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The Effects of Regret on Internalization of Academic Motivation: A Longitudinal Study

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Abstract

We examined whether and how regret contributes to the internalization of autonomous motivation with the aim of gaining a deeper understanding of the intrapersonal process of the internalization of academic motivation. We conducted a longitudinal survey to examine the longitudinal relationship between motivation and regret in academic situations. Results of a path analysis showed that regret about neglecting study, experienced immediately after an end-of-term examination, mediated the conversion of controlled (especially, introjected) motivation into autonomous (i.e., intrinsic and identified) motivation. In contrast, participants' regret about not having enjoyed themselves in the long term negatively predicted autonomous motivation in a subsequent examination. These results indicated that participants' regret about neglecting their studies contributed to internalization, but regret about not having enjoyed themselves interfered with this. We discussed new insights for both educational practices and psychological theories.

Keywords: academic motivation, self-determination theory, regret, self-control, high school student

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1. Introduction

It is well known that when motivation is autonomous and self-endorsed, rather than externally controlled or pressured, goal achievement is more likely (see Ryan & Deci, 2000, for a review). In academic situations, autonomous motivation can help students study harder and achieve better grades (Guay, Ratelle, & Chanal, 2008). Autonomous motivation is also effective in the achievement of other goals, including health regulation (Ng et al., 2012) and playing sports (Pelletier, Fortier, Vallerand, & Briere, 2001). Thus, autonomous motivation is a successful means of achieving goals.

Self-determination theory (Ryan & Deci, 2000) posits that autonomous and controlled motivation lie on a continuum. The theory also suggests that controlled motivation can be converted into autonomous motivation by satisfying one's psychological needs (i.e., autonomy, competence, and relatedness); this is referred to as *internalization*. Previous research has revealed that intrinsic motivation can be enhanced through choice (Patall, Cooper, & Robinson, 2008) and autonomous support (Black & Deci, 2000; Grolnick & Ryan, 1989). However, few studies have focused on verifying the intrapersonal process of internalization; thus, there is a profound dissociation between internalization of motivation and other findings in cognitive psychology. Therefore, we address this issue by considering the intrapersonal process of self-control and reinforcement learning. More specifically, we examined whether and how regret contributes to the internalization of autonomous motivation by focusing on the adoptive role of regret.

1. 1. Does Regret Contribute to Internalization?

Regret is a negative emotion caused by counterfactual comparison between the fact (what is) and the possible state (what might have been) (Roese & Olson, 1995). When people are aware that the consequences of choosing an option were worse than the consequences of a rejected option, they feel regret. Regret is a self-conscious emotion associated with the feeling of

responsibility (Connolly & Ordo, 1997). Thus, when people feel regret, they blame themselves for failing to act differently.

Regret is known to have a profound impact on decision making. In regret theory, economists suggest that people anticipate the option that causes the least regret and choose the option that will maximize their pleasure (Bell, 1982; Loomes & Sugden, 1982). Many psychological researchers have verified the usefulness of the function of regret in decision making (see Zeelenberg & Pieters, 2007, for a review). Cognitive neuroscientists have revealed that regret is associated with activity in the orbitofrontal cortex and it can modulate the value of options (Coricelli, Dolan, & Sirigu, 2007). People place a high value on the option that will cause them to feel the least regret after their decision.

Recent research on self-control suggests that experience of self-conscious emotions can increase goal importance in subsequent situations wherein self-control is required for goal achievement (Hofmann & Fisher, 2012). Hofmann and colleagues conducted an experience-sampling survey and examined relationships between self-control failure/success, self-conscious emotions, and subsequent self-control. They revealed that the experience of guilt, a negative self-conscious emotion, in situations in which participants had failed to resist their own desires improved goal importance in subsequent occurrences of the same type of desire. This result is consistent with the theoretical explanation of the role of regret, in which negative emotions associated with poor choices modulate the value of options in subsequent decision making.

By having this function that benefits self-control, regret can contribute to the internalization of motivation. Self-determination theory suggested four types of extrinsic motivation; external, introjected, identified, and integrated (Ryan & Deci, 2000). External and introjected motivation types are typically assumed to be controlled, and identified, integrated, and intrinsic motivation types are assumed to be autonomous. Self-determination theory suggests that people increasingly internalize their motivation—moving from external to integrated motivation—as they grasp the importance of goal achievement. As noted above, regret can

improve goal importance in subsequent situations requiring self-control. Therefore, it follows that regret would also contribute to internalization.

1. 2. How Does Regret Contribute to Internalization?

