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Fixed intelligence mindset moderates the impact of adverse academic experiences on students' self-esteem

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Abstract

The present research, by using cross-sectional (Study 1, N = 413) and daily diary methods (Study 2, N= 95) aimed to investigate the way intelligence mindset influences students' self-esteem and emotional experiences when they are confronting academic adversities (i.e., failures and difficulties). Although fixed intelligence mindset showed no association with students' daily positive or negative emotions, results consistently indicated that fixed intelligence mindset moderated the effect of academic failures (Study 1) and daily difficulties (Study 2) on their self-esteem. Academic adversities reduced students' self-esteem, and fixed intelligence mindset amplified this effect.

Keywords: intelligence mindset, academic difficulties, failure, self-esteem, emotion, daily diary study

Experiencing setbacks, difficulties or failures is an inevitable part of academic life; however, the impact of these experiences on students varies considerably. While some students bounce back fairly easily and try to overcome and learn from these experiences, others might feel helpless and suffer more negative consequences (Aditimo, 2015) such as increases in negative emotions (Nummenmaa & Niemi, 2004), decreases in self-esteem (Crocker & Wolfe, 2001), motivation, and persistence (Dweck, 2013). For many students, college is a challenging period and coping successfully with these challenges is crucial for their academic success and mental health. Thus, investigating the factors which might influence their reaction to academic adversities is essential.

Dweck's (2013) social-cognitive model of achievement motivation provides an explanation regarding the psychological resources that enable students to efficiently manage sustained challenges or failures they might face. According to Dweck's model students' beliefs or mindsets about the malleable vs. stable nature of learning-related abilities (e.g., intelligence) influence their meaning and reactions to adverse academic situations and have important implications in their academic success (Blackwell et al., 2007) and well-being (Schleider et al., 2015). Individuals who believe that their intelligence cannot be improved (fixed mindset) attribute failures to their low levels of intelligence, while discounting the role of effort. Hence, failure not only represents their performance, but it is seen as evidence of their inadequacy or lack of intelligence (Dweck & Yeager, 2019). Making trait attributions when facing failure might lead to decreased state self-esteem and increased levels of negative emotions (Weiner, 1985). In contrast, individuals who believe that their intelligence can be improved (growth mindset) are more likely to attribute poor performance to lack of effort and perceive difficulties as challenges or opportunities to learn (Dweck, 1999), and demonstrate greater persistence (Cury et al., 2008). These interpretational frameworks created by intelligence mindsets might explain why some students recover quite easily after setbacks, while for others failure is a discouraging and overwhelming experience which represents a threat to their self-worth. Therefore, the present research using cross-sectional and daily diary methods proposed to investigate whether, according to students' intelligence mindset, academic adversities (i.e., academic failures and difficulties experienced during preparing for exams) exert a differential effect on their self-esteem and affective states.

Intelligence Mindsets and Self-Esteem

Although the link between fixed intelligence mindset and self-esteem is theoretically meaningful, relatively few studies have explicitly investigated the association between these constructs. Previous studies have consistently reported that fixed intelligence mindset is related to lower level of self-esteem (Lee et al., 2017; Rhodewalt, 1994) and greater self-esteem decline over time (Robins & Pals, 2002).

According to Dweck (2013), fixed mindset transforms every achievement situation into an evaluation. Individuals with fixed mindset perceive their failures and successes as the reflections of their innate abilities. Therefore, they tend to be preoccupied with proving their abilities, so their self-esteem becomes highly contingent on external validation (Molden & Dweck, 2000). Thus, failure represents a debilitating experience for them (Robins & Pals, 2002). This is well-illustrated by Zhao and Dweck (1997) who found that after an intellectual failure self-doubt regarding one's worth was common among individuals with fixed intelligence mindset. Moreover, after failing an unsolvable problem, individuals holding fixed intelligence mindset started to doubt their abilities, and one-third of them asserted that they would be unable to solve the previously correctly solved problems (Licht & Dweck, 1984). In contrast, Niiya et al. (2004) found that after a growth mindset prime, despite experiencing failure, students could maintain their self-esteem. In sum, for individuals with fixed mindset, due to maladaptive self-attributions failures become a measure of self-worth (e.g., "I failed because I am stupid. I am a failure."; Robins & Pals, 2002).

Intelligence Mindsets and Emotions

Dweck's theory also emphasizes that emotional reactions to task demands derive from students' belief system (Sternberg & Dai, 2004). Since competence has a different meaning to individuals with fixed or growth mindset, the meaning they attach to achievement situations also differs dramatically. Attributing academic hardship to stable internal factors leads to intensive negative emotions, discouragement (Chan, 2012; Robins & Pals, 2002; Shih, 2011), pessimism about the future and rumination (Baer et al., 2005).

There are a growing number of studies supporting that fixed mindset is related to students' mental health outcomes, such as generalized and social anxiety, depression, and maladaptive

perfectionism (Schleider et al., 2015). Several cross-sectional studies examined the link between students' mindsets and their academic emotions, and consistently supported the associations between fixed mindset and negative academic emotions (e.g., shame, anxiety, anger, hopelessness; Cook et al., 2017; King et al., 2012). In a diary study over two months, Baer et al. (2005) found that students who endorsed stronger fixed mindset reported higher levels of depressive symptoms, which was mediated by extensive rumination over setbacks. Moreover, in a longitudinal study, fixed mindset was also predictive of adolescent's depressive symptoms measured three weeks after baseline (DaFonseca et al., 2009). Lee et al. (2018) demonstrated that academic stressors are more frequently appraised as threats among students with fixed intelligence mindset and after an intense academic stressor their salivary cortisol levels remained high the next day, while growth mindset students returned quicker to baseline. Furthermore, two comprehensive meta-analyses found that believing personal attributes are fixed is associated with negative affective states and more pronounced mental health problems (Gál & Szamosközi, 2016; Shleider et al., 2015).

