Students' Response to Academic Setback: "Growth Mindset" as a Buffer Against Demotivation

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## Abstract

It is important to understand why some students are able to bounce back following setbacks, while others become de-motivated and suffer negative consequences. This study tests a model which places students' beliefs about ability (Dweck & Leggett, 1988) as a key factor which may influence students' motivational response to setbacks and achievement. A survey was conducted among second semester university students in Indonesia (N=123, mean age 18.67 years, 81% female) enrolled in a challenging statistics course. Beliefs about intelligence, about academic ability, and goal orientation were measured at the beginning of the semester, while effort attribution and de-motivation were measured one week after the mid-term examination grades were announced. Mid-term and final examination grades were obtained from the course instructor, while first semester GPA (as an index of prior ability) was obtained from the university register. Path analysis indicated that growth mindset about academic ability (but not about intelligence) prompted the adoption of mastery goals and effort attribution, which buffered against demotivation in the face of academic setback, which in turn led to better academic achievement. This motivational pattern became more pronounced among students who experienced setback in their mid-term exam

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# Respuesta del Alumnado a las Dificultades Académicas: La "Mentalidad de Crecimiento" como Mediador contra la Desmotivación

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**Resumen**

Es importante comprender porqué algunos estudiantes son capaces de recuperarse después de dificultades, mientras que otros se desmotivan y sufren consecuencias negativas. Este estudio analiza un modelo que entiende las creencias del alumnado sobre su habilidad (Dweck & Leggett, 1988) como un factor clave que puede influir tanto la respuesta motivacional del alumnado a los obstáculos como el rendimiento. Se llevó a cabo una encuesta entre estudiantes universitarios de segundo semestre en Indonesia (N=123, 18.67 años de edad media, 81% mujeres) matriculados en una asignatura difícil de estadística. Las creencias sobre la inteligencia, la habilidad académica y la orientación de logro se midieron al inicio del semestre, mientras que la atribución del esfuerzo y la desmotivación se midieron una semana después de que las notas del examen a mitad del semestre se publicasen. Las notas de los exámenes de mitad y final de semestre se obtuvieron vía el docente del curso, mientras que la nota media del primer semestre (como índice de habilidad previa) se obtuvo del registro de la universidad. El análisis de trayectoria indicó que la 'mentalidad de crecimiento' acerca de la habilidad académica (pero no acerca de la inteligencia) provocaba adoptar objetivos de éxito y atribución de esfuerzo, lo que amortiguaba la desmotivación cuando había que enfrentarse a dificultades académicas y esto, en consecuencia, conducía a un mejor rendimiento académico. Este patrón motivacional apareció más pronunciado entre los estudiantes que experimentaron dificultades en el examen de mitad de trimestre.

**Palabras clave:** dificultades académicos, teoría implícita sobre la habilidad, motivación, rendimiento académico, orientación de logro.

F ailure and setbacks are part and parcel of academic life, and also life more generally. While not every student will experience dramatic failures such as getting kicked out of school/university in their academic career, most are likely to experience lesser forms of setbacks such as obtaining a low grade in an exam and failing to pass individual courses. Students can respond to such setbacks in more or less productive ways: some may feel de-motivated and avoid similar challenges, while others could feel challenged, evaluate the causes of their setback, and plan strategies to address those problems. Understanding the psychological factors that lead to such differing interpretations of and responses to setback is important. The present article aims at testing a model that describes the motivational dynamics that may stem from beliefs about intelligence and ability, which is a class of potentially important individual difference factor. The model is based on a theoretical framework (outlined in the next section) proposed by Dweck and her colleagues (1995). The article extends prior work in several ways: by comparing directly students who have just experienced a setback to those who did not; by applying the theoretical framework in a non-Western sample (Sternberg & Grigorenko, 2004); and by measuring beliefs about ability (Dweck, 1986) at two levels of generality (general intelligence and academic ability).

## Fixed vs. Growth Mindsets

Implicit theory of intelligence refers to one's beliefs about whether intelligence is malleable, or whether it is largely determined at birth and difficult to change (Dweck, et al., 1995). Dweck (2006) has more recently used the terms "growth" and "fixed mindsets" to refer to these beliefs. Having a growth mindset doesn't mean believing that all individuals are equally intelligent, or equally able to learn new skills/knowledge. Rather, it means believing that for any particular individual, his/her intelligence could be further developed (Blackwell, Trzesniewski, & Dweck, 2007). Although often described as two different beliefs, the fixed and growth mindsets could be seen as opposite ends of a continuum. A person could hold relatively weaker or stronger beliefs that intelligence can be developed.

