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Self-downing mediates the association between fixed intelligence mindset and different indicators of students' mental health

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Abstract

While there is ample evidence documenting associations between fixed intelligence mindset and students' mental health much less is known about the mediating mechanisms through which fixed intelligence mindset exerts its influence. The present study (N=310) aimed to investigate exam-related irrational beliefs from cognitive-behavioral theories as potential mediators between fixed intelligence mindset and students' mental health-related outcomes during the exam period. Structural equation modeling revealed that self-downing—as evaluating one's worth globally and negatively due to failure on exams— and depressive symptoms mediated the effect of fixed intelligence mindset on emotions in a causal chain. Other types of irrational beliefs such as low frustration tolerance of poor exam performance, demandingness and catastrophizing about exam failure did not serve as mediators. These findings suggest that students with fixed intelligence mindset interpret exam performance from the perspective of its repercussions on their self and its worth, which, in turn, predisposes them to poorer mental health during the exam period.

Keywords: intelligence mindset, irrational beliefs, depressive symptoms, negative emotion

The exam period is one of the most taxing periods of the academic year with concerns about success being the primary source of hardship (Aselton et al., 2012). According to Neuderth et al. (2009), exam nerves significantly impair the functioning of 15-20% of students. However, academic challenges and adversities experienced during the exam period influence students' mental health differently, leading to highly disparate affective responses. These diverse reactions are well illustrated by students' testimonies regarding their perceptions and reactions to academic challenges or failures. For example, when failing an exam, one student mentions negative feelings such as being "upset, ashamed at my failure, angry that I couldn't have done better, and even a little depressed". Others perceive failure less disturbing "I feel I can do much better in school. It is still hard for me to accept the fact that I have a C on my transcript, but I look at my grades, and I am inspired to do well. And, despite my grades, I feel like I have learned a lot." (Robins & Pals, 2002, p. 313).

One might ask, what determines the type and intensity of students' emotional reactions and which are the factors that predispose to poorer mental health outcomes during the exam period? According to Dweck's (1995) social cognitive theory of achievement motivations, academic challenges and adversities (Schleider et al., 2015) might act as environmental "triggers" predisposing students to interpret academic difficulties from a fixed mindset perspective (i.e., What this situation tells about my intelligence?; Dweck, 2013), consequently leading to more helpless reactions (e.g., symptoms of anxiety and depression; see Baer et al., 2005; King et al., 2012). Although a clear link has been established between intelligence mindset and different mental health outcomes (for a review see Schleider et al., 2015), little is known about the nature of this relationship. Does endorsing fixed intelligence mindset lead directly to poorer mental health outcomes, or is mindset's effect mediated by other factors?

Another construct that might be implicated in students' mental health is irrational beliefs. From the perspective of Rational Emotive Behavior Therapy (REBT), interpreting adverse situations through the lenses of irrational beliefs — beliefs which are illogical, non-constructive and have no empirical support — (e.g., "Failing this exam is awful, it is the worst thing that could have happened"; Ellis, 1962) leads to dysfunctional emotions (e.g., depression, anxiety, anger, distress; see David et al., 2010; Harrington, 2005).

Although Dweck and Ellis offer different explanations as to why individuals react differently in the same situation (i.e., holding a fixed intelligence mindset or irrational beliefs), one might wonder if these theories could complement each other in explaining why certain students experience more pronounced mental health problems during the exam period. The literature suggests that there is an overlap in the emotional reactions associated with fixed intelligence mindset and irrational beliefs, which suggests a potential link between these two constructs. According to Dweck et al. (1995), fixed intelligence mindset transforms achievement situations into evaluations, where a judgment about one's intelligence is made (Dweck, 2013); thus, validating one's abilities is essential. It is plausible that fixed intelligence mindset might predispose individuals to interpret exam performance through the lenses of irrational beliefs (e.g., "I must succeed on this exam." "Failing is the worst thing that could happen."), which, in turn, promote the emergence of the above-detailed dysfunctional negative emotions and mental health outcomes in the case of failure. Hence, the present study proposed to investigate this hypothesized model, and, in addition, tested the mediating role of exam-related irrational beliefs between fixed intelligence mindset and indicators of mental health (e.g., symptoms of depression, positive and emotions).

Intelligence Mindset and Mental Health

An abundance of literature evidenced that the way individuals view their abilities exerts considerable influence on their academic and psychological functioning (Blackwell et al., 2007; Cury et al., 2008; Haimowitz et al., 2011). More specifically, studies reported significant associations between fixed intelligence mindset and negative emotions (King et al., 2012; King, 2016), symptoms of anxiety and depression (Baer et al., 2005; Schleider et al., 2015). Furthermore, diary studies have revealed that students with fixed intelligence mindset reported higher levels of depressive symptoms during a two months period (Baer et al., 2005) and they also tended to appraise academic stressors as threats and were characterized by a more enduring stress response (Lee et al., 2018).

The consistent link between fixed intelligence mindset and students' mental health could be explained by the fact that for students with fixed intelligence mindset, every achievement situation represents an evaluation (Dweck, 2013), where demonstrating one's abilities is essential (Leonardi & Gialmas, 2002). Since success and failure are perceived as the direct reflections of one's innate ability,

attributing performance to internal factors is common among individuals endorsing fixed intelligence mindset (Hong et al., 1999). As follows, hardship and failures represent a threat to one's self-worth or are perceived as evidence of incompetence (e.g., "I failed this exam because I am stupid.") (Hong et al., 1999). Attributing negative events or, more specifically, failures to internal, global, and stable factors might make individuals more vulnerable to a series of negative mental health consequences such as anxiety and depression (Abramson et al., 1978).