Setbacks, Emotions, Self-Esteem and Intelligence Mindset

Academic adversities are not equally taxing to all students, and considering the differential interpretational frameworks associated with fixed and growth intelligence mindsets (Dweck & Yeager, 2019) it is reasonable to assume that mindsets might also play a role in determining the magnitude of academic adversities' impact. In performance-related situations the role of intelligence mindset has been investigated in relation to self-handicapping, motivation, persistence (Spray et al., 2006), challenge seeking and performance (Mueller & Dweck, 1998); however, its impact on self-esteem and emotions is less extensively studied. Previous studies have documented that fixed intelligence mindset is generally associated with lower levels of self-esteem (Lee et al., 2018), but only two experimental studies examined the changes in students' self-esteem associated with their intelligence mindset (Robins & Pals, 2002; Zhao & Dweck, 1997). Similarly, only a few cross-sectional studies have examined the relationship between emotions and mindsets (DaFonseca et al., 2012; King et al., 2012); results suggesting that fixed intelligence mindset is associated with higher levels of negative emotions. Thus, the present study aimed to explore whether intelligence mindset might differentiate the impact academic adversities exert on students' self-esteem and emotions.

Overview of the Present Studies

Study 1, using cross-sectional methods, investigated the role of fixed intelligence mindset in moderating the effect of academic success and failure on students' self-esteem. Study 2, using a daily diary method, replicated and extended this work by examining if fixed intelligence mindset moderates the impact of daily academic difficulties (experienced during preparing for exams) on students' emotional experiences and self-esteem

Study 1

There is ample evidence in the literature demonstrating that success and failure experiences have a strong negative impact on self-esteem (Crocker & Wolfe, 2001). However, the present study proposes that intelligence mindset may play a role in determining the magnitude of this negative effect. The belief that intelligence is as an unchangeable trait where improvement is impossible, excludes the role of effort as a tool to remedy failure or poor performance. Thus, failure and performance become the direct reflection of one's abilities or intelligence. Attributing failure to an innate ability might predispose to greater self-esteem loss when encountering failure. It was hypothesized that fixed intelligence mindset would moderate the effect of academic failure on self-esteem; more precisely, following academic failure, individuals with stronger fixed intelligence beliefs would report lower levels of self-esteem.

Materials and Methods

Participants. 413 college students (295 females, 118 males), aged between 18 and 36 years (M_{age} = 21.22, SD_{age} = 3.01) participated in this study. Most participants were undergraduate students (73.4%), while graduate (24%) and doctoral students (3%) were less represented. Among undergraduate students 48% were in their first year, 29% in their second and 23% in their third year in their college studies. Regarding participants' major, the most common were psychology (24%), biology (17%), linguistics (7%), economics (6%) and communication sciences (5%).

Procedure. The present studies were conducted in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of the related university. Participants were recruited through advertisements at the local university's social media page and online groups

frequented by its students. Those who were interested were guided to an online questionnaire platform where they could provide their written consent and enter the survey. Participation was voluntary, completely anonymous and no compensation were offered. First, participants completed a survey measuring their intelligence mindset. Then, in order to examine the effect of success and failure on self-esteem, each participant was instructed to recall as vividly as they could, the last time they had experienced success in college. Subsequently, they were asked to complete a measure of self-esteem referring to this experience. In the case of failure, the same procedure was followed, and the same self-esteem scale was administered. To separate the recalled success and failure experiences, demographic questions were presented between the two recollected events.

Measures.

Intelligence mindset. Intelligence mindset was assessed using the Hungarian version of the Implicit Theories of Intelligence Scale which demonstrated good psychometric properties in previous studies (Orosz et al., 2017). This scale consists of eight items capturing the belief in the fixed vs. malleable nature of intelligence. Participants rated their agreement on a 6-point scale (1 = totally disagree; 6 = completely agree). Following previous practices which treated fixed and growth mindset as unitary constructs (Blackwell et al., 2007; Cook et al., 2017; Rickert et al., 2014), the growth mindset items were reverse coded and combined with the fixed mindset items, thus forming a single composite indicator of fixed mindset. The scale showed good internal reliability (Cronbach's $\alpha = 0.86$).

Self-esteem. To measure self-esteem associated with success and failure, the Hungarian version of the Rosenberg Self- Esteem Scale was used (Rosenberg, 1965; Sallay et al., 2014). Previous studies supported the factor structure and composite reliability of the scale (Sallay et al., 2014). Participants completed this measure twice, after recalling an academic success and a failure experience; they were asked to rate retrospectively how strongly would they have agreed with each statement. Participants indicated agreement on a 5-point scale (1 = totally disagree; 5 = completely agree). Negatively worded items were reverse coded, thus higher scores reflect higher levels of self-esteem. The scale showed good internal reliability with a Cronbach's α of 0.93 for the success scenario and 0.95 for the failure scenario.

Statistical analysis. To test the hypothesis, a mixed model analysis was performed. The recalled academic success and failure experiences were dummy coded (1 = success, 0 = failure) and since the reference category is the category coded as 1, it was possible to examine the change in students' self-esteem due to academic failure. Fixed intelligence mindset was centered at the grand mean; so, the intercept represents students' average level of self-esteem when they experienced academic success and their fixed intelligence mindset is at the grand mean. The type of experience (failure vs. success experience) and fixed intelligence mindset were introduced in the model as between-subject variables, while self-esteem was nested within individuals. A simple linear two-level model with random intercept was estimated using restricted maximum likelihood estimation. All main analyses were carried out using the linear mixed-effects procedure in SPSS version 22 (IBM Corp., Armonk, New York).

Results and Brief Discussion

Preliminary analyses (Table 1) suggested that fixed intelligence mindset weakly negatively correlated with failure-related self-esteem, and it showed no association with self-esteem related to past success experience. Furthermore, there was no significant correlation between success and failure-related self-esteem.

