

From Distraction to Reaction: Exploring Self-Regulated Learning and Off-Task Thoughts in Online Learning from Videos

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Abstract

Self-regulated learning (SRL) plays a crucial role in online learning success. However, students inevitably encounter off-task thoughts (mind wandering or task-related interference) that can disrupt the learning process. Although SRL and off-task thoughts have been studied independently, their interaction has not been extensively explored. This research project investigates the relationship between SRL and off-task thoughts in the context of learning from videos. A multi-method approach will be employed, comprising a conceptual paper, meta-analyses, case study, two experiments, and comparative analysis. The conceptual paper will present a model illustrating how off-task thoughts may trigger reactive self-regulation during learning. The meta-analyses will synthesize findings on the occurrence and impact of task-related interference and off-task thoughts. A naturalistic case study and two controlled experiments will collect self-caught thought reports during actual and simulated video learning, respectively. The case study will explore whether students rewind videos after mind wandering. The experiments will test whether the anticipation of learning activities at pauses in the video leads to increased awareness of off-task thoughts and whether rewinding a video following off-task thoughts balances out the negative effect of mind wandering. Comparing the case study and both experiment results will assess the generalizability of findings across contexts. A comparative analysis will also examine the association between SRL and off-task thought frequency in naturalistic and controlled settings. This research project aims to provide theoretical and empirical insights into the interaction between off-task thoughts and SRL when learning from videos.

Keywords

self-regulated learning, mind wandering, metacognition, meta-awareness, off-task thought

1. Introduction

Learners often find their minds drifting to unrelated matters when striving to acquire knowledge. Research indicates that during educational pursuits, students experience off-task thoughts approximately 30% of the time [1]. As such thoughts are unavoidable, it is crucial to consider their impact when examining the learning process. Consequently, off-task thoughts can hinder the acquisition of knowledge [2]. How learners adjust their learning strategies to accommodate current circumstances, including distractions, falls under the domain of self-regulated learning [3]. Distractions like off-task thoughts can manifest during learning, necessitating learners to adapt to these disruptions in real-time.

2. Background

2.1. Off-Task Thoughts

Off-task thoughts can be categorized based on stimulus-dependency and task-relatedness [4]. Within the scope of this research project, the focus lies on stimulus-independent thoughts, which can be further classified as task-unrelated or task-related. Stimulus-independent

and task-unrelated thoughts are called task-unrelated thoughts (TUT), while stimulus-independent and task-related thoughts are known as task-related interference (TRI).

A recent meta-analysis revealed that TUTs occur about 30% of the time during educational activities and negatively correlate with learning outcomes [1]. Although a comparable meta-analysis on the frequency and impact of TRI on learning has not been conducted, some studies suggest that TRI may have a neutral or even positive effect on learning outcomes [5], [6], [7]. Nevertheless, learners encounter off-task thoughts during the learning process and must adapt their learning strategies accordingly.

Given the detrimental effect of mind wandering on learning outcomes, various laboratory studies have aimed to reduce the frequency of mind wandering among learners. In the context of learning from videos, this has been achieved through the use of interpolated testing [5], [7], [8]. Other learning activities, such as generative activities like self-explanations, have positively influenced learning outcomes [9]. However, the impact of these activities on the frequency and type of off-task thoughts remains unknown. It is also possible

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for students to become aware of their mind wandering, a phenomenon known as meta-awareness.

Meta-awareness refers to the conscious recognition of one's thoughts [10]. This concept is rooted in metacognition and is a form of metacognitive monitoring [11]. When students engage in metacognitive monitoring, they actively reflect on their recent thoughts, potentially becoming aware of any off-task thoughts. The information gained from this self-reflection can then be utilized to adjust their thoughts through actions designed to refocus their attention on the task at hand. This process is known as metacognitive control. Students continue studying until they engage in metacognitive monitoring once more, which may trigger further metacognitive control. This cyclical metacognitive monitoring and control process forms the foundation of self-regulated learning [12].

2.2. Self-regulated Learning

Self-regulated learning provides a framework for understanding the emotional, motivational, and cognitive aspects of learning [3]. This research project is underpinned by the COPES model of self-regulated learning [13], as it elucidates the role of metacognition in self-regulated learning and how students adapt their learning process to the current task. According to Winne and Hadwin [13], self-regulated learning occurs across four interconnected stages. These stages are task definition, goal setting and planning, enacting study tactics and strategies, and metacognitively adaptive studying. During the third stage, as students implement study tactics and strategies, they frequently alternate between cognition and metacognitive monitoring [14]. Students will likely recognize their off-task thoughts during this stage and modify their learning behavior based on this realization. This research project explicitly explores this self-regulated learning phase, as no existing model currently describes how off-task thoughts influence self-regulated learning.