Irrational Beliefs and Mental Health

According to Cognitive Behavioral (CBT) and Rational Emotive Behavior Therapy (REBT), beliefs and evaluations play a central role in determining our behavioral and emotional reactions to adverse situations (Ellis et al., 2010). According to the "ABC" model (Ellis, 1962), cognitions and beliefs (B) are interposed between an unpleasant activating event (A) and our emotional, behavioral and physiological reactions (C), meaning that cognitions are not only triggered by events, but they determine our reactions to them (David, 2017). According to rational emotive behavior therapy, evaluative cognitions and beliefs which can be formulated rationally or irrationally, are the proximal antecedents of psychological disturbance. Irrational beliefs (IBs), can be characterized as illogical, rigid, non-pragmatic beliefs which have no empirical support, and are associated with dysfunctional or maladaptive behaviors and emotions (e.g., depression, anger) (Ellis et al., 2010).

There are four types of IBs. The first is *demandingness* (DEM), which refers to absolutistic requirements in the form of "musts" or "shoulds" (e.g., "I must do well on all of my exams."). The second is *awfulizing* (AWF), which indicates that a situation is evaluated as being catastrophic or the worst thing that could happen (e.g., "Failing that exam was the worst thing that could have happened to me."). The third is *self-downing or global self-evaluation* (SD/GE), which appears when individuals are excessively critical to themselves and evaluate themselves globally and negatively (e.g., "I failed that exam, that means that I am completely incompetent."). Finally, *low frustration tolerance* (LF) refers to the belief that one is unable to endure an unwanted situation (e.g., "Failing the exam would be unbearable.") (Ellis et al., 2010).

Adverse life events do not necessarily lead to psychological disturbance unless they are interpreted and evaluated irrationally. For example, failure on an exam or confronting with difficulties will not provoke such disturbing emotional reactions as hopelessness or depression, unless there is an absolutistic demand that failure is or would be unbearable, catastrophic, or it should not have happened.

IBs, in general, have been consistently linked to mental health (Bernard & Pires, 2006; David, 2003; Szentagotai & Jones, 2010; Ziegler & Hawley, 2001). Similarly, several studies have demonstrated that IBs are also relevant in the academic context, indicating significant associations with test-anxiety, distress, negative affect, depression, and academic adjustment (Flett et al., 2008; Montgomery et al., 2007).

Linking of Fixed Intelligence Mindset and Irrational Beliefs from the Perspective of Mental Health

Even though there is no direct evidence in the literature linking fixed intelligence mindset to irrational beliefs, a handful of studies from the mindset and REBT literature suggest that there might be a positive association between these two constructs. Studies from the mindset literature demonstrated that individuals with fixed mindset tend to display maladaptive emotional reactions when facing difficulties and failures (Robins & Pals, 2002; Schleider et al., 2015; Tuckwiller & Durdick, 2018), while the REBT literature evidenced the crucial role of irrational beliefs in eliciting those same negative emotional reactions (Cuijpers et al., 2013).

Individuals with fixed intelligence mindset frequently report intensive negative emotions (e.g., anxiety, depression, shame") when confronting failure (Robins & Pals, 2002). Shame, anger, and depression are dysfunctional emotions which, according to REBT theory, are triggered by irrational beliefs (David & Cramer, 2010), like demandingness, low frustration tolerance, awfulizing and self-downing (e.g., "I must succeed on the exam under any circumstances, and I could not stand failing, that would be the worst thing that could happen to me."). Moreover, fixed intelligence mindset has also been linked to students' symptoms of depression and anxiety (Tuckwiller & Durdick, 2018), and the role of irrational beliefs in the onset and maintenance of these psychological disorders is well-established (Ellis et al., 2010). Irrational beliefs were also found to be related to anxiety and distress in school (Amuito & Smith, 2008; DiLorenzo et al., 2011), and were found to mediate the effect of life stress on depressive symptoms (Deal & Williams, 1988).

How Fixed Intelligence Mindset and Irrational Beliefs Operate in Threatening Situations

Fixed intelligence mindset exerts its greatest impact when ego-threat is salient (Blackwell et al., 2007), and the exam period is filled with these situations. Fixed intelligence mindset predisposes individuals to perceive their achievements as the direct reflections of their intelligence, a stable, unchangeable trait, which has to be proved and validated in every performance situation (Dweck, 2013). Thus, challenges, difficulties, and setbacks experienced during this period might act as triggers to fixed intelligence mindset (Dweck, 2013), which, in turn, predisposes individuals to interpret achievement situations based on how they reflect on their intelligence and self.

Given the importance of demonstrating one's abilities and intelligence through performance, it is likely that individuals with fixed intelligence mindset are more prone to interpret or evaluate achievement-related situations in an irrational manner. According to REBT theory, interpreting situations irrationally provokes emotional disturbance. Taking together mindset and REBT theories (see also Figure 1), it is plausible that individuals with fixed intelligence mindset might hold absolutistic demands to attain success (i.e., validating intelligence), or avoid failure (i.e., revealing inadequacies). In the salience of failure, individuals with fixed intelligence mindset frequently report high levels of negative emotions (Robins & Pals, 2002). For example, feeling ashamed about failure could be triggered by rating one's self or worth globally (i.e., self-downing) based on one's performance (e.g., "If I fail, that would mean that I am stupid."), and catastrophizing (e.g., "Failure would be the worst thing that could happen.") could also play a role in precipitating anxiety symptoms when failure is impending. Individuals with fixed intelligence mindset are characterized by an interpretational framework that stresses the necessity to validate their intelligence and the repercussions to one's self if failing to do so. Thus, it is reasonable to assume that fixed intelligence mindset might incline individuals to interpret achievement situations in a more irrational manner, which in turn would trigger more intensive negative emotional reactions.