The results of the linear mixed model (Table 2) suggested that failure experiences were associated with lower levels of self-esteem ($b = -4.42$, $t = -9.52$, $p < .01$, $\beta = -.61$). In general, compared to students' success-related self-esteem, following failure their self-esteem dropped by approximately 0.6 standard deviations (SDs). The interaction between fixed intelligence mindset and the type of experience (failure) proved to be significant ($b = -.12$, $t = -2.68$, $p < .01$, $\beta = -.17$). In order to probe this interaction a simple slope analysis was carried out. Results suggested that the effect of academic failure on self-esteem differed when fixed intelligence mindset was centered one SD below the mean ($b = -.12$, $t = -2.68$, $p = .008$) , at the mean ($b = -.14$, $t = -3.16$, $p = <.003$) and one SD above the mean ($b = -.17$, $t = -4.42$, $p <.001$). This trend is also illustrated in Figure 1.

Results of Study 1 confirmed our hypothesis and the interaction between fixed intelligence mindset and the type of experience proved to be significant. The effect of academic failure on self-esteem was different at different values of fixed intelligence mindset: the stronger students believed in

the unchangeable nature of their intelligence, the greater the decline in their self-esteem was after experiencing academic failure.

These results are in line with previous studies suggesting that failure has significant implications in the self-evaluations of individuals with fixed intelligence mindset (Robins & Pals, 2002; Zhao & Dweck, 1997). Considering that individuals with fixed intelligence mindset tend to make internal attributions when confronting failures (Hong et al., 1999), it is understandable why their self-esteem is more reactive to these situations. However, the present results should be interpreted judiciously, since success and failure experiences and the associated self-esteem levels were based on recollections, which are susceptible to retrospective bias and their ecological validity might be compromised (Hurlburt & Melancon, 1987). Hence, Study 2 aimed to address this limitation by assessing academic experiences (i.e., difficulties experienced during preparing for exams) and self-esteem on a daily basis, by using a daily diary methodology and it also aimed to expand this previous work by examining fixed intelligence mindset's role in students' emotional reactions to academic difficulties.

Study 2

Studies investigating the role of intelligence mindset in students' reactions to academic failures and difficulties put relatively little emphasis on the way daily classroom challenges and setbacks can shape the affective landscape of students over a shorter period of time. Although previous studies supported the association between fixed mindset and negative emotional reactions to academic failures and challenges (Chan, 2012; Cook et al., 2017; DaFonseca et al., 2009; Dinger et al., 2013), little is known about the way these beliefs operate in students' day-to-day educational experiences.

It was hypothesized that fixed intelligence mindset would moderate the impact of daily academic difficulties on students' self-esteem, positive and negative emotions. Students who endorse fixed intelligence beliefs would be more reactive to daily academic difficulties, and they would report lower levels of daily self-esteem and positive emotions and higher levels of daily negative emotions.

Materials and Methods

Participants. A total of 95 college students provided daily reports through five consecutive days during the exam period. Participation in the study was voluntary; however, three vouchers were offered through random drawing for those who provided daily reports each day. To be included in the study, participants had to provide five days of data. Initially, 141 students enrolled, from which 17 did not provide daily reports at all, 29 were excluded because they have provided daily responses less than five times. The mean age of the final sample was 20.08 years (SD = 2.44), with 14% males and 86% females. All participants were undergraduate students, 74% of them were in their first year of college, while 17% in their second and 9% in their third year. Participants had diverse backgrounds regarding their major; the most represented were psychology (31%), linguistics (16%), pedagogy (14%), and mathematics (12%).

Procedure. Data collection took place during the first week of the second semester's exam period in the 2017-2018 academic year (January). Participants were recruited via posters and flyers placed in highly frequented areas at the University and through announcements in different social media platforms. The recruitment took place one week before the beginning of the exam period. Participation had two modalities: students could choose to receive each evening an email with an online questionnaire, or they could send their daily reports through an application called Paco, which is a free, open-source tool for building and conducting personal science experiments. Upon enrollment, participants were informed about the aim of the study and informed consent was obtained. Next, they completed a background questionnaire with demographic questions and a measure of intelligence mindset. Daily reports were collected through five consecutive days. Since the exam period is highly stressful, we did not want to overburden participants, so we opted to collect data once a day and scheduled it at eight o'clock in the evening. Surveys closed four hours after had been sent in order to avoid next day completion.

Measures.

Intelligence mindset (measured one week before daily assessments). Intelligence mindset was assessed with the Hungarian version of the Implicit Theories of Intelligence Scale (Orosz et al., 2017), which was used in the same manner as in Study 1. The scale showed good internal consistency (Cronbach's $\alpha = 0.82$).

Preparing for an exam (daily measure). In order to assess academic difficulties, first, we asked participants whether or not they were preparing for an exam during the day ("Have you been preparing for an exam today?"). Their responses were coded 0 if they have not and 1 if they have been preparing.

Difficulty while studying (daily measure). If participants indicated that they have been preparing for exams during the day, we asked them "*What amount of difficulties have you met during studying?*", and they provided their responses on a 5-point Likert scale (1 = none; 5 = very high). For those participants who responded that they have not been preparing for an exam, this question was not presented, but all other measures (i.e., self-esteem, positive and negative emotions) were considered.

Exam vs. No exam day (daily measure). Since taking an exam could have considerable influence on students' self-esteem and emotions, we asked participants if they took an exam on a particular day. Their responses were coded 0 if they did not have an exam and 1 if they had an exam.

Self-esteem (daily measure). Taking into consideration that the data collection occurred during the exam period and that the attrition rates are generally high in ESM studies, in order to counter this threat and not to overburden participants, only the six highest loading items from the Hungarian version of the Rosenberg Self-Esteem Scale (Rosenberg, 1965; Sallay, et al., 2014) was used. In previous studies the scale demonstrated adequate factor structure and composite reliability (Sallay et al., 2014). The wording of the items was modified in order to refer to the present moment. Participants indicated their agreement on a 5-point scale (1 = totally disagree; 5 = completely agree). Negatively worded items were reverse coded, higher scores reflecting higher levels of self-esteem. In order to assess the reliability of the daily diary measures, the generalizability theory framework was used (Cranford et al., 2006). Variance components were estimated for each scale and were used to compute the generalizability coefficients. The R_{1F} value of 0.93 suggests that the abbreviated six-item self-esteem scale's ability to differentiate between persons is good, while an R_c value of 0.79 indicates that the scale measured individual differences in change over time reliably.

