to measure when a student makes an effort, regardless of the result.

This research aims to design SRL achievements for the educational mobile app—Practi. By integrating SRL-based achievements into Practi, the upgrade makes Practi capable of awarding points to students so they can unlock more features and virtual trophies according to the improvement of their performance. The students can also receive feedback when they are engaged in a task and consult with tips to boost their performance. The number of tips have been checked by students becomes an index

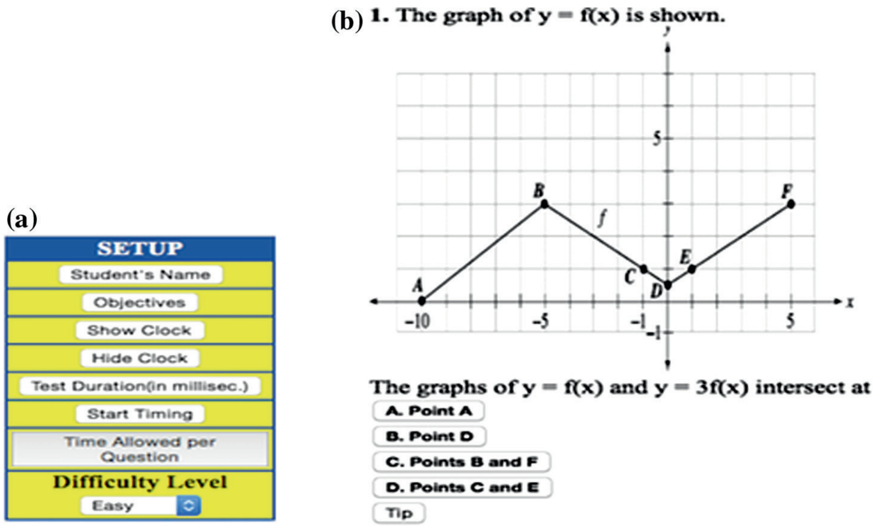


**Fig. 30.1** The simulation program

for Practi to compute students' individual and overall scores. Students are also allowed access to more difficult quizzes when needed. As soon as students complete a level with a noticeable performance increase, the upgraded Practi unlocks student access to a more difficult quiz level.

The research team has developed a simulation program to implement the designed SRL-based achievements to prove the possibility of implementing the proposed design. We use questions from Alberta's high school Math diploma examination bank to create the quizzes for the simulation. Figure 30.1a shows the simulation program that allows researchers to simulate a student setting-up objectives, choosing quiz difficulties, and answering questions in a quiz. When students are answering a question, they can view a tip if they want as Fig. 30.1b shows. Once the students complete a quiz, they can check their overall and individual achievement scores as Fig. 30.2 shows. John lowers his score by seven points for spending too much time on task objectives. The achievement criteria deduct 1 point for each additional 5 s increment beyond the maximum allowed time that John spends on the task objectives. John is also awarded 6 points each time he progresses 25 % in doing the quiz. He also receives 18 points for his achievement consistency. Each time John skips 5 % of the questions in this quiz, his Interest achievement receives a − 2 point deduction. Likewise, other achievements are calculated for John by the program based on the criteria shown in Table 30.1.

| | Task Sig. | Consistency | Interest | Technique | Focus | Compliance | Knowledge | Accessory | Effort | Total Score |
|---|---|---|---|---|---|---|---|---|---|---|
| John | -7 | 18 | -2 | -5.22 | 3 | -2 | 12 | -0.8 | -0.4 | 15.58 |

**Fig. 30.2** Student achievement score per SRL category

## 30.3 Conclusion

This research designs SRL-based achievements based on the result of reviewing SRL literature. In order to demonstrate the possibility of implementing the proposed design in the existing educational mobile app, Practi, a simulation program is implemented. We recognize the importance of equipping students with SRL skills in the transition from classroom learning to computer-supported learning environments. Ultimately, we see the possibility of implementing this set of tools and skills to help put students on a road to success utilizing mobile technologies.

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