As regret is known to have an effective role in experimental studies, we should consider exactly how regret could contribute to internalization in everyday situations. Participants in experimental studies often have only one goal; however, in everyday situations, people may have multiple goals at once. For instance, Fries, Schmid, Dietz, and Hofer (2005) revealed that only 11.4% of the students who participated in their study reported never having experienced motivational conflict in academic situations. Previous research also showed that goals or values concerning leisure interfere with academic goal achievement (Fries, Dietz, & Schmid, 2008; Hofer et al., 2007). Therefore, students are likely to regret not having enjoyed themselves and this regret can affect their motivational states, even though they have a specific academic goal.

In addition to this, regret can change dynamically, although the issue that caused the regret does not change. Gilovich, Medvec, and Kahneman (1998) proposed that regret has two aspects in terms of temporal dynamics: *hot regret* and *wistful regret*. In the short term, hot regret is evoked by strong emotional responses to facing alternative outcomes, and then fades quickly. Conversely, wistful regret occurs gradually when considering other possible outcomes in the long term. Accordingly, we considered regret about neglecting one's studies and not having enjoyed oneself in both the short and long terms.

We hypothesized that regret about neglecting one's studies in the short term would contribute to long-term consequences, such as internalization. Regret that best contributes to decision making in experimental studies, is hot regret, which occurs soon after a choice has been made (i.e., in the short term; Coricelli et al., 2007). An experience sampling study also revealed that self-conscious emotion in the short term can improve goal importance regardless of time distance (Hofmann & Fisher, 2012). These results support the notion that regret in the short term may continue to affect distant situations. In addition, regret that concerns ongoing goals is more

stable than the other types of regret (Summerville, 2011). Therefore, hot regret about goals to be achieved in the short term would be more beneficial for internalization relative to wistful regret in the long term.

Conversely, we hypothesized that regret about not having enjoyed oneself in the long term would interfere with internalization. Previous research demonstrated that the need for self-control biased decision making (Trope & Fishbach, 2000). Marketing research has shown that, when facing the need for self-control, regret about resisting temptation (e.g., enjoyment) was suppressed soon after participants made decisions, but then resurfaced a considerable amount of time after the decisions had been made (Kivetz & Keinan, 2006). Kivetz and Keinan regarded this regret as wistful and insisted that it occurred because participants felt as though they were “missing out,” as the criteria against which they assessed themselves became liberated from the need for self-control. Therefore, regret about competitive goals (i.e., enjoyment), which might interfere with internalization, might be less dominant in hot regret (in the short term) but more dominant in wistful regret (in the long term).

1. 3. Who Feels More Regret that Contributes to Internalization?

We discussed the effect of regret on motivation above and consider the opposite effect below. Internalization refers to the conversion from controlled motivation to autonomous motivation. Therefore, it is crucial to clarify whether and why regret can mediate the possible longitudinal relationship between controlled motivation and autonomous motivation.

As described above, regret is associated with a sense of responsibility. Connolly and Ordo (1997) assumed that regret is caused by both compatible outcomes and feelings of self-blame for having made a poor choice. Some research has shown that the strength of regret depends on the consistency of actual decisions and the orientation of the decision maker (Seta & Seta, 2013). For instance, individuals who have maintenance goals tend to regret action more than do individuals who have change goals, and the opposite is true for regret about inaction.

We hypothesized that controlled motivation would promote regret about failing to attain goals (i.e., regret about neglecting study). As described above, the need for goal achievement causes far-sighted bias. This bias is related to the feeling of *doing the right thing*, strengthens regret about failure to engage in goal-related behavior, and lessens regret about not having engaged in other enjoyable activities soon after decisions have been made (Kivetz & Keinan, 2006). Self-determination theory posits that controlled motivation reminds students that they *should do* something (Deci & Ryan, 1995). Therefore, if people with controlled motivation feel more responsible for attaining their goals, controlled motivation should enhance stronger regret concerning the ongoing goal in the short term. In conjunction with the enhancement of this regret, it follows that controlled motivation would suppress regret about competitive goals in the short term.

The enhancement of regret may be adaptive for people with controlled motivation with respect to repetitive goal achievement. Regret is also known to be a fundamental process in reinforcement learning, in which agents repeatedly experience similar decision-making situations and update the predicted value of options according to their experience in order to maximize future rewards. As previously discussed, regret is beneficial for modulating the value of options. In a lesion study, patients with orbitofrontal cortex lesions did not experience regret and could not learn to maximize future rewards (Camille et al., 2004).