Positive and negative emotions (daily measure). Daily emotions were assessed using Pekrun et al.'s (2011) list of academic emotions. Participants were asked to indicate on a 5-point scale (1 = not at all; 5 = very much) the extent to which they have experienced specific negative (i.e., boredom, anxiety, anger, shame, disappointment, hopelessness) and positive emotions (i.e., relief, pride, enjoyment, hope) during the day. Items measuring positive and negative emotions were summed separately. For the negative emotions scale, the R_{1F} value is 0.81, while the R_c is 0.76, suggesting moderate to good reliability. The reliability of the positive emotions scale was poor to moderate with 0.60 R_{1F} and 0.69 R_c values.

Statistical analysis. To test our hypothesis hierarchical linear mixed modeling (HLM) was used. Since the current study is based on repeated assessment, HLM is especially suited, since HLM takes into account the non-independence among the repeated measurements (Heck et al., 2014), it allows estimates which are weighted according to the number of daily reports and it handles missing data well (Bryk & Raudenbush, 1992).

The present data had a two-level structure, daily observations being nested within individuals. As recommended by Bolger and Laurenceau (2013), Level 1 variables were person-mean centered, while Level 2 variables were grand-mean centered. The mean of the experienced difficulties (referring to it later as mean academic difficulties) was also included to prevent the confounding of levels. The close relationship between self-esteem and emotions are well-documented (Crocker & Wolfe, 2001; Nezlek & Plesko, 2001), so we included daily self-esteem (person-mean centered) as a predictor of daily emotions. According to Bolger and Laurenceau (2013) when modeling within-person causal processes, elapsed time should be included in the model in order to rule out time as a source of confounding; for example, with each day passing it is possible that students' fatigue increases, which might be related to their emotional experiences. By a similar rationale, exam vs. no exam day was also included in the model as a covariate, since exams and the perceived success on the exams might also have an impact on students' self-esteem and emotions.

All main analyses were carried out using SPSS version 22 (IBM Corp., Armonk, New York). Since our main research question refers to the differential effect of academic difficulties on students' self-esteem and emotions, in the statistical analysis, only those days were included when students were preparing for an exam and have reported the amount of difficulty they have met during studying (out of the 475 data points collected, 332 were used for the analyses).

Within-person (Level 1) variables included the repeated measures of daily academic difficulties, self-esteem, positive and negative emotions, time, and whether students had an exam on a particular day. Between-person (Level 2) variables included fixed intelligence mindset and mean academic difficulties. Level 1 and 2 fixed and random effects were estimated using restricted maximum likelihood estimation. Following the recommendation of Bolger and Laurenceau (2013) autoregressive covariance structure was used for the repeated statement of the model and unstructured covariance structure for the random statement.

Results

Descriptive analysis. Given that nearly one third of the initially enrolled participants were excluded from the study due to failure to provide daily reports at least five times, as a first step, we explored whether participants included in the study differed from those who were excluded. No differences were found regarding their intelligence mindset (t [141] = 1.16, p = .24), age (t [140] = 1.68, p = .56) or gender (χ^2 [1] = .27, p = .37). Similarly, there were no differences among those who participated through the application or email in terms of their intelligence mindset (t [95] = -1.07, p = .43), age (t [95] = 1.77, p = .08), and gender (χ^2 [1] = .06, p =.79).

In order to examine the associations between the study variables, we aggregated them across the entire measurement period. Table 3 presents means, standard deviations (SD), and pairwise correlations between the aggregated study variables.

Main analyses. An initial step was estimating a null model to determine if there was significant variation in daily assessments. Intraclass correlation (ICC) was used as an indicator of the variability estimates (Bryk & Raudenbush, 1992). For daily self-esteem, ICC suggested that 61% of the overall variability lied between individuals, and only 39% was within-person variation. For negative affect, 37% was between-person, and 63% was within-person variation. Only one third (34%) of the total variation of positive affect was between person, while 66% represents within-person variation. These results indicated that the development of a multilevel model was appropriate since intercepts varied significantly across individuals.

Predicting daily self-esteem level. According to the results (Table 4), higher level of perceived difficulties in a given day was related to lower levels of self-esteem on that day (b = -1.01, t = -4.63, p < .001, β = -.11), and higher average level of experienced academic difficulties during the five days was also significantly associated with lower levels of self-esteem (b = -1.94, t = -2.91, p < .01, β = -.24). Results suggested that with every increase of one SD in daily or mean academic difficulties, students' self-esteem dropped by 0.10 - 0.24 SDs.

The daily academic difficulties-self-esteem slope significantly varied across participants (s^2 = 1.02, Wald Z = 25.38, p < .001), suggesting that there was a variation in the effect of academic difficulties across participants. Results suggested that students' intelligence mindset partly explained this variation since fixed intelligence mindset moderated the impact daily academic difficulties had on daily self-esteem (b = -.14, t = -2.18, p = .03, β = -.05). Furthermore, this moderating effect was present at the between-subject level also; fixed intelligence mindset moderated the effect of mean academic difficulties on self-esteem (b = -.53, t = -2.67, p < .01, β = -.21).

