

# Training Emotion Regulation Strategies During Computerized Learning: A Method for Improving Learner Self-Regulation

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**Abstract.** A host of negative emotions such as anxiety, frustration, and boredom inevitably occur during computerized learning. These emotions can have serious negative consequences on students' metacognitive and cognitive processes and learning outcomes. Thus, students should be equipped with the ability to regulate these negative emotions in order to achieve positive learning outcomes. Building on previous research on learning-centered emotions, I (first author) propose a series of investigations into the ways in which emotion regulation strategies can be effectively implemented in an intelligent tutoring system. This paper discusses ongoing experiments, future plans, and the implications of the findings for the development of ITSs that aid in the regulation of students' emotions.

**Keywords:** Emotion, emotion regulation, cognitive reappraisal, ITSs

## 1 Introduction

Learning episodes are replete with emotional experiences. Learners' emotions have been the focus of considerable theoretical and empirical work in the last decade [1-3]. While these endeavors have offered some insight into the kinds of emotions that are likely to arise during learning, none offer effective methods for helping students regulate or alter certain negative emotions once they occur. In contrast, several ITSs have been developed to help learners regulate their cognitive and metacognitive processes [for example, 4-6]. Because emotional processes are equally important to learning as cognitive and metacognitive processes, it follows that ITSs should also have the capacity to help learners regulate their emotions as they arise. This is the goal of the present research.

In this paper, I (first author) describe my ongoing research projects which I am completing under the guidance of the second and third authors, and propose a research plan with several goals. These goals include: (1) discovering which kinds of strategies students typically use to regulate learning-centered emotions, (2) determining which strategies are effective and which are ineffective, (3) devising creative training methods for helping students use effective emotion regulation strategies, and (4) implementing these training techniques in an intelligent tutoring system.

## **2 Background and Previous Research**

Emotion regulation is defined as the physiological, behavioral, and cognitive processes that enable individuals to manage the experience and expression of emotions [7]. Research in other disciplines of psychology has identified several emotion regulation strategies such as distraction, rumination, suppression, etc. [see 7 for details]. The strategy that has received the most attention is cognitive reappraisal, or changing the way one thinks about a given situation in order to alter its emotional meaning. Previous research (not in learning contexts) has demonstrated that using cognitive reappraisal is an effective method for regulating positive and negative emotions, and can increase memory for important details. But is cognitive reappraisal an effective method for regulating learning-centered emotions and improving comprehension?

This question was investigated in a pilot study where learners were trained to use two forms of cognitive reappraisal to regulate emotions that arose during a 45-minute computerized learning session [8]. Specifically, we explored the efficacy of cognitive reappraisal by examining learners' self-reported emotions, valence, and arousal throughout the learning session, and their learning outcomes. Our findings suggested participants who used cognitive reappraisal reported positive, activating emotions like engagement, while the do-nothing control condition reported negative, deactivating emotions like disinterest. We also found that participants in the cognitive reappraisal conditions achieved better learning outcomes than the controls. This study provided some initial data into the use of cognitive reappraisal as an effective strategy for regulating emotions during learning.

## **3 Future Research Plans**

With the knowledge that even a simple, trained cognitive reappraisal strategy could help learners regulate their emotions and achieve better comprehension, I have set forth a research plan designed to achieve the four goals listed above.

The first goal is to identify the emotion regulation strategies are used by typical learners. Although the trained cognitive reappraisal strategy used in the experiment described above were successful, it is possible that there are other strategies that are more relevant to learning. To address this issue, I plan to conduct a qualitative, survey-based experiment with approximately 100 college students from a southern university in the U.S. Participants will be provided with definitions and examples of a number of emotion regulation strategies and will be asked to rate how frequently they have used each strategy during learning. Additionally, when they indicate that a particular strategy was used, they will be required to fully describe the learning situation when it was used and if they felt that the strategy was effective. This exploratory study is expected to yield a large corpus of data about which emotion regulation strategies are frequently used, and whether students consider them to be effective in regulating their emotions during learning.

Data from this study will be used to develop scripts for training effective strategies to students. In a web-based, between-subjects experiment similar to the one described

in Section 2, participants will be trained on the use of various emotion regulation strategies before a one-hour learning session. Participants in each condition will be trained on one specific reappraisal strategy, and their valence, arousal, and discrete emotions (e.g., frustration, confusion) will be collected, along with their comprehension scores. Synchronized videos of participants' face and computer screen will be used to analyze participants' affective responses to the given context. I will then compare each condition to determine which strategies are most effective for regulating learning-centered emotions and improving outcomes.

The third goal of this research is to refine the training scripts and implement them in AutoTutor [5], a mixed-initiative ITS that simulates a human tutor by holding conversation in natural dialogue. While this ITS has traditionally been used to improve learning by being responsive to students cognitive states, the proposed research will endow AutoTutor with the capacity to convey effective emotion regulation strategies to help learners simultaneously manage their emotional states as they occur. A controlled experiment will then compare this emotionally intelligent AutoTutor to the default version that only focuses on learners' cognitive states.

The regulation of emotional states during learning is an area of research that is ripe for innovation and exploration. The research plan described here is a preliminary step toward understanding this typically neglected domain, and has the potential to impact the development of future affect sensitive and responsive ITSs.

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