The Present Study

Mental health issues among college students have become a growing concern (Oswalt et al., 2020); thus, investigating factors that might influence students' mental health and the potential mechanisms through which these factors exert their influence is essential. The exam period is one of the most taxing periods during the academic year (Aselton, 2012), and it is filled with challenges, difficulties, and setbacks. These situations which might act as triggers to fixed intelligence mindset and might also serve as activating events to performance-related irrational beliefs; thus, exploring their relationship and impact on mental health is especially suitable during this period. To examine the role of intelligence mindset and irrational beliefs on students' mental health-related outcomes, we adopted a context-specific approach and measured irrational beliefs related to exam performance, since, during this period, exam performance is a great concern among students. We also considered it important to control the effect of prior academic performance (i.e., grade point average; GPA) when investigating the proposed mediational model, since there is a close association between academic achievement and students' mental health (Murphy et al., 2015), and evidence in the literature also indicates that fixed intelligence mindset exerts greater influence among low-achieving students (Hwang et al., 2019).

We expected fixed intelligence mindset to be positively related to students' negative emotions, depressive symptoms, and exam-related irrational beliefs, but negatively to positive emotions experienced during the exam period. Furthermore, it was also hypothesized that exam-related irrational beliefs would be positively associated with symptoms of depression and negative emotions, while negatively to positive emotions and that the effect of fixed mindset on emotions and depressive symptoms would be mediated by exam-related irrational beliefs.

Although REBT theory posits that irrational beliefs are the antecedents of psychological disturbance, according to a recent review, conclusions about their etiopathogenetic nature are limited (Visla et al., 2016). Longitudinal studies have also yielded mixed results, with some supporting REBT's causal assumption that change in irrational beliefs are related to the magnitude of depressive symptom recovery over time (Nieuwenhuijsen et al., 2010), while other studies reporting that depression-related cognitions arise concomitantly with a depressive episode (Lewinshon et. al 1981). Furthermore, since high negative affectivity and low positive affectivity is a common component of depression (American Psychiatric Association, 2013), it is also arguable whether the relationship between these mental health outcomes are bi- or unidirectional. As regards to intelligence mindset, according to Dweck's theory mindset could be conceptualized as a core belief, a meaning system, which give rise to different

interpretations, behaviors and emotions (Dweck & Yeager, 2019). Although there are experimental studies demonstrating that priming growth intelligence mindset lead to more adaptive outcomes, like decreased anxiety (Burns & Lisbell, 2007), negative affect and increased self-esteem (Niiya et al., 2004), however in terms of persistence and achievement results were mixed (Braten et al., 2017; Burns & Lisbell, 2007). Besides, according to our knowledge, the causal or temporal association between mindset, irrational beliefs has not been studied. Given these theoretical considerations and the cross-sectional nature of the present study, we tested several alternative models, where the position or the relationship between the assessed mental health outcomes was modified (e.g., irrational beliefs predict depressive symptoms which in turn predict negative and positive affect; versus depressive symptoms predict irrational beliefs, which in turn is related to negative and positive affect).

The present study, apart from expanding theoretical knowledge by linking mindset and REBT theory and by exploring potential intervening mechanisms through which different factors influence students' mental health-related outcomes, might also offer some guidance in designing more directed and effective interventions to ameliorate students' mental health problems.

Materials and Methods

Participants

Overall, 323 individuals agreed to participate in the study; however, 13 individuals were excluded due to non-completion of the measures (seven individuals did not complete any of the measures, while six of them did not complete the fixed intelligence mindset measure). The final study sample consisted of 310 college students (245 females, 65 males), aged between 18 and 33 years (M_{age} = 22.15, SD_{age} = 2.57). The majority of participants were undergraduate students (79%), and had diverse majors; the most represented were psychology (10%), economy and finances (8%), linguistics (6%), mathematics and informatics (5%), and 24% of the participants attended medical school. All participants belonged to the Hungarian minority in the Transylvania region of Romania.

Procedure

The present study was conducted in accordance with the Declaration of Helsinki and was approved by the Research Ethics Committee of the related university. Data collection occurred in two waves, during the Fall and Spring Semesters' exam periods in the 2018-2019 academic year. One hundred six participants enrolled in the study during the first wave and 217 during the second wave. Participation in this study consisted of completing a set of online questionnaires, which was advertised on social media platforms featuring contents relevant to students. Participants were informed about the aim of the research, and informed consent was obtained. Participation was completely voluntary and anonymous; no rewards were offered for those who completed the questionnaires. Participants were Hungarian minority students from Romania.

Measures

Intelligence mindset. Participants' intelligence mindset was assessed using the fixed mindset subscale of the Hungarian version of the Implicit Theories of Intelligence Scale (Dweck et al., 1995; Orosz et al., 2017). This subscale consists of four items capturing the belief in the unchangeability of intelligence (e.g., "You have a certain amount of intelligence, and you really can't do much to change it."). Participants rated their agreement with each statement on a 6 -point scale (1 = totally disagree; 6 = completely agree); higher scores indicating stronger fixed intelligence beliefs. The scale showed good internal consistency (Cronbach's $\alpha = .84$).