In order to probe these interactions simple slope analyses were carried out. Results suggested that at the within-subject level, the effect of daily academic difficulties on daily self-esteem differed when intelligence mindset was centered 1 SD below the mean (b = -.07, t = -1.788, p = .06, β =- .04) , at the mean (b = -.17, t = -3.142, p = <.01, β = -.06) and 1 SD above the mean (b = -.21, t = -6.51, p <.001; β = -.13). These results suggest that when daily academic difficulties are held constant, at each persons' mean, with every increase of 1 SD in fixed intelligence mindset, students' self-esteem decreases by an additional 0.05 standard deviation. Furthermore, the daily academic difficulties × fixed intelligence mindset interaction explained 12% of daily difficulties' total slope variance. At the between-subject level a similar pattern emerged: fixed intelligence mindset centered at 1 SD below the mean (b = -.14, t = -2.88, p =.005, β = -.24), at the mean b = -.19, t = -3.96, p <.001, β = -.32), and 1 SD above the mean (b = -.22, t = -4.83, p <.001, β = -.38). At the between-subject level, one standard deviation increase in students' fixed intelligence beliefs was associated with an additional 0.05-0.10 SD

decrease in self-esteem, when academic difficulties were held constant at the grand mean.[1]. To illustrate the differential effect daily academic difficulty exerts on students' self-esteem, we estimated and plotted person-specific slopes and intercepts for each individual and also the average effect across individuals. For illustrating the average effect, intelligence mindset was centered at 1 SD above and below the grand mean. Figures 2a and 2b illustrate that the slopes of the average effect are different when mindset is centered above or below its mean. These results demonstrate that academic difficulties impact students' self-esteem differentially according to their mindset; those students who believe that their intelligence cannot be improved experience greater decline in their level of self-esteem when confronting increasing levels of academic difficulties compared to those who believe in the changeability of their intelligence.

Predicting daily positive emotions. Daily (b = -.32, t = -1.88, p = .05, β =-.07) and mean academic difficulties (b = -1.10, t = -3.51, p <.01, β = -.24) had a significant negative effect on daily positive emotions. Contrary to our hypothesis, fixed intelligence mindset was unrelated to positive emotions (b = -.39, t = -1.32, p = .18, β = -.11), and it did not moderate neither the effect of daily (b = -.00, t = -0.11, p = .91, β = -.00) nor the effect of mean academic difficulties (b = .09, t = 1.00, p = .31, β = .06) on positive emotions. Time had a small, but significant negative effect (b = -.21; t = -2.27, p = .02, β = -.08), suggesting that with each day passing, participants experienced fewer positive emotions. Higher levels of daily self-esteem (b = .27, t = 5.34, p < .001, β = -.23) predicted increases in positive emotions. Furthermore, results suggested that on days when students were taking an exam, they felt fewer positive emotions (b = -1.53, t = -5.58, p = <.001, β = -.46).

Predicting daily negative emotions. Similarly to positive emotions, fixed intelligence mindset was unrelated to negative emotions (b = -.21, t = -0.33, p = .73, β = -.14) and it did not moderate neither the effect of daily (b = .10, t = 1.09, p = .27, β = .03) nor the effect of mean academic difficulties (b = .16, t = -0.83, p = .40, β = -.06). In contrast, higher daily self-esteem (b = -.71, t = -7.77, p <.001, β = -.32) was related to lower levels of negative emotions. In addition, on days when students took an exam, they reported lower levels of negative emotions (b = -.99, t = -2.06, p = .04, β = -.15).

Aggregated analysis. Since the results of the mixed model analysis are based on only five repeated assessments, which might compromise their reliability, an aggregated (all variables were averaged across the five days) hierarchical linear regression analysis was performed, which yielded similar results (Table 5). At the aggregated level, the interaction between academic difficulties and fixed intelligence mindset was also significant. Academic difficulties and fixed intelligence mindset were both directly and negatively related to students' self-esteem, furthermore, intelligence mindset moderated the relationship between academic difficulties and self-esteem.

General Discussion

The results of the present studies suggest that fixed intelligence mindset amplifies the effect of academic difficulties and failures on students' self-esteem. In study 1, based on retrospective personal failure and success experiences, we found that fixed intelligence mindset moderated the impact of academic failure on students' self-esteem. Study 2, using daily diary method, confirmed these results. However, we found no evidence indicating that fixed intelligence mindset would moderate the effect of daily academic difficulties on students' emotions.

Regarding the impact of academic failures and difficulties, results suggest that these experiences are associated with lower levels of self-esteem and positive emotions and higher levels of negative emotions. Similarly, several studies support that academic failure has a significant impact on self-esteem (Crocker & Wolfe, 2001; Hayes & Chiarrochi, 2015) and that perceiving the study material as more difficult is associated with higher levels of negative emotions (Zaharia et al., 2015).

In accordance with previous results (Lee et al., 2017; Rhodewalt, 1994), fixed mindset was negatively related to self-esteem; students who endorsed stronger fixed intelligence beliefs, generally, had lower levels of daily self-esteem and self-esteem associated with failure situations. Interestingly in Study 1, fixed intelligence mindset was associated only with failure-related self-esteem, and not with

[1] To ensure that the results are not biased because 48% of the participants have been preparing for exams only three days out of five an additional analysis was carried out where only those participants were included who have been preparing for exams at least four days (N=50). This analysis yielded similar results, namely that fixed intelligence mindset moderated the influence daily (b = -.16, p = .02, β = -.05) and mean (b = -.69, p < .01, β = -.26) academic difficulties exerted on self-esteem.

success-related self-esteem, suggesting that academic adversities might be the most impactful situations when it comes to the effect of fixed intelligence mindset.

Results also suggest that fixed mindset moderates the effect of academic failures and difficulties on students' self-esteem. The self-esteem of students' who believed more strongly in the unchangeable nature of their intelligence, were affected in a greater degree by academic failures. When confronting with academic failures, a one standard deviation increase in fixed intelligence mindset led to an additional 0.19 standard deviation decrease in students' self-esteem. These conclusions are further corroborated by the results of Study 2, suggesting that on days when students encountered higher levels of academic difficulties than their average level of daily difficulties, those with stronger fixed intelligence mindset reported lower levels of daily self-esteem than those who endorsed more growth-oriented intelligence beliefs. When academic difficulties were held constant (at the person and grand mean), with each one standard deviation increase in students' fixed intelligence beliefs, their self-esteem decreased with an additional 0.05-0.10 standard deviation. Furthermore, the academic difficulties-mindset interaction explains about 12% of the variance in academic difficulties' effect on self-esteem.