3. Research Approach

This research project consists of two parts. The first part is theory development, complemented by a meta-analysis. Together, these inform the second part, exploring self-regulated learning and off-task thoughts while learning from videos.

3.1. Theory Development and Meta-Analysis

By synthesizing the existing literature, a model will be constructed to illustrate how off-task thoughts influence the learning process and how students might respond upon realizing they have experienced off-task thoughts. This model will draw upon the COPES model of self-

regulated learning, theories on off-task thoughts, and the concept of metacognition, which will be presented in a conceptual paper. A key aspect of this model posits that a self-regulated learner's reaction to the realization of being off-task is contingent upon the type of off-task thought they experienced. While the frequency and relationship with learning outcomes have been established for TUT [1], this information is lacking for TRI and the overarching category of off-task thoughts (TUT + TRI), which motivates the first two research questions.

- **RQ1:** What is the frequency of TRI, and how are these thoughts associated with learning outcomes?
- **RQ2:** What is the frequency of off-task thoughts, and how are these thoughts associated with learning outcomes?

The developed model will provide a theoretical foundation, which the meta-analyses will enhance. Collectively, these components will elucidate the frequency with which students encounter each type of off-task thought and, consequently, the need to respond to such off-task thoughts. To investigate these dynamics further and evaluate their practical implications, the context of video-based learning has been selected as the focus of subsequent studies.

3.2. Exploring self-regulated learning and off-task thoughts during video learning

The theoretical assumption of mutual influence between self-regulated learning and off-task thoughts led to the overarching question, "What is the 2-way relationship between self-regulated learning and off-task thoughts in video-based learning?" The overarching research question has been broken down into specific research questions.

- **RQ3:** How does self-regulated learning influence off-task thoughts when learning from a video?
- **RQ4:** How does self-explanation during video watching influence off-task thoughts compared to interpolated testing?
- **RQ5:** Does rewinding a video after off-task thoughts offset the negative effect of off-task thoughts on learning outcomes?
- **RQ6:** Is the relationship between self-regulated learning and off-task thought frequency consistent across study designs?

The fact that most research on off-task thoughts and learning has been conducted in controlled laboratory

settings motivates RQ3. The observation that attempts to reduce off-task thoughts during video-based learning have primarily relied on interpolated testing has inspired RQ4. The lack of research investigating whether a learner's response to their off-task thoughts can balance out the negative effects of off-task thoughts motivates RQ5. RQ6 is motivated by apprehensions regarding the generalizability of findings obtained from laboratory-based research in naturalistic settings.

4. Methodology

A multi-method approach will address the aim and research questions, comprising a conceptual paper, meta-analyses, a case study, and two experiments. The data collected from the case study and both experiments will be combined to analyze and compare the frequency of off-task thoughts and assess the potential impact of self-regulated learning on these thoughts. In the case study and experiments, participants will be asked to provide self-caught free-text thought reports and complete subscales from the self-regulation for learning online (SRL-O) questionnaire [15].

4.1. Conceptual Paper

The theoretical connection between self-regulated learning and off-task thoughts will be explored by developing a conceptual paper. This paper will build upon the COPES model of self-regulated learning, theories on off-task thoughts and learning, and metacognition. By synthesizing the existing literature, a model will be constructed to illustrate how off-task thoughts influence the learning process and how students might respond upon realizing they have experienced off-task thoughts.

4.2. Meta-Analyses

Research questions one and two will be addressed through meta-analyses. A systematic search and screening of the existing literature on TRI will be conducted. Subsequently, the frequency and effect size of the relationship between TRI and learning outcomes will be extracted and included in the meta-analysis.

Furthermore, the TUT frequencies and effect sizes on learning outcomes will be extracted from the identified sources and combined with the TRI data from off-task thought frequencies and effect sizes, which can be used for a meta-analysis.

This information will shed light on the prevalence of TRI and off-task thoughts and the magnitude of their impact on learning outcomes.