Exam-related irrational beliefs. A context-specific approach was adopted to assess exam-related irrational beliefs. The four performance-related irrational beliefs subscales (i.e., demandingness, low frustration tolerance, awfulizing, self-downing) of the Attitudes and Beliefs Scale-2 (ABS2; DiGiuseppe et al., 1988) were translated to Hungarian using the protocol of Beaton et al. (2000). Since these subscales refer to performance in general, items were rephrased in order to reflect irrational beliefs related to exam performance (e.g., "I must perform well at this exam" DEM; "If I fail this exam, it would be a catastrophe." AWF; "I would be a worthless person if I failed this exam." SD; "I cannot tolerate to do poorly on this exam, it would be unbearable to fail." LFT. Each subscale consists of three items. Participants were asked to reflect on their thoughts that they usually have before taking an exam and rate on a 5-point scale (1 = not at all, 5 = completely) how closely the items describe their way of thinking. Higher scores indicate higher levels of irrational beliefs. Separate scores were calculated for each subscale, and all subscales showed good internal consistencies (Cronbach's $\alpha_{DEM} = .79$, $\alpha_{LFT} = .83$, $\alpha_{SD} = .86$, $\alpha_{AWF} = .80$).

Symptoms of depression. The Hungarian version of the 9-item Beck Depression Inventory was used (BDI-II; Beck et al., 1996; Rózsa et al., 2001). The BDI-II contains items assessing all nine symptoms listed in the DSM-5 as criteria for a major depressive episode. Each item was rated from 0 to 3 according to the severity of the symptoms or the difficulties experienced. Total scores were calculated, and higher scores indicating higher levels of depressive symptoms. Since BDI-II was not used as a diagnostic tool but as an indicator of distress, total scores were not further interpreted according to the established cut-off values. The scale showed good internal consistency (Cronbach's $\alpha = .85$).

Positive and negative emotions. To assess participants' positive and negative emotions, we used Pekrun et al.'s (2011) list of academic emotions, which are thought to arise when students are engaged in learning-related activities (e.g., studying or taking exams). 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., anxiety, anger, shame, hopelessness, boredom) and positive emotions (i.e., relief, pride, enjoyment, hope) during the current exam period. Items measuring positive and negative emotions were summed separately. The internal consistency of the positive (Cronbach's $\alpha = .71$) and negative (Cronbach's $\alpha = .75$) subscales was acceptable.

GPA. GPA was assessed through self-reports; students were asked to provide their average GPA from the previous semester. GPA typically ranges from 1 (fail) to 10 (excellent). While we were not able to obtain objective grades from the university, the reported high correlations between self-reported and actual school grades (Noftle & Robins, 2007; for a meta-analysis, see Kuncel et al., 2005) gives us confidence about the adequacy of this measure.

Statistical Analysis

Statistical analyses were conducted using Mplus 8 (Muthén & Muthén, 2017) and the weighted least squares mean- and variance-adjusted (WLSMV) estimator which, compared to maximum-likelihood-based estimation methods, has been found to be superior for Likert-type ordered-categorical items, particularly when the response categories follow asymmetric thresholds (for a review, see Finney & DiStefano, 2013). A preliminary measurement model was first estimated (Model 0), using confirmatory factor analysis (CFA) to confirm the factor structure and psychometric adequacy of the measures used in this study. In this model, each item loaded on their corresponding latent factors, and latent factors were allowed to correlate among each other. Main analyses involved the estimation of fully latent path models. Model-based composite reliability indices (ω; McDonald, 1970) were also calculated to assess the reliability of the factors. GPA was also included in this preliminary measurement model to examine its associations with the other variables.

Several theoretically plausible alternative path models were estimated and compared: in Model 1, mindset predicted self-downing and low frustration tolerance which predicted depression, negative and positive affect. In Model 2, self-downing and low frustration tolerance predicted depression and affect which predicted mindset. In Model 3, mindset predicted depression which predicted self-downing and low frustration tolerance which predicted negative and positive affect. In Model 4, mindset predicted self-downing and low frustration tolerance which predicted depression which predicted negative and positive affect. Finally, in Model 5, depression predicted self-downing and low frustration tolerance which predicted negative and positive affect which predicted mindset.

The adequacy of the models was examined with the following goodness-of-fit indices and their respective cut-off values (Marsh et al., 2005): comparative fit index (CFI; $\geq .95$ for good, $\geq .90$ for acceptable fit), Tucker- Lewis index (TLI; $\geq .95$ for good, $\geq .90$ for acceptable fit), and the root-mean-square-error of approximation (RMSEA; $\leq .06$ for good, $\leq .08$ for acceptable fit). In line with typical model selection guidelines (Marsh, 2007), the final path model was selected based on the inspection of model fit, parameter estimates (e.g., regression coefficients, standard errors) and the interpretability and theoretical conformity of the results. In the final predictive model, to test potential mediating mechanisms, 95% bias-corrected bootstrapped confidence intervals were also computed in Mplus. Based on Preacher and Hayes (2008), 5000 bootstrap replication samples were requested, and the mediation was considered statistically significant if the confidence intervals exclude zero.

Results

Preliminary Analyses

The preliminary measurement model incorporating all variables had good model fit (see Model 0a in Table 1). However, taking a look at the latent correlations in this model (reported in Table S1 of the online supplements) revealed that mindset was not associated with demandingness, catastrophizing,

and GPA. Contrary to our expectation, GPA was only related to positive emotions, but not any of the other variables. For these reasons, we decided to remove these three variables from further analyses.