From a theoretical point of view, the presence of intelligence mindsets' moderating effect is reasonable, considering that from a fixed mindset perspective, one's intelligence is contingent on accomplishments and performance is a testimony for high or low intelligence (Dweck, 2007; Hong et al., 1999). Moreover, Snyder et al. (2014) also found that the messages regarding students' abilities interacts with success and failure experiences. After receiving a fixed mindset message, participants tended to engage in behavioral self-handicapping, which is a strategy adopted to protect one's self-esteem (Urdan & Migdley, 2001).

The present results suggest that fixed intelligence mindset plays an important role in students' self-esteem and it might constitute an intervening point to help students maintain a healthy, stable sense of self-worth. Previous studies have shown that mindsets can be changed by interventions (Aronson et al., 2002; Yeager et al., 2016; Yeager et al., 2019). Teaching students to view failures from the perspective of growth mindset (in which setback is not a testimony of incompetence, but part of the learning process) might protect their self-esteem to be overly responsive to failures or difficulties. Having a stable sense of self-worth is especially important since low or unstable self-esteem is detrimental to coping (Lo, 2002) and achievement (Trautwein et al., 2006). Furthermore, feelings of deficiency or incompetence is associated with a perceived lack of control over academic achievement especially among academically high-risk students (Pizzolato, 2004).

Individuals with fixed intelligence mindset frequently engage in self-handicapping, avoidance and procrastination (Rickert et al., 2014), which are strategies used to protect their self-esteem. However, when believing that intelligence can be improved, students do not need to constantly validate their intelligence which might help them to preserve their mental resources and approach academic adversities in a more adaptive manner (e.g., greater persistence, the use of more effective strategies, see also Dweck & Yeager, 2019). Previous studies have also demonstrated that a growth mindset intervention led to higher academic effort (Sriram, 2013), engagement and achievement (Aronson et al., 2002), and it also helped students to overcome stereotype threat (Good et al., 2003). Furthermore, fostering a growth mindset can reduce the achievement gap between advantaged and disadvantaged students (Yeager et al., 2016), as it is also illustrated by a recent meta-analysis indicating that mindset interventions are the most effective among high-risk student populations (Yeager et al., 2019). Considering that academically high-risk student populations are more vulnerable to low self-esteem (Pizzolato, 2004), course withdrawal (Shell et al., 2016) and underachievement, growth mindset interventions might be especially suitable to enhance their achievement and retention.

Online mindset interventions are cost-effective, scalable and easily delivered, thus their wide implementation at the class or school level is feasible. Furthermore, creating school and classroom norms which advocate the adoption of intellectual challenges might lead to sustained benefits (Yeager et al., 2019). These norms can be created by framing achievement outcomes as the result of the learning process, putting emphasis on the learning process, persistence, effort expenditure and strategy use instead of on the outcomes or marks, and giving process (e.g., "The new strategy you have tried is working well."), rather than ability praise (e.g., "It comes natural to you."). By focusing on the learning process and on the role of effort, students might perceive that they have control over their achievement through their effort expenditure and strategy use while also feeling less helpless when encountering setbacks. Moreover, through acknowledging the role of effort, they might be less likely to make ability

attributions and would be less inclined to jump from the evaluation of their performance (e.g., "I performed poorly") to the evaluation of their self (e.g., "I am a bad student.").

Previous studies supported that fixed mindset is directly associated with negative emotions, higher emotional distress (Rosenberg et al., 2016) and mental health problems (Schleider et al., 2015). However, our results contradict the existence of a direct relationship between fixed intelligence mindset and emotions. Fixed intelligence mindset showed no association with daily emotions, and it did not moderate the effect of academic difficulties on affective states. In contrast, mean and daily self-esteem was the best predictor of daily emotions. Students who had higher mean self-esteem during the assessment period, and had more favorable daily self-evaluations, and tended to experience more positive and fewer negative emotions. These results are supported by the vast literature documenting the impact of self-esteem on emotions (Crocker & Wolfe, 2001; Nezlek & Plesko, 2001).

Limitations and future directions. Although these studied broadens our understanding regarding the role of intelligence mindset in students' emotions and self-esteem when facing academic adversities, they have several limitations. First of all, in Study 1 success and failure experiences and the associated self-esteem levels were based on recollections, which are susceptible to retrospective bias (Hurlburt & Melancon, 1987), thus results should be interpreted accordingly. For more reliable conclusions, self-esteem should be measured in real time, after academic successes and failures were experienced.

In Study 2, a great majority of participants (48%) have been preparing for exams only three days out of five, thus providing only three data points. Thus, the lack of extensive repeated assessments might make the results of this study unreliable especially at the within-person level. Hence future studies should collect data for a longer period of time. Moreover, data was collected once a day, and it might be possible that answering the daily questions did not coincide with experiencing the difficulties in question, which might alter students' responses, especially if these difficulties were successfully resolved before completing the daily reports. Attrition rate was high, and the sample consisted primarily of female college students, which might raise questions about internal validity and the generalizability of the results. Furthermore, the reliability of the scales measuring positive and negative emotions is only moderate, meaning that their ability to differentiate between persons and to measure individual differences in change is restrained.

Another limitation of both studies is that they did not measure actual academic achievement. It might be possible that poorer academic achievement is related to higher levels of perceived academic difficulties, or the impact of failure differs across students according to their GPAs. Additionally, the total number of exams students had to take during the exam period was not controlled. A higher number of exams might alter the perception of academic difficulties as being more pressuring, thus leading to more negative emotions.

Moreover, neither of the studies took into account the effect of other factors like contingencies of self-worth, perceived control and value of academic performance, which might also be crucial in shaping students' emotions and self-esteem. Basing self-esteem on academic competence was found to moderate the effect of poor grades (Crocker et al., 2003), while appraisals of control and perceived value are central in determining achievement emotions (Pekrun, 2006).