One of the reasons that reinforcement learning may enable agents to maximize future rewards is that it can steer them towards less effortful goal achievement. At the beginning of the learning process, the agent encodes the association between the behavior and the potential consequences. As learning progresses, agents act somewhat automatically according to encoded reward history. The former is known as goal-directed action, and the latter is known as habitual action (Balleine & O'Doherty, 2010; Daw, Niv, & Dayan, 2005). Previous research has demonstrated that habitual actions require less effort in self-control (Goto & Kusumi, 2013). In

sum, feeling regret at the beginning of reinforcement learning is an adaptive way of maximizing future rewards efficiently.

Autonomy is also related to the effort required for goal achievement. Muraven, Rosman, and Gagné (2007) revealed that participants who were rewarded according to their performance experienced less autonomy and performed worse following a cognitive control task relative to those who were rewarded regardless of their performance. Other studies have also demonstrated that participants with controlled motivation invest more effort in a task than do those with autonomous motivation (Moller, Deci, & Ryan, 2006; Muraven, 2008). These results suggest that people with controlled motivation may suffer from a high mental load in goal achievement if they continue to attempt to attain the same goal. Therefore, it is adaptive for them to feel regret if this leads to the rapid progression of internalization with respect to efficiency, similar to agents in reinforcement learning.

1. 4. The Present Research

Our aim was to investigate whether and how regret contributes to internalization. To do so, we conducted a longitudinal survey to examine the longitudinal relationship between motivation and regret in academic situations. More specifically, we sought to determine whether students' controlled motivation for taking examinations affects their post-examination regret and whether their regret about previous examination affects autonomous motivation for taking subsequent examinations. The conflict between studying and enjoying oneself in an academic situation is commonly used in self-control studies (e.g., Myrseth, Fishbach, & Trope, 2009). In these situations, students continuously attain study goals and experience the temptation to enjoy other activities. Moreover, self-determination theory was mainly developed in academic situations (Ryan & Deci, 2000); therefore, testing our hypothesis regarding internalization in an academic situation is valid.

We predicted three longitudinal relationships. First, controlled motivation should enhance regret about neglecting study (Hypothesis 1a) and lessen regret about failing to enjoy oneself in

the short term (Hypothesis 1b). Second, regret about neglecting study in the short term should improve autonomous motivation in subsequent examinations (Hypothesis 2). Third, regret about not having enjoyed oneself in the long term should interfere with autonomous motivation in subsequent examinations (Hypothesis 3).

We also confirmed the role of autonomous motivation discussed in previous research. In other words, we verified whether autonomous motivation would contribute to efficient goal achievement in educational situations. Self-control researchers have revealed that effortful goal achievement causes mental exhaustion (Muraven, Tice, & Baumeister, 1998; Hagger, Wood, Stiff, & Chatzisarantis, 2010). Thus, if autonomous motivation contributes to efficient goal achievement, students' post-examination fatigue will negatively correlate with autonomous motivation and positively correlate with controlled motivation.

2. Methods

2. 1. Participants

Participants were 320 students in the 10th grade at a high school in Japan (ages ranged from 15 to 16). The data from 67 participants were lost due to listwise deletion of missing data. Therefore, the data for 253 participants (106 females and 147 males) were analyzed.

2. 2. Ethical consideration

Prior to the survey, we explained the aim and procedure of our research to the principal and teachers in the high school and obtained their approval to conduct this survey. For all assessments, participants were assured that their responses would remain confidential and would in no way influence their grades. Participants were also permitted to withdraw from the survey at any time.

2. 3. Measures

2. 3. 1. Academic motivation.

Participants' Academic motivation was assessed using a slightly revised version of the Japanese Learning Motivation Scale (LMS-J; Hayamizu, Tabata, & Yoshida, 1996; Okada,

2008). The LMS-J was developed to assess academic motivation in Japanese students, and is based on self-regulation questionnaires (Ryan & Connel, 1989). It consists of four subscales with four items each. The LMS-J includes a question about why participants studied for upcoming examinations in a variety of subjects, with response options as follows: external (e.g., “because I was supposed to study”), introjected (e.g., “because I will feel anxious if I do not study”), identified (e.g., “because it is important to me to study”), and intrinsic (e.g., “because it is fun”).¹ The LMS-J uses a 5-point Likert-type scale with anchors from 1 (*not at all true*) to 5 (*very true*). As the examinations for all subjects were conducted consecutively throughout a single week in this high school, we measured students’ motivations for examinations in general (i.e., all subjects) rather than for specific subjects.

2. 3. 2. Regret.