4.3. Case Study

The third research question will be examined through a case study, which aims to overcome a significant limitation of many studies on the interaction between off-task thoughts and learning, namely their reliance on controlled laboratory environments. In the context of learning from videos, this limitation meant that learners were not allowed to react to realizing their off-task thoughts, even if they desired to. This study addresses this issue by requesting students to watch course videos and report their off-task thoughts as they become aware of them. Unlike other studies on off-task thoughts, students in this case study can interact with the video player while learning. This interaction allows them to react to the realization of their off-task thoughts. The resulting trace data, consisting of thought reports and video interaction data, can be analyzed using learning analytics techniques such as sequential pattern mining and multilevel modelling to model and understand metacognitive processes. In addition to measuring students' self-caught off-task thoughts, participants will be asked to complete SRL-O subscales. The findings from this study will provide insights into the frequency of off-task thoughts in a naturalistic setting and whether students react to the realization of being off-task by, for example, rewinding the video.

4.4. First Experiment

The fourth research question will be addressed through an experiment to compare the effect of interpolated testing and self-explanation writing on the self-reported frequency of off-task thoughts. The experiment will include three conditions: two experimental conditions (interpolated testing and self-explanations) and a control group. Participants will complete SRL-O subscales and a pre-test, watch a video while reporting off-task thoughts (self-caught), engage in a filler task, and then take a post-test. The results from this study will provide insights into which learning activity (interpolated testing or self-explanations) leads to better learning outcomes and whether the frequency of off-task thought realization differs between the two experimental conditions and the control group.

4.5. Second Experiment

The fifth research question will be investigated through an experiment examining whether students' rewinding the video they are learning from following their off-task thoughts balances out the negative effects of off-task thoughts. The experiment will include three conditions: two experimental conditions (optional rewind following off-task thought, mandatory rewind following off-task thoughts) and a control group.

The participants for the study will be recruited using Prolific, and the study will be conducted online. Participants will complete an SRL questionnaire, be introduced to the concept of off-task thought, and, depending on conditions, will be instructed to rewind the video they are learning from following their off-task thoughts. While watching the video, participants will provide self-caught thought reports. After watching the video, they will answer a knowledge test.

Data analysis will involve comparing the groups on their knowledge test performance to assess whether video rewinding following off-task thoughts offsets the negative effect of off-task thoughts.

4.6. Comparison of Off-Task Thought Frequency Across Study Designs

Once the case study and both experiments are completed, research question six can be addressed. The data from the three studies will be combined. By merging the data, the frequency and types of off-task thoughts can be compared between the studies based on the participants' SRL-O questionnaire scores. This combined data can provide insights into students' self-regulation in different contexts. They may reveal whether students with similar scores on the SRL-O subscales exhibit a similar or different frequency of self-caught off-task thoughts across study designs.

5. Status

The current status of this research project is that the conceptual paper is being prepared for submission. The meta-analysis and the case study have been written, submitted, and are under review. The experiment results were published in the proceedings of the Nineteenth European Conference on Technology Enhanced Learning [16]. The data collection for the second experiment is in progress.

6. Ethical Considerations

Ethical considerations have been prioritized in this research project. The Human Research Ethics Committee of the University of South Australia has granted ethical approval for the case study and the first experiment. The Institutional Review Board of the University of Minnesota has approved the second experiment.

To protect participants' privacy, personal information collected during the case study will be de-identified prior to data analysis, and only anonymous data will be gathered for the experiment. Only data from informed consent participants will be utilized in the case study and experiments.

7. Contribution

The primary objective of this research project is to investigate how off-task thoughts influence students' learning processes during online video-based learning. The developed model will provide a theoretical foundation enriched by the meta-analyses on TUT, TRI, and off-task thoughts. These components will collectively describe the frequency with which students encounter each type of off-task thought and, consequently, the need to react to such occurrences. The case study will then explore if and how students respond when they become aware of their off-task thoughts. One possible reaction students might undertake is to modify the learning task by incorporating interactive learning activities. The first experiment will test which learning activities influence the frequency of off-task thoughts. The second experiment will test if rewinding a video following off-task thoughts balanced out the negative effect of off-task thoughts. The comparative analysis will examine how the frequency of reported off-task thoughts in an experimental setting can be compared to a naturalistic setting.

In summary, this research will contribute to the existing literature by elucidating the interaction between off-task thoughts and self-regulated learning, how students might influence the frequency of their off-task thoughts, and how their reaction following off-task thoughts could influence learning outcomes. Furthermore, this research provides evidence of learning and expands learning theories, which can be used to inform the development of interventions to enhance learning outcomes.

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