If future studies would also support the influence intelligence mindset exerts on students' self-esteem in academically challenging situations, we might assume that adding self-compassion elements to growth mindset interventions could further improve their effectiveness. Self-compassion training is highly effective in reducing self-judgment and over-identification (Neff, 2016; Neff & Germer, 2013), which, as previous studies have indicated, are common among individuals with fixed mindset. Thus, teaching students to interpret challenging academic situations through the lens of growth mindset (where persistence and effort are crucial to success), and to evaluate their experiences and themselves in a more non-judgmental or self-compassionate manner (where the individual does not become less worthy as a person due to his or her failures or shortcomings) could be highly effective in reducing academic stress and mental health problems among college students.

Conclusion. Fixed intelligence mindset makes students' self-esteem more reactive to academic difficulties and failures in a sense that it amplifies their effect, leading to greater drops in self-esteem levels. Low self-esteem and its protective strategies are related to various maladaptive emotional and behavioral outcomes, thus, cultivating growth mindset might help to counter in part these negative consequences.

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Figure 1

Levels of self-esteem in recalled success and failure situations

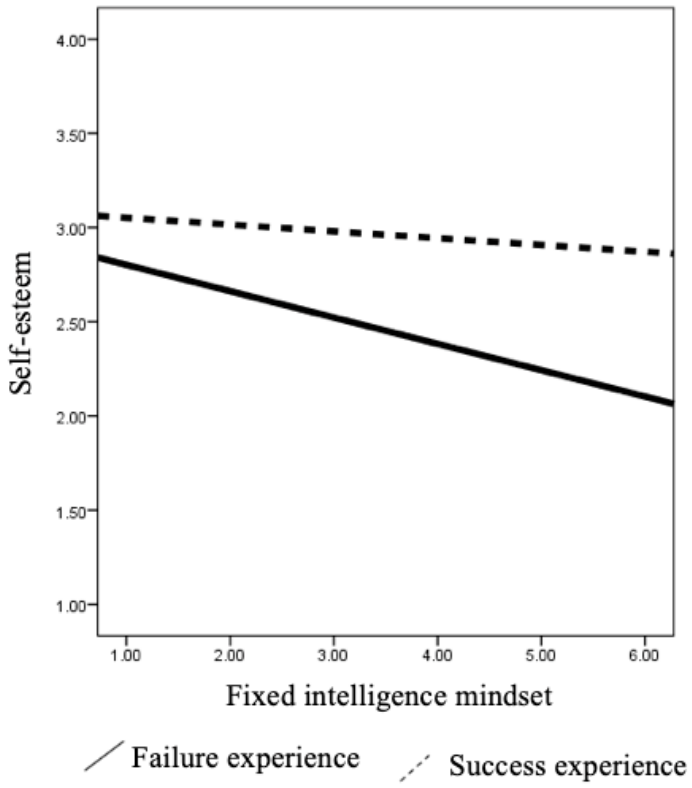

Figure 2a.

Daily academic difficulties predicting daily self-esteem when fixed intelligence mindset is centered at - 1 SD below the mean

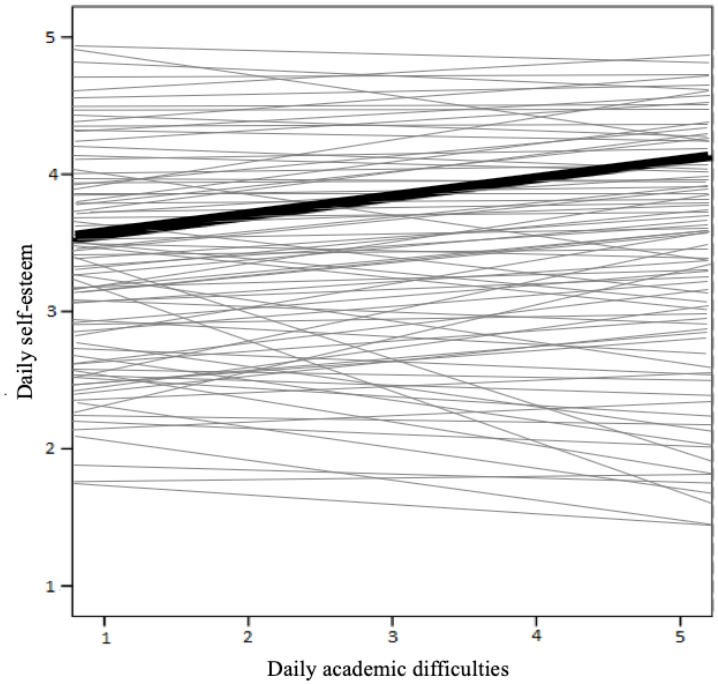

Figure 2b.

Daily academic difficulties predicting daily self-esteem when fixed intelligence mindset is centered at + 1 SD below the mean

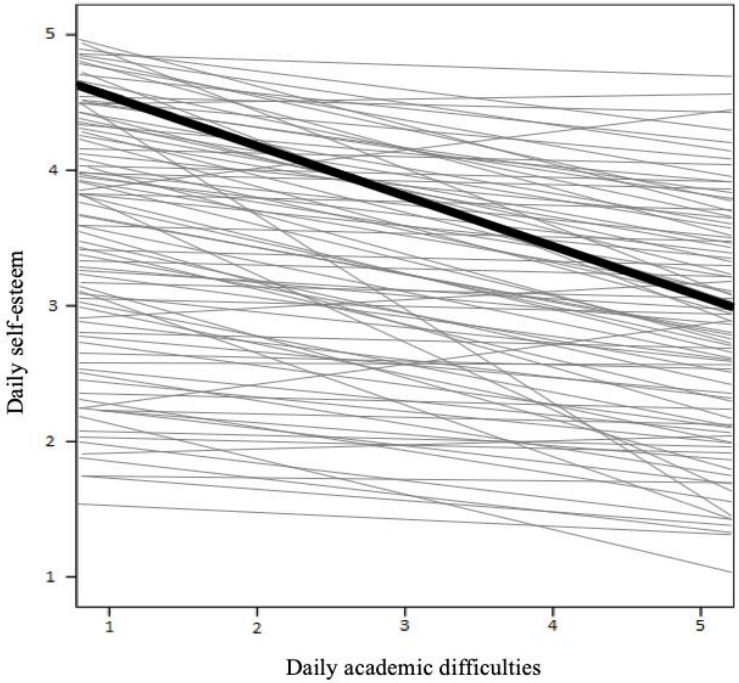

Table 1

Descriptive statistics and pairwise correlations among variables (Study 1)