The revised measurement model showed equally good fit to the data (see Model 0b in Table 1). Parameter estimates for this measurement model are presented in Table 2. In general, results indicated well-defined and reliable factors for fixed intelligence mindset (λ = .526 to .859; ω = .856), self-downing (λ = .782 to .906; ω = .888), low frustration tolerance (λ = .794 to .921; ω = .877), depressive symptoms (λ = .466 to .863; ω = .913), as well as positive (λ = .574 to .705; ω = .789) and negative affective states (λ = .596 to .763; ω = .744). Latent correlations (reported in Table 3) showed that these associations remained highly similar after the removal of three variables. More specifically, fixed intelligence mindset positively correlated with self-downing, low frustration tolerance, depressive symptoms and negative emotions but negatively with positive emotions. Both self-downing and low frustration tolerance positively correlated with depression and negative emotions but negatively with positive emotions. While the very high correlation between self-downing and low frustration tolerance might be concerning at first, this association is perfectly reasonable as both are constituents of irrational beliefs and previous studies have also reported similarly strong correlations between these variables (DiLorenzo et al., 2007; Suso-Ribera et al., 2016).

Alternative Models

Given that different path models were plausible from a theoretical perspective, we estimated five alternative models which are described above. Goodness-of-fit indices associated with these models are reported in Table 3 and revealed that all models fitted the data equally well which is not surprising as that they are based on the same measurement model. Here, inspection of parameter estimates could be highly informative. Both Models 2 and 5 yielded invalid estimates (e.g., standardized regression coefficients greater than one) and theoretically unreasonable regression coefficients, thus these models were rejected. Model 3 had little theoretical underpinning and when depressive symptoms are placed before irrational beliefs (Model 3) or before negative and positive emotions (Model 4), irrational beliefs are no longer related to affective states, which suggest that irrational beliefs might be primarily linked to negative and positive affect through depressive symptoms. The mediating role of depressive symptoms is also supported by theory, allowing us to discard Model 1. Overall, based on these available theoretical and statistical information, Model 4 (Mindset → SD, LFT → Depression → PA, NA) was retained as the final path model.

Retained Model and Mediational Analysis

The final retained model is graphically depicted on Figure 2, and shows that fixed intelligence mindset positively predicted both self-downing (β = .616, p < .001) and low frustration tolerance (β = .314, p < .001). Self-downing positively predicted depressive symptoms (β = .592, p < .001) but it showed no statistically significant associations with negative or positive emotions (p > .165). Contrary to our expectations, low frustration tolerance did not predict depressive symptoms, negative or positive emotions (p > .507). In fact, negative (β = .617, p < .001) and positive (β = -.569, p < .001) affect were only predicted by depressive symptoms.

Serial mediation analysis yielded a significant indirect path between fixed intelligence mindset and positive (indirect β = -.208, 95% CI = -.553 to -.007) and negative emotions (indirect β = .225, CI = .004 to .549), both paths involving self-downing and depressive symptoms in each chain. Finally, the proportion of explained variance was 38% for self-downing, 9.9% for low frustration tolerance, 29.1% for depression, 75.2% for negative and only 31.6% for positive emotions.

Discussion

Dweck (1995) argues that fixed intelligence mindset is triggered by achievement situations that bear the threat of failure, and when activated, it promotes the emergence of maladaptive emotional and behavioral responses. There is ample evidence in the literature documenting the association between students' fixed intelligence mindset and their poorer mental-health outcomes (Lee et al., 2018; Robins & Pals, 2002; Schleider et al., 2015). Still, our understanding regarding the direct or indirect nature of this relationship is limited. However, REBT theory could offer new insights into the mechanisms through which fixed intelligence mindset influences students' mental health. REBT stresses the importance of irrational beliefs in mental health, and it suggests that adverse events do not lead to emotional disturbance unless they are interpreted irrationally. In other words, irrational beliefs are the proximal antecedents of dysfunctional or maladaptive emotions and behaviors. Therefore, the present study aimed to investigate irrational beliefs related to exam performance (i.e., demandingness, self-

downing, low frustration tolerance, awfulizing) as potential mediators between fixed intelligence mindset and different mental-health-related outcomes (i.e., depressive symptoms, positive and negative emotions).

In line with previous findings (David et al., 2010), our results indicate that higher levels of exam-related irrational beliefs were associated with higher levels of depressive symptoms and negative emotions, and lower levels of positive emotions. In turn, fixed intelligence mindset showed weak to moderate associations with depressive symptoms and negative emotions, while its relationship with positive emotions was only weak. Given the emotional and behavioral reactions (e.g., helplessness, anger, anxiety, self-handicapping, procrastination) displayed in the face of failure by individuals with fixed intelligence mindset, it was presumed that there is a relationship between fixed intelligence mindset and the four types of irrational beliefs. Contrary to our hypothesis, it seems that fixed intelligence mindset is associated distinctively with exam-related irrational beliefs. While it was not associated with demandingness and awfulizing, it is was positively related to low frustration tolerance and self-downing. Result also suggested that GPA was unrelated to students' intelligence mindset. A recent meta-analysis (Costa & Faria, 2018) evidenced that although there is a significant low association between intelligence mindset and achievement, the magnitude of this association is not consistent across different study levels, subjects, or across cultures. Intelligence mindset showed the strongest association with achievement during middle school and was more closely related to specific subjects (e.g., verbal or quantitative subjects) rather than general achievement level. Moreover, the type of intelligence mindset also showed differential associations with achievement, while in Asian countries fixed intelligence mindset was unrelated to achievement, in European countries it was positively associated with it. Thus, the lack of findings regarding mindset's association with GPA, might be the result of factors relating to assessment (i.e., general and not subject related mindset and achievement were measured) or to participants' characteristics like study level (i.e., college student sample) or their cultural background.

Correlations also indicated that those with higher GPA tended to experience higher levels of positive emotions, although, this association was only weak. In relation to the lack of association between GPA and negative mental health outcomes we might speculate that during the exam period actual performance on exams override the effect of general achievement level and actual achievement is more strongly linked to negative mental health outcomes experienced during this period. Correspondingly, a diary study conducted during a three-week assessment period found no association between affective states, the changeability of emotions and GPA (Peterson et al., 2015), while others suggested that the effect of prior achievement depends on attribution and on the value of achievement (Schutz & Davies, 2000).