Mindsets about ability themselves are malleable. Children's mindsets are likely to be shaped by feedback from caregivers. Praising a child and attributing his/her success to intelligence, as opposed to effort or process, encourages the development of a fixed mindset (Pomerantz & Kempner, 2013) and can undermine persistence and enjoyment of an activity (Mueller & Dweck, 1998). Consolations from teachers endorsing a fixed mindset (e.g. "It's alright, not everyone is good at math"), while comforting, leads to lower student motivation and expectancy (Rattan, Good, & Dweck, 2012). On the other hand, ability mindsets could be changed through training, such that a person with a fixed mindset could develop a belief that intelligence is malleable (Burke & Williams, 2012; Donohoe, Topping, & Hannah, 2012).

Dweck's socio-cognitive theory postulates that mindsets about intelligence is an important personality variable that underlie motivational dynamics in achievement situations, such as when students engage in academic tasks (Dweck, 1986, 2006; Dweck, et al., 1995; Dweck, Mangels, & Good, 2006). One possible mechanism by which mindsets about intelligence influence motivation is through achievement goals (Dweck & Leggett, 1988). When intelligence is seen as fixed, success in a task tends to be seen as validating the adequacy of one's ability (and vice versa, failure is seen as validating the inadequacy of ability). Thus, a fixed mindset is associated with what Dweck and Leggett (1988) called a performance orientation, i.e. wanting to validate, prove, or demonstrate ability. In contrast, when intelligence is seen as malleable, success and failure in a task are not taken as validations of ability. Rather, engagement in a task tends to be experienced as opportunities to improve one's competence. This is what Dweck and Leggett (1988) called a learning orientation.

Achievement goals have been found to influence motivation and task engagement (Ames, 1992; Daniels, et al., 2009; Dweck, 1986; Grant & Dweck, 2003). Observations of children in laboratory settings show when they perceive their present ability to be low, adopting a performance goal leads to negative affect, low persistence, and avoidance of challenge (Ames, 1992; Dweck, 1986; Dweck & Leggett, 1988). More recently some researchers have suggested a distinction between *normative* goals, i.e.competing or comparisons with peers, and *ability* goals, which is closer to the original meaning of performance goal (Grant & Dweck, 2003; Hulleman,

et al., 2010). Grant and Dweck (2003) found that ability goals, but not normative goals, predicted loss of intrinsic motivation and withdrawal of effort when confronted with setbacks.

Mindsets about intelligence may also influence motivation through attributions, in addition to achievement goals. Attributions are the explanations we generate about why events happen. Attribution theory (Weiner, 1985, 2010) postulates a number of important causal dimensions, including locus and stability. Thus, individuals could attribute success and failure to factors within (intelligence, effort) vs. outside of one's self (social structures, pure luck); and stable (intelligence) vs. changeable factors (effort). Mindsets about intelligence may provide a framework or meaning system with which individuals make causal attributions of events. A growth mindset may predispose an individual to explain successes and failures events in terms of effort (Hong, et al., 1999). Furthermore, individuals with growth and fixed mindset may both attribute failure (or success) to intelligence. However, from a fixed mindset perspective, intelligence is a stable and uncontrollable factor, whereas from a growth mindset perspective, it is seen as less stable and more controllable.

In turn, attributions about successes and failures can influence how individuals feel and respond to those events (Weiner, 1985, 2010). Attributing the cause of failure or negative performance to stable, uncontrollable factors will tend to prompt negative emotions, de-motivation, and maladaptive behaviours such as withdrawal. Thus, if a fixed mindset predisposes an individual to explain failure more in terms of intelligence than effort, then having such a mindset will make them vulnerable to negative emotions and maladaptive responses (King, MCInerney, & Watkins, 2012; Robins & Pals, 2002). Moreover, because intelligence is believed to be stable and uncontrollable, then expending more effort can be seen as futile (Hong, et al., 1999).

## Mindsets and Academic Achievement

Based on the previous description about mindsets and motivation, believing intelligence as malleable should lead to better academic achievement. Having a growth mindset would predispose students to orient towards

acquiring new knowledge/skills and less concerned about proving their intelligence (or avoiding the threat of appearing unintelligent) (Dweck, 1986; Dweck & Leggett, 1988). In the face of setbacks and failure, having a growth mindset would also predispose students to make effort attributions, which could protect them from negative emotions and de-motivation (Hong, et al., 1999). These contentions are also supported by neurological evidence which suggest that attention is biased by one's mindset about ability. Mangels et al. (2006) collected event-related potentials data on subjects who were engaged in a task and were given both evaluative feedback (whether one have provided a right or wrong answer to a question) and learning-relevant feedback (the correct answer to a question). They found that subjects with fixed mindsets attend more to evaluative feedback, whereas those with growth mindsets give more attention to semantic processing of learning-relevant feedback.