Two aspects of participants’ regret were measured. Participants were first instructed to reflect on how they spent the week preceding their last examination. They then rated six regret statements regarding their inaction during that week in addition to some filler statements. Three of these statements suggested that they should have studied more during the week preceding the examination (e.g., I should have studied harder for my last examination), whereas the other three statements suggested that they should have enjoyed themselves more (e.g., I should have enjoyed myself more). These questions were answered on a 7-point Likert-type scale with anchors from 1 (*not at all true*) to 7 (*very true*).

2. 3. 3. Fatigue.

Participants’ fatigue was measured by three items (e.g., “I became tired”) along with some questions to evaluate how they felt about the examination (e.g., “that it was fun,” “difficult” or “required concentration”). These questions were answered on a 7-point Likert-type scale with anchors from 1 (*not at all true*) to 7 (*very true*).

2. 4. Procedure

We conducted a five-wave longitudinal survey. At Time 1 (1 week before the end-of-term examinations for the 1st semester), participants reported their daily home-study time in multiples of fifteen minutes and completed the Academic motivation measure for the end-of-term examinations. At Time 2 (1 week after the end-of-term examinations for the 1st semester), participants retroactively reported their daily home-study time for the week preceding the end-of-term examinations. Participants then completed the regret and fatigue measures. At Time 3 (following a month's vacation; 8 weeks after the end-of-term examinations for the 1st semester), they completed the regret measure again and retroactively reported their daily home-study time during the vacation. At Time 4 (11 weeks after the end-of-term examinations for the 1st semester; 1 week before the mid-term examinations for the 2nd semester), participants completed the LMS-J for the mid-term examinations. At Time 5 (1 week after the mid-term examinations for the 2nd semester), participants retroactively reported their daily home-study time for the week preceding the mid-term examinations and completed the fatigue measure. All assessments were conducted as a homeroom activity.

3. Results

3. 1. Preliminary Analysis

3. 1. 1. Confirmatory factor analysis of Academic motivation.

Before the primary analysis, confirmatory factor analysis was conducted to determine whether the revised LMS-J retained the same structural properties as the original scale. The analysis was conducted using Amos 19.0, and goodness of fit statistics for the path analyses was assessed using the comparative fit index (CFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Solutions were generated on the basis of maximum-likelihood estimation. Because the models had a poor fit when all of the items were entered at Times 1 and 4, we omitted one item from each subscale at these two time points to improve their internal reliability (Cronbach's α). This is because we cannot assume that the items of each subscale represent the concept exactly if the internal reliability of each subscale is low.

We omitted the same items from Time 1 and Time 4. Thereafter, the results confirmed that the revised models had generally better fits to the data for both Time 1 ($\chi^2(48) = 182.85, p < .05$, CFI = .89, RMSEA = .11, SRMR = .09) and Time 4 ($\chi^2(48) = 121.04, p < .05$, CFI = .93, RMSEA = .08, SRMR = .07), although the fits of the models were not good enough for the standard criteria (i.e., CFI > .95, RMSEA < .10, SRMR < .10). We accepted the latter models for the subsequent analysis. We averaged participants' responses to form indices for each of the variables in the study. Table 1 displays the descriptive statistics and internal reliability for these variables, and the correlations between them.

3. 1. 2. Academic motivation and fatigue.

Hierarchical regression analyses were conducted to examine predictive relationships between students' academic motivation, study time, and fatigue following examinations. We confirmed that the participants spent more time studying before the examinations than usual using a paired *t*-test ($t(252) = 11.08, 7.27, ps < .05$, see mean and *SD* of study time in Table 1). We entered both usual study time and study time before the examinations as independent variables. We also entered gender (a dummy variable using 1 for male gender and 0 for female gender), perceived difficulty, perceived physical cost, and perceived time cost as control variables. When the data were analyzed excluding these control variables, the pattern of effects was identical. As can be seen in Table 2, identified motivation negatively predicted fatigue following the examination, and introjected and external motivation positively predicted fatigue following the examination. These results indicated that autonomous motivation caused less resource depletion following self-regulatory behavior.

3. 2. Primary Analysis

We conducted a path analysis to examine the longitudinal relationship between motivation and regret. We entered four subscale scores for motivation at Time 1 and Time 4 and two scores for regret at Time 2 and Time 3 (see Figure 1). In the tested model, each of the four subscales of motivation at Time 1 was allowed to follow the direction of the identical motivation

and theoretically adjacent motivations at Time 4 (e.g., identified motivation at Time 1 was allowed to follow the direction not only of identified motivation but also of intrinsic and introjected motivation at Time 4). Because the four subscales were assumed to be intercorrelated during the confirmatory factor analysis, all four subscales at Time 1 were allowed to covary, as were the disturbance terms for all four subscales at Time 4. The four subscales of motivation at Time 1 were allowed to follow the direction of both types of regret at Times 2 and 3, and both types of regret were then allowed to follow the direction of the four subscales of motivation at Time 4.