Alternative model testing indicated that a serial mediational model fitted the data best, where self-downing and depressive symptoms mediated the effect of fixed intelligence mindset on positive and negative affect. Low frustration tolerance was unrelated to all the mental health outcomes. These results suggest that students who believed in the unchangeable nature of their intelligence tended to engage in self-downing in the salience of failure (e.g., "If I fail this exam, I would be a worthless person."), which led to higher levels of depressive symptoms experienced during the exam period, which, in turn, contributed to higher levels of negative and lower levels of positive emotions. Results indicated that depressive symptoms were predictors of positive and negative affective states and they also mediated the effect of fixed mindset and self-downing on affect. These findings could be explained by the fact that depression is a broader construct encompassing the presence of depressive mood and diminished interest and pleasure, symptoms which are consistent with increased negative and decreased positive affect (APA, 2013). These results also confirmed REBT and mindset theories' assumptions that irrational beliefs are proximal antecedents of functional and dysfunctional emotions and that intelligence mindset influence the interpretation (i.e., exam performance is interpreted as an indicator of one's worth) and reactions (i.e., symptoms of depression, positive and negative emotions) to performance situations.

The role of self-downing in the mental health of students with fixed intelligence mindset is not totally unexpected since the presence of negative global self-evaluation (i.e., which in REBT terms translates into self-downing) in their maladaptive failure-reactions is frequently discussed. Believing that one cannot improve one's intelligence and that academic performance is highly contingent on it implies that effort confers no additional benefits to performance. Thus, academic achievement becomes the direct reflection of one's intelligence, and failure can be interpreted as the manifestation of one's

low level of intelligence or irreversible lack of ability. Hence, failure, instead of simply being an indicator of performance, becomes a measure of self-worth (e.g.," I failed because I am stupid"). Dweck's theory (2013) posits that individuals with fixed mindset are preoccupied with proving their abilities and their self-esteem, thus, becomes highly contingent on external validation (e.g., "I am a good student if I perform well."). When they fail to demonstrate their abilities, they tend to make internal attributions (e.g., "I got a poor grade because I am dumb.") (Hong et al., 1999). Given this interpretational framework, it is apparent how holding a fixed intelligence mindset might predispose individuals to engage in self-downing and evaluate themselves globally when facing academic adversities.

The lack of findings regarding fixed mindset's association with low frustration tolerance, awfulizing and demandingness and their mediating role might be explained by one of the premises of Dweck's theory which holds that fixed intelligence mindset exerts its greatest influence when a threat to one's self-worth is imminent (2013). Fixed intelligence mindset turns every achievement situation into evaluation when a judgment about one's intelligence is made. If success is easily attainable, one's self-worth is preserved, since high achievement is proof of high intelligence or competence. In contrast, failure could reveal one's inadequacies or lack of ability presenting a threat to one's self or worth. Thus, it is reasonable to assume that, when reflecting on one's exam performance, those with fixed intelligence mindset would be more likely to evaluate their performance in terms of its repercussions or consequences regarding their selves.

Besides theoretical considerations, the close association between fixed intelligence mindset and self-evaluative processes, more specifically self-downing, is further corroborated by studies demonstrating that students with fixed intelligence mindset after an intellectual failure tended to question their global self-worth (Zhao & Dweck, 1997) and started to doubt their abilities (Licht & Dweck, 1984). Similarly, Reich and Arkin (2006) also assert that self-doubt is closely linked to the belief that other people consider personal successes and failures as indicators of one's abilities, while Knauss (2006) points out that self-doubt is precipitated by self-downing. Previous studies have consistently reported that fixed intelligence mindset is related to lower levels of self-esteem (Lee et al., 2017) and greater self-esteem decline over time (Robins & Pals, 2002). These results confer additional indirect evidence supporting the association between fixed intelligence mindset and self-downing since low self-esteem could be conceptualized as a negative global evaluation about the self (Fennel, 1998), which in REBT literature is known as self-downing (Ellis et al., 2010).

Even though the present study offers valuable insights regarding the relationship between fixed intelligence mindset and students' mental health, it is not without its limitations. First of all, exam-related irrational beliefs and emotions were not assessed right before taking an exam, which might challenge the accuracy of their measurement; thus, future studies should measure exam-related irrational beliefs in the presence of their activating event. Since our results rely on cross-sectional data from which causality cannot be inferred, future studies should manipulate mindsets or irrational beliefs in order to test whether endorsing growth intelligence mindset would reduce students' self-downing tendencies or fostering unconditional self-acceptance (the rational counterpart of self-downing) would benefit students' mental health.

Results of a recent meta-analysis called into question the universal effectiveness of mindset interventions in improving academic achievement, suggesting that only high-risk and academically disadvantaged students might benefit from them (Sisk et al., 2018). The present results might broaden our perspective regarding the content of mindset interventions since it is possible that besides focusing on changing the beliefs about the malleability of intelligence, incorporating elements related to unconditional self-acceptance or self-compassion might improve the effectiveness of growth mindset interventions. Moreover, these self-worth related elements might enhance not only students' mental health, but it might decrease the self-handicapping, and procrastinating behavior of individuals with fixed intelligence since the function of these behaviors is the protection of the self or its worth (Covington, 1992). Furthermore, holding rational beliefs and cultivating unconditional self-acceptance were proved to be associated with higher achievement (Balkis et al., 2013). If global self-worth is not based on performance, and one could accept oneself with one's shortcomings, it is possible that one would be less inclined to engage in escape and avoidance behaviors. Thus, it is reasonable to assume that merging unconditional self-acceptance elements into growth mindset interventions, would confer more diversified benefits for students; however, future studies should test these assumptions.