	1	2	3
1. Fixed intelligence mindset	-		
2. Self-esteem (success)	-.07	-	
3. Self-esteem (failure)	-.21***	.06	-
Mean	22.88	29.85	25.42
Standard deviation	9.58	5.73	7.76
Skewness (SE)	.43 (.12)	-.23 (.12)	-.34 (.12)
Kurtosis (SE)	-.35 (.24)	.53 (.24)	-.36 (.24)

Note. *** $p < .001$.

Table 2

Linear mixed model predicting self-esteem associated with past success and failure experiences (Study 1)

	Self-esteem		
	B (SE)	β (SE)	*p*
Intercept	29.84 (0.28)		
Type of experience (Failure)	-4.42 (0.46)	-.61(0.06)	<.001
Fixed intelligence mindset	-.04 (0.02)	-.06 (0.03)	.130
Failure experience * Fixed intelligence mindset	-.12 (0.04)	-.17 (0.06)	.008

Note. B: unstandardized regression coefficient; β: standardized regression coefficient; SE: standard error.

Table 3

Mean, standard deviations and pairwise correlations among the aggregated variables (Study 2)

	1	2	3	4	5
1. Intelligence mindset	-				
2. Self-esteem	-.33**	-			
3. Academic difficulties	.11	-.21*	-		
4. Positive emotions	-.12	.49***	-.28**	-	
5. Negative emotions	.14	-.72***	.273**	-.36***	-
Mean	7.79	22.54	2.96	7.18	15.43
Standard deviation	3.22	5.41	0.74	2.32	4.66

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4

Hierarchical linear model predicting daily self-esteem, positive and negative emotions (Study 2)

	Self-esteem		Positive emotions		Negative emotions	
	B (SE)	β (SE)	B (SE)	β (SE)	B (SE)	β (SE)
Intercept	28.64 (2.13)		11.76 (1.05)		9.48 (2.17)	
Level 1 and 2 covariates						
Time	0.10 (0.09)	.02 (0.02)	-0.21 (0.09)	-.08 (0.03) *	-0.09 (0.14)	-.02 (0.03)
Exam (vs. No exam)	-0.16 (0.30)	-.02 (0.04)	-1.53 (0.27)	-.46 (0.08) ***	-0.99 (0.48)	-.15 (0.07) *
Daily self-esteem	-	-	0.27 (0.05)	.23 (0.04) ***	-0.71 (0.09)	-.32 (0.04) ***
Fixed intelligence mindset	-1.19 (0.63)	-.21 (0.08) *	-0.39 (0.30)	-.11 (0.07)	-0.21 (0.63)	.14 (0.07)
Mean academic difficulties	-1.94 (0.66)	-.24 (0.08) **	-1.10 (0.31)	-.24 (0.07) ***	2.26 (0.66)	.27 (0.08) **
Daily academic difficulties	-1.01 (0.21)	-.11 (0.02) ***	-0.32 (0.17)	-.07 (0.03) *	0.85 (0.31)	.09 (0.03) **
Interactions						
Daily difficulties * Fixed int. mindset	-0.14 (0.06)	-.05 (0.02) *	-0.00 (0.05)	-.00 (0.03)	0.10 (0.09)	.03 (0.03)
Mean difficulties * Fixed int. mindset	-0.53 (0.20)	-.21 (0.07) **	0.09 (0.09)	.06 (0.06)	0.16 (0.19)	-06 (0.07)

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; B: unstandardized regression coefficient; β: standardized regression coefficient; SE: standard error.

Table 5

Aggregated regression analysis on mean self-esteem, positive and negative emotions (N=94)

	Self-esteem				Positive emotions				Negative emotions			
	R^2	R^2_{adj}	B (*SE*)	β	R^2	R^2_{adj}	B (*SE*)	β	R^2	R^2_{adj}	B (*SE*)	β
Model 1	.14***	.12			.09*	.06			.07*	.05		
Academic difficulties			-1.21 (0.70)	-.17*			-.80 (0.31)	-.27*			1.43 (0.63)	.24*
Fixed intelligence mindset			-0.51 (0.16)	-.31**			-.07 (0.07)	-.10			0.16 (0.14)	.12
Model 2	-	-			.26***	.23			.52***	.50		
Academic difficulties			-	-			-0.56 (0.29)	-.19			.70 (0.46)	.11
Fixed intelligence mindset			-	-			0.02 (0.07)	.04			-0.14 (0.11)	-.10
Self-esteem			-	-			0.19 (0.04)	.45**			-0.61 (0.07)	-.71**
Model 3	.21***	.18			.30***	.27			.52***	.50		
Academic difficulties			-1.64 (0.69)	-.23*			-0.39 (0.29)	-.11			.58 (0.48)	.09
Fixed intelligence mindset			-0.46 (0.15)	-.29**			0.02 (0.06)	.04			-0.13 (0.11)	-.10
Self-esteem			-	-			0.22 (0.04)	.51***			-0.63 (0.07)	-.74***
Academic difficulties * Fixed intelligence mindset			-0.57 (0.20)	-.27**			0.18 (0.08)	.20			-0.13 (0.14)	-.07

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; R^2: variance; R^2_{adj}adjusted variance; B: unstandardized regression coefficient; β: standardized regression coefficient; SE: standard error;