This model revealed an adequate fit to the data ($\chi^2(10) = 19.99, p < .05$, CFI = .99, RMSEA = .06, SRMR = .04). Regret about neglecting study at Time 2 was positively predicted by introjected and external motivation at Time 1. Furthermore, this regret positively predicted intrinsic and identified motivation at Time 4. The results of a Sobel test (Sobel, 1982) revealed that the indirect effects of introjected motivation on both identified and intrinsic motivation were significant ($\beta = .05, p < .05$ for identified motivation; $\beta = .03, p < .05$ for intrinsic motivation), but indirect effects from external motivation were not ($\beta = .01, p = .12$ for identified motivation; $\beta = .02, p = .11$ for intrinsic motivation). Conversely, regret about neglecting study at Time 3 was positively predicted by introjected motivation at Time 2 and the same type of regret at Time 2. However, results showed that this type of regret did not significantly predict any of the four types of motivation. These results support Hypotheses 1a) and 2): namely, regret about neglecting study in the short term but not in the long term contributed to the transition of controlled motivation to autonomous motivation.

The results showed a more complex pattern between participants' regret about not having enjoyed themselves and motivation. Participants' regret about not having enjoyed themselves at Time 2 was negatively predicted by identified and introjected motivation at Time 1 and positively predicted by external motivation at Time 1. However, this type of regret did not predict any type of motivation at Time 4. Conversely, participants' regret about not enjoying

themselves at Time 3 negatively predicted intrinsic and identified motivation at Time 4, even though it was only predicted by the same type of regret at Time 2. These results support Hypotheses 1b) and 3): participants' regret about not having enjoyed themselves may have counteracted the acquisition of autonomous motivation via the different process observed for regret about neglecting their studies.

4. Discussion

Self-determination theory posits that autonomous motivation and controlled motivation lie on a continuum. The theory also proposes that internalization as controlled motivation can be converted into autonomous motivation by satisfying basic psychological needs, and this theoretical explanation has been verified by many researchers (Ryan & Deci, 2000). However, few studies have focused on the intrapersonal process of internalization, which bridges self-determination theory and cognitive psychology. In the current study, we addressed this issue by focusing on the adaptive role of regret.

We conducted a five-wave longitudinal study with high school students and examined longitudinal relationships between academic motivation and regret. We predicted three longitudinal relationships: controlled motivation would enhance regret about neglecting study (Hypothesis 1a) and lessen regret about not having enjoyed oneself in the short term (Hypothesis 1b); regret about neglecting study in the short term would improve autonomous motivation in subsequent examinations (Hypothesis 2); and regret about not having enjoyed oneself in the long term would interfere with autonomous motivation in subsequent examinations (Hypothesis 3). Results of the path analysis showed that regret about neglecting study immediately following the end-of-term examinations was positively predicted by controlled (particularly introjected) motivation. These results support Hypothesis 1a. Previous research showed that feelings of responsibility cause strong regret (Connolly & Ordo, 1997). As introjected motivation reminds students that they *should do* something (Deci & Ryan, 1995), feelings of responsibility should enhance regret about neglecting study.

The results also showed that regret about neglecting study in the short term positively predicted autonomous (i.e., intrinsic and identified) motivation for the subsequent examinations. These results support Hypothesis 2. Short-term regret is dominated by hot regret rather than wistful regret, which is itself dominant in long-term regret (Gilovich et al., 1998). Previous research revealed that hot regret plays a role in the re-evaluation of options or goals in similar situations (Camille et al., 2004; Coricelli et al., 2007; Hofmann & Fisher, 2012). Therefore, these results indicated that regret about neglecting study in the short term led to the re-evaluation of studying and improved autonomous motivation. This is congruent with a theoretical explanation of internalization, in which autonomous motivation is enhanced by identifying the value of a goal.

In addition, we verified that post-examination fatigue was negatively predicted by autonomous motivation and positively predicted by controlled motivation. These results are congruent with previous research that showed that a lack of autonomy causes high depletion of mental resources (Moller et al., 2006; Muraven et al., 2007; Muraven, 2008). Acquiring autonomous motivation via regret involves efficient goal achievement and is an adaptive means of repetitive attainment of the same goal.