One of Dweck's theory's premises holds that the self-worth of individuals with fixed intelligence mindset is contingent on performance and external validation (2013). Although the present results might provide indirect support for this assumption through evidencing the crucial role of global self-evaluation, future studies should investigate explicitly the role of contingent self-worth in the emotional and behavioral reactions of students with fixed intelligence mindset when confronting difficulties and failures.

In conclusion, the results of the present research broadened our understanding regarding the mechanisms through which fixed intelligence mindset influences students' mental health-related outcomes and evidenced the crucial role of negative global self-evaluation or self-downing. Furthermore, these results suggest new ways of improving the current mindset interventions by putting more emphasis on students' self-evaluative processes.

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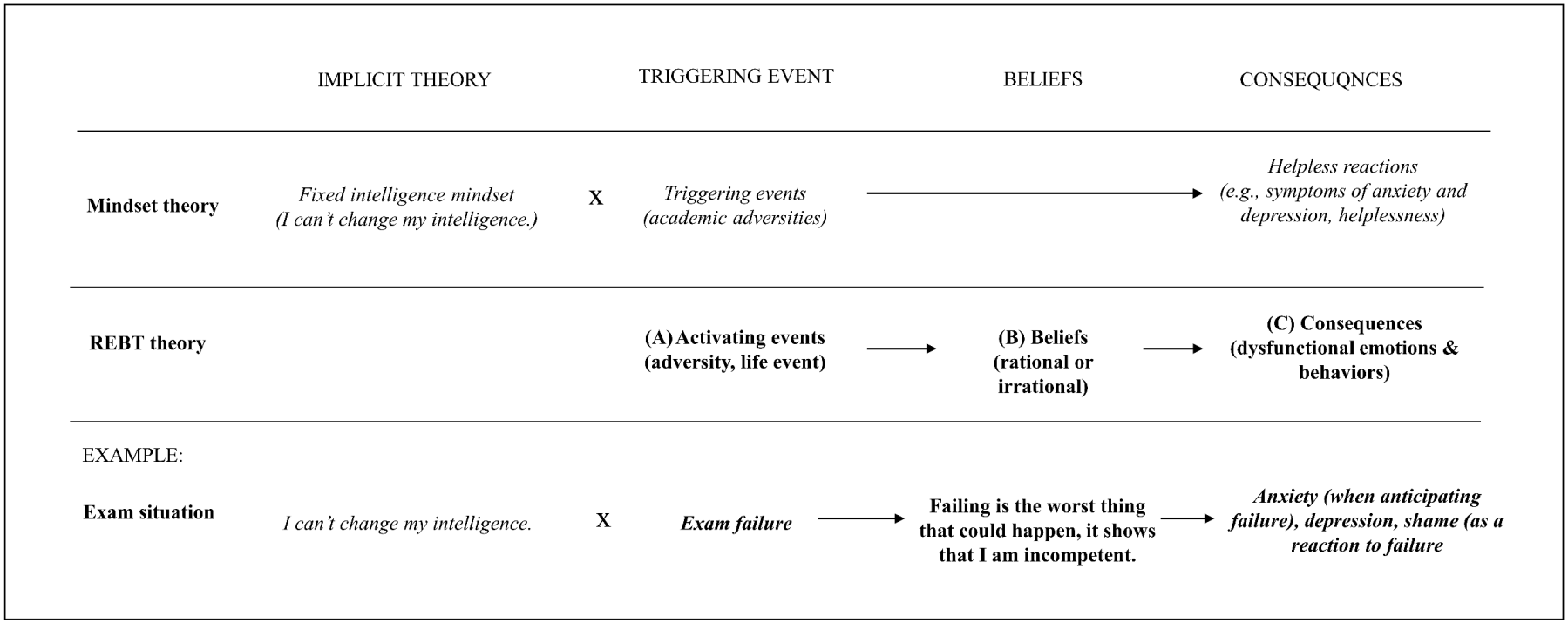

Figure 1

Maladaptive emotional reactions to adverse situations from the perspective of mindset and REBT theories and their superposed model explaining emotional reactions to exam failure

Note. Mindset theory emphasizes that intelligence beliefs are activated by triggering events (the x in the figure represents this interaction), thus leading to maladaptive reactions. REBT theory posits that triggering events lead to maladaptive reactions only when they are interpreted in an irrational manner. The last row of the figure presents, through an example, the two theories superposed, when the constructs of the two theories are combined. For greater understanding, the two theories are presented with different font styles (i.e., italics and bold), when a construct are present in both theories the font styles are merged.