These results suggest that there may be a common process between internalization and reinforcement learning. Both internalization and reinforcement learning suggest dynamic change in valuation. Previous research shows that in reinforcement learning, regret can contribute to updating value in order to adopt repetitive goal achievement with respect to efficiency (Camille et al., 2004). Our results indicated that internalization obtains a similar benefit from regret. As many researchers have clarified the psychological and biological mechanisms involved in reinforcement learning (O'Reilly, Frank, Hazy, & Watz, 2007; Stocco, 2012), it appears that bridging internalization and reinforcement learning might clarify the intrapersonal process of internalization.

Theoretical explanations of internalization are compatible with our results. Many psychologists have suggested that the feeling of agency is important for goal achievement (e.g., Bandura, 1991). Self-determination theory also insists that the satisfaction of autonomy enhances internalization (Ryan & Deci, 2000). Previous research has revealed that those who experience a feeling of agency are able to cope with the negative consequences that they have evoked (Legault & Inzlicht, 2012; Murayama et al., in press). As people become satisfied with the feeling of agency, they may be able to cope with regret better and get more autonomous motivation in subsequent situations. Future research is required to address the possibility of making the intrapersonal process of internalization clearer.

Contrary to the beneficial aspects of regret, regret about not having enjoyed oneself interfered with internalization. According to our results, regret about not having enjoyed oneself in the long term negatively predicted autonomous motivation. These results support Hypothesis 3. This regret may cause conflict in students and interfere with the acquisition of autonomous motivation. The results also partly support Hypothesis 1b, in that regret about not having enjoyed oneself in the short term would be negatively predicted by identified and introjected motivation. Conversely, external motivation positively predicted regret about not having enjoyed oneself in the short term. As regret about not having enjoyed oneself in the long term is dominated by wistful regret and less suppressed by the goal-attainment bias (Kivetz & Keinan, 2006), it may be related to thoughts about competitive goals. These results indicated that goal-attainment bias affect these regret differently, that is, suppressing regret for the competitive goal demands a bit of (not fully) internalization of motivation though regret for the focal goal does not. Future research needs to distinguish these processes with focusing the conceptual difference of these motivations.

These results are important from two perspectives. From an educational perspective, they highlight reasons why autonomous motivation is difficult to acquire for most students. This is not to say that we suggest that teachers should promote students' regret to facilitate their autonomous motivation. Instead, results regarding the beneficial aspects of regret show that

people can obtain autonomous motivation naturally. However, it is difficult to acquire autonomous motivation naturally, and most studies address this issue. Our results showed that regret concerned with competitive goals interferes with internalization, which increases gradually. Though competitive goals are known to have negative effects on goal achievement (Fries et al., 2008; Hofer et al., 2007), we clarified that regret about not having enjoyed oneself is crucially harmful with respect to the quality of motivation. This is a beneficial towards developing ways of easing regret about the failure to achieve competitive goals or to prevent this type of regret from presenting itself.

From the perspective of regret research, our results challenged the notion that different types of regret work in similar ways. Regret is known to change dynamically and to be affected by various factors, such as action/inaction (Gilovich & Medvec, 1995) or goal congruency (Seta & Seta, 2013). However, these functions are almost identical; feeling regret modulates the valuation of options in decision making through repetitive experience (Camille et al., 2004). A recent study showed that the functions of self-conscious emotions appeared to be more complex than expected (Hofmann & Fisher, 2012). Our results also revealed that whether regret concerned ongoing or competitive goals, how it works depends on the dominance component, that is, hot or wistful. These results suggest that we can develop deeper insight into regret via examination of what, when, and how it works in everyday situations.

However, there were some limitations to our research. First, we did not examine the causes of regret. For instance, whether students achieve better or worse marks than expected would influence their regret. Because there are still few studies on regret in educational situations, future researchers should clarify how regret arises and functions in educational contexts. Such studies would also contribute towards integrating various motivational theories (e.g., possible selves [Markus & Nurius, 1986] or causal attributions [Weiner, 1972]) with self-determination theory by using regret as the bridge. Second, we did not examine the role of basic psychological needs (i.e., autonomy, competence, and relatedness) in our model. Regret might be

affected by social support, learning strategies, or personality, but we did not measure these variables in the present study. Because educational practices that support students' basic psychological needs are effective for internalization, future research should examine how these need satisfactions moderate or are mediated by the contribution regret makes to internalization. Third, the concept of enjoyment should be addressed. In this study, we treated enjoyment as the mean of "the achievement of competitive goals" in academics, along the line of Fries et al. (2008) and Hofer et al. (2007). However, self-determination theory conceptualized that needs satisfaction is related to one's enjoyment or subjective well-being. Intrinsically motivated students have might experience studying for examinations as enjoyable activities. Thus, elaborating the concept of enjoyment would provide beneficial insight to how students can integrate their competitive goals (e.g., academic achievement and enjoyment).

Future research should also verify whether our results can be replicated in other situations. As mentioned in the introduction, autonomous motivation is beneficial in many situations including health regulation (Ng et al., 2012) and playing sports (Pelletier et al., 2001). Differing motivational contexts might moderate the role of regret in internalization. Moreover, future research should examine whether nationality would affect the role of regret in internalization. Such research would help in generalizing the contribution regret makes to internalization.

The present findings contribute in several ways to a better understanding of the intrapersonal process of the internalization of academic motivation by focusing on the role of regret. We revealed that regret concerning ongoing goals emerged in the short term to contribute to internalization, that is, conversion from controlled motivation (particularly introjected motivation) to autonomous motivation. This process occurs naturally in order to enhance the efficiency of goal achievement in a similar manner to reinforcement learning. However, regret concerning competitive goals, which comes about gradually in the long term, interferes with internalization. This type of regret may make it difficult to acquire autonomous motivation

naturally. Our results bridge the theory of educational and cognitive psychology and supply new insights into autonomous motivation for use in educational practice and psychological theories.

Footnote

1. Theoretically, self-determination theory includes integrated motivation as one type of extrinsic motivation, and it represents a fully internalized motivation. However, integrated motivation is difficult to distinguish from identified motivation in questionnaire assessments (Valleland, Pelletier, Blais, Brière, Sénécal, & Vallières, 1992). Some research has also defined identified and intrinsic motivation as aspects of autonomous motivation (e.g., Gagné, Forest, Gilbert, Aubé, Morin, & Malorni, 2010). Therefore, we assessed intrinsic motivation as one aspect of autonomous motivation, instead of integrated motivation.

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12	Regret about not having enjoyed oneself	.00	-.07	-.19*	-.16*	.16*	.05	.13*	-.16*	.42*		-.11+	-.21*							
Time 4 (11 week after the end-of-term examination for 1st semester; week before the mid-term examination for 2nd semester)																				
13	Intrinsic motivation (for mid-term examination)	.04	.67*	.43*	.20*	-.05	.00	-.05	.18*	-.10		.03	.09	-.16*						
14	Identified motivation (for mid-term examination)	.09	.41*	.55*	.31*	-.04	.01	-.03	.24*	-.19*		.13*	.16*	-.29*	.54*					
15	Introjected motivation (for mid-term examination)	.18*	.18*	.37*	.59*	.00	.11+	.08	.24*	-.21*		.16*	.23*	-.15*	.22*	.54*				
16	External motivation (for mid-term examination)	.02	-.09	-.12+	-.07	.61*	-.06	.16*	.00	.29*		-.03	.00	.16*	-.15*	-.04	.06			
Time 5 (1 week after the mid-term examination of 2nd semester)																				
17	home-study time (prior to mid-term examination)	.36*	.09	.22*	.19*	-.09	.43*	.07	.06	-.09		.35*	.08	-.07	.06	.08	.17*	-.15*		
18	Fatigue (after mid-term examination)	.06	-.13*	.04	.08	.15*	.11+	.51*	-.01	.11+		.01	.02	.12+	.00	-.04	.09	.14*	.06	
Mean		2.60	3.26	3.79	4.12	2.49	3.38	4.14	5.35	2.69		4.21	5.26	2.96	3.27	3.79	3.91	2.44	3.15	3.82
SD		0.80	0.87	0.83	0.76	0.94	1.25	1.13	1.21	1.05		1.67	1.20	1.22	0.76	0.67	0.76	0.86	1.23	1.08
Observed range																				
	Minimum	0.50	1.00	1.00	1.00	1.00	0.50	1.00	1.00	1.00		0	1.00	1.00	1.00	1.00	1.00	1.00	0	1.00
	Maximum	6.00	5.00	5.00	5.00	5.00	8.00	6.67	7.00	6.33		10.00	7.00	7.00	5.00	5.00	5.00	5.00	10.00	7.00
Cronbach's α		-	0.82	0.77	0.77	0.80	-	0.72	0.85	0.83		-	0.84	0.85	0.79	0.68	0.75	0.77	-	0.67

Note: $N = 253$, * $p < .05$, + $p < .10$.

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Table 2.