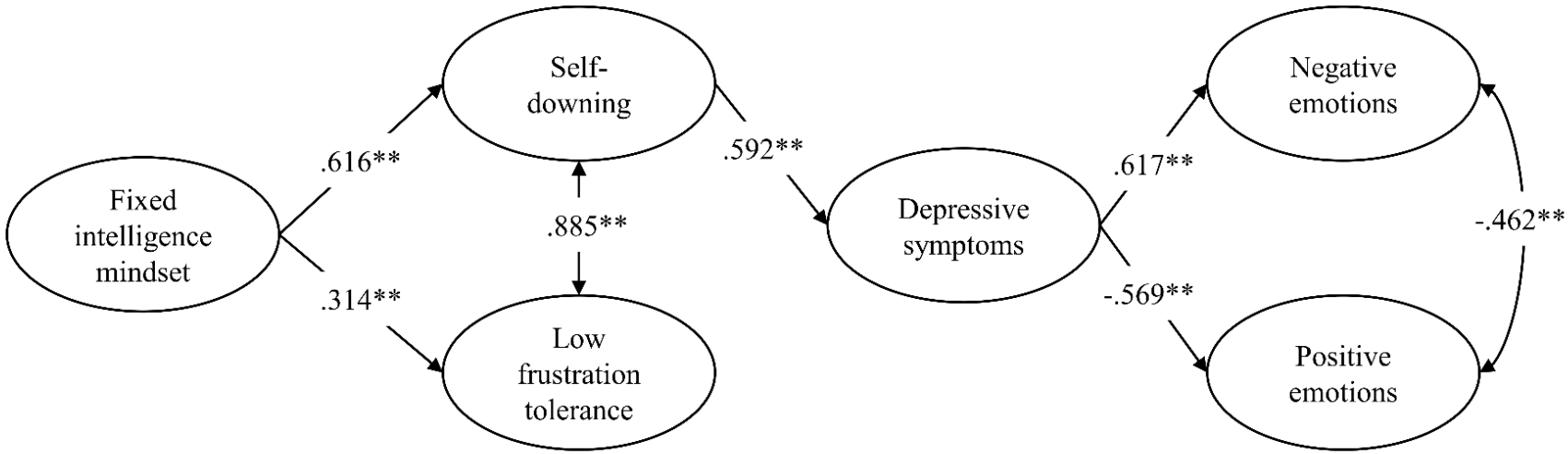

Figure 2
The associations between the study variables

Note. **$p < .001$; All variables presented in ellipses are latent variables. For the sake of simplicity, observed variables are not depicted in this figure. One-headed arrows represent standardized regression weights, while two headed arrows represent correlations. Only statistically significant paths are shown.

Table 1

Goodness-of-fit indices for the estimated models

Model	χ^2 (df)	CFI	TLI	RMSEA [90% CI]
Model 0a: Preliminary measurement model	877.342* (525)	.959	.953	.047 [.041, .052]
Model 0b: Revised preliminary measurement model	595.412* (335)	.962	.957	.050 [.044, .057]
Model 1: Mindset → SD/LFT → Depression, PA, NA	595.413* (335)	.962	.957	.050 [.044, .057]
Model 2: SD/LFT → Depression/PA/NA → Mindset	595.412* (335)	.962	.957	.050 [.044, .057]
Model 3: Mindset → Depression → SD/LFT → PA/NA	595.413* (335)	.962	.957	.050 [.044, .057]
Model 4: Mindset → SD/LFT → Depression → PA/NA	595.413* (335)	.962	.957	.050 [.044, .057]
Model 5: Depression → SD/LFT → PA/NA → Mindset	595.412* (335)	.962	.957	.050 [.044, .057]

Note. *$p < .05$; χ^2: robust chi-square test of exact fit; df: degrees of freedom; CFI: comparative fit index; TLI: Tucker–Lewis index; RMSEA: root mean square error of approximation; 90% CI: 90% confidence interval of the RMSEA; SD: self-downing; LFT: low frustration tolerance; PA: positive affect; NA: negative affect.

Table 2

Parameter estimates from the latent mean measurement model

	FM (λ)	SD (λ)	LFT (λ)	DS (λ)	NE (λ)	PE (λ)	δ
Fixed mindset							
Item 1	.830**						.310
Item 2	.859**						.262
Item 3	.846**						.284
Item 4	.526**						.724
Self-downing							
Item 1		.782**					.389
Item 2		.906**					.178
Item 3		.865**					.252
Low frustration tolerance							
Item 1			.921**				.152
Item 2			.794**				.370
Item 3			.796**				.366
Depressive symptoms							
Item 1				.803**			.355
Item 2				.832**			.307
Item 3				.466**			.783
Item 4				.639**			.592
Item 5				.577**			.667
Item 6				.722**			.479
Item 7				.863**			.254
Item 8				.787**			.380
Item 9				.849**			.280
Negative emotions							
Item 1					.705**		.504
Item 2					.650**		.578
Item 3					.574**		.671
Item 4					.699**		.512
Item 5					.641**		.589
Positive emotions							
Item 1						.763**	.418
Item 2						.614**	.623
Item 3						.596**	.645
Item 4						.615**	.621
ω	.856	.888	.877	.913	.789	.744	

Note. **$p < .01$; λ: Factor loading; δ: Item uniqueness; ω: model-based omega composite reliability based on McDonald (1970).

Table 3

Latent correlations among the variables

	1	2	3	4	5
1. Intelligence mindset	—				
2. Self-downing	.616**	—			
3. Low frustration tolerance	.314**	.856**	—		
4. Depressive symptoms	.362**	.537**	.434**	—	
5. Negative emotions	.481**	.689**	.553**	.812**	—
6. Positive emotions	-.161**	-.275**	-.193**	-.554**	-.632**

Note. **$p < .01$.

Online suppmentary materials for:

Self-downing mediates the association between fixed intelligence mindset and different indicators of students' mental health in exam periods

Table S1

Latent correlations among the variables

	1	2	3	4	5	6	7	8
1. Intelligence mindset	—							
2. Demandingness	-.007	—						
3. Self-downing	.616**	.445**	—					
4. Low frustration tolerance	.315**	.777**	.862**	—				
5. Awfulizing	.031	.877**	.617**	.923**	—			
6. Depressive symptoms	.362**	.170**	.537**	.434**	.399**	—		
7. Negative emotions	.481**	.302**	.689**	.554**	.483**	.811	—	
8. Positive emotions	-.161**	-.058	-.276**	-.193**	-.217**	-.553**	-.632**	—
9. GPA	-.073	.116	-.102	.000	.020	-.157*	-.090	.209**

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