Hierarchical Regression Analysis of Post-Examination Fatigue

Predictor variables	Time 2 Fatigue ^b			Time 5 Fatigue ^c		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Gender ^a	-.01	-.02	-.02	-.05	-.05	-.05
Home-study time (usual)	-.06	-.08	-.07	.05	.04	.03
Home-study time (prior to exam)	.34*	.31*	.32*	.05	.03	.05
Perceived difficulty		.13+	.14*		.07	.09
Perceived physical cost		.12+	.13+		.16+	.17+
Perceived timely cost		.06	.02		.00	.00
Intrinsic motivation			-.05			.11
Identified motivation			-.20*			-.19*
Introjected motivation			.18*			.06
External motivation			.17*			.14*
R^2	.09*	.15*	.23*	-.01	.03*	.05*
ΔR^2		.07*	.10*		.05*	.04*

Note: Scores reflect standardized β ; $N = 253$, * $p < .05$, + $p < .10$

a Gender was a dummy variable (male = 0, female = 1)

b For the analysis of Time 2 fatigue, we entered Home-study time (usual) collected at Time 1, Home-study time (prior to exam) collected at Time 2 and other variables collected at Time 1 as independent variables.

c For the analysis of Time 5 fatigue, we entered Home-study time (usual) collected at Time 1, Home-study time (prior to exam) collected at Time 5 and other variables collected at Time 4 as independent variables.

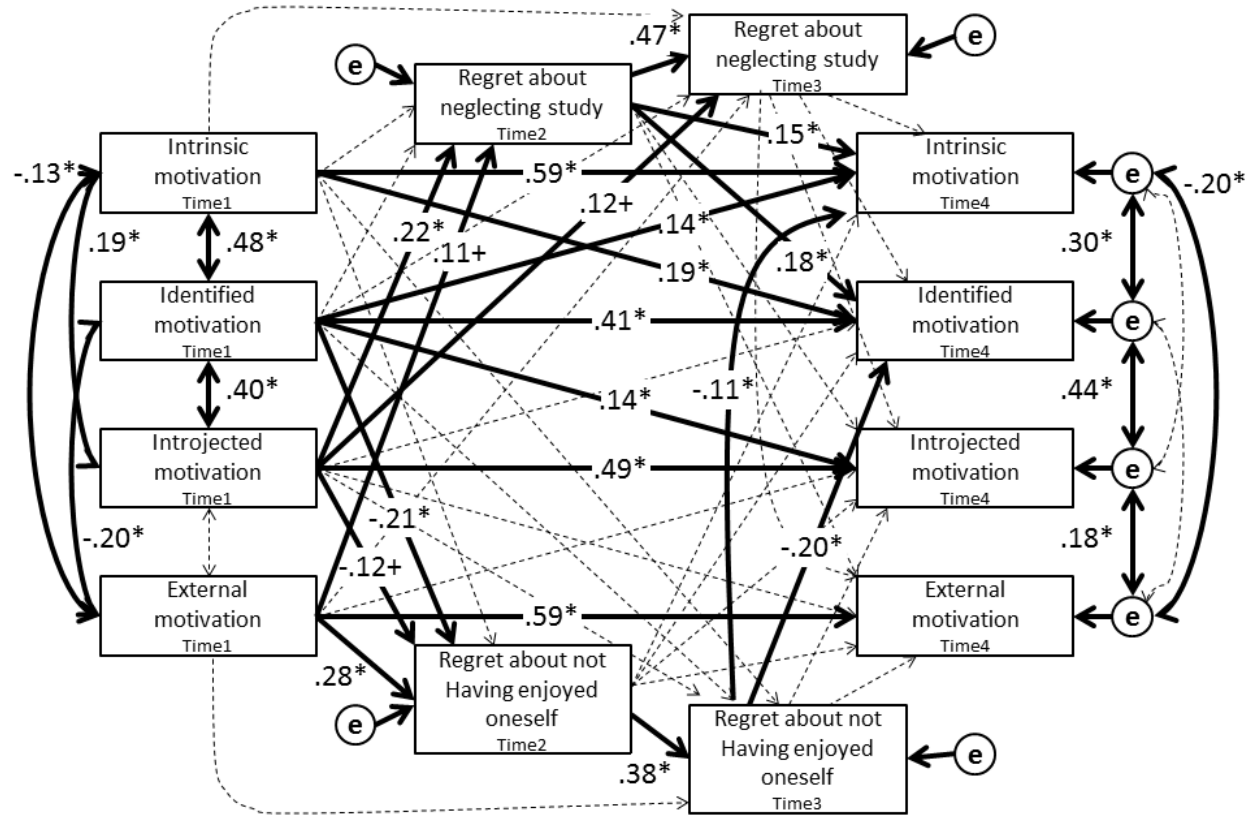


Figure 1. Standardized coefficients for the path model of the longitudinal data analysis of academic motivation and regret. Scores were standardized. This shows significant scores only ($*p < .05$) and marginally significant paths ($+p < .10$). Tested but statistically non-significant paths are shown with dashed lines.