While the motivational patterns associated with a growth mindset are adaptive and should lead to better outcomes, academic achievement is a multiply-determined variable. A recent systematic review indicates that college grade point average (GPA) was predicted by more than 30 demographic and psychological variables (Richardson, Abraham, & Bond, 2012). Among these variables, most were only weakly correlated with college GPA. Psychological factors with moderate correlations with college GPA include cognitive (high school achievement and academic aptitude) and motivational variables (self efficacy and effort regulation). College GPA was only weakly correlated with learning and performance goals, while attribution did not predict college GPA (Richardson, et al., 2012, p. 366). Thus, it is important to investigate the mechanisms by which mindsets about intelligence influence achievement in real academic settings.

A number of articles report data that is relevant to this question. Romero (2014) found that growth mindset predicted middle-school GPA (r= .33). Similarly, Stipek and Heidi's (1996) study on third to sixth grade students found that mindset about intelligence was correlated with performance in math and social studies (r between .10 and .25). These authors also noted that contrary to theoretical predictions, goals and strategies did not mediate the relationships between mindset and performance. Consistent with this, Faria (1996) conducted a study with Portuguese high school students and

reported that mindset about intelligence was weakly correlated with grades, but this relationship was not mediated by effort attribution (which she termed "controllability").

In contrast, Shively and Ryan's (2013) study of college students found that mindset about intelligence (in general and for math ability) did not predict achievement in an algebra class. Dupeyrat and Marine (2005) also found no direct relationship between mindsets about intelligence and achievement (college GPA) in a sample of adult students in France. They did, however, observe an indirect relationship, where learning goal and effort acted as mediators between fixed mindset and achievement. This is consistent with findings reported by Blackwell et al. (2007), which show that growth mindset was linked with increases in math performance during the first two years of junior high school, and that the relationship was mediated by learning goals, effort attribution, and positive strategies. In summary, there is mixed evidence regarding whether mindsets about intelligence directly predicts achievement, and also regarding the mediating roles of motivational factors that are postulated by Dweck's theory. In studies which found that mindsets predicted achievement, the effect sizes were mostly small.

## Overview and Research Questions

According to the motivational theory proposed by Dweck and her colleagues (Dweck, 2006; Dweck, et al., 1995), a growth mindset about intelligence should be associated with better academic achievement. This is because a growth mindset predisposes students to strive for improving one's ability (as opposed to proving or demonstrating it), and to attribute successes and failures more to effort rather than ability. The theory further suggests that the motivational dynamics linking mindset and achievement should be more pronounced when students are unsure about their chances of succeeding in task. In other words, mindsets about intelligence should be more important when a student is in a situation perceived to be challenging. Thus, in could be inferred that mindsets about intelligence would play an important role when students are faced with setbacks.

The present study extends prior research in a number of ways. First, few prior studies have examined the role of mindsets in the motivation and achievement among students who have experienced a setback in actual academic setting. Early studies have examined this issue in laboratory settings, in which researchers manipulate the level of task difficulty (Dweck, 1986). It is important to examine whether this is true for academic achievement, which is determined by numerous factors other than psychological ones. Prior studies linking mindset about intelligence and academic achievement have typically found small effect sizes. This may be because prior studies have not specifically looked at students who experienced setbacks, in comparisons to students did not experience the setback. Second, the present study examines the mediating role of goals, attribution, and demotivation (diminished effort and interest). Only few studies have tested these mediating variables in model, and the available studies suggest a mixed evidence regarding the role of goals, in particular (Dupeyrat & Marine, 2005; Huang, 2012). Again, this may be due to the fact that prior studies did not differentiate between students who are more or less challenged by the situation (e.g. experiencing setback or not).

Finally, the present study extends prior research by testing predictions based on Dweck' theory in a non-Western sample. This is important because the notion of intelligence may contain culture-specific dimensions. In the Confucian and Taoist tradition, for instance, intelligence is associated with both knowledge and wisdom (Yang & Sternberg, 1997a). The intelligent person is one who is capable of making wise moral judgments. A survey of Taiwanese also indicate that intelligence is associated with not only cognitive ability, but also inter-personal and intra-personal skills, as well as self-effacement (Yang & Sternberg, 1997b). A study in the Indonesian context also found that intelligence is characterized by cognitive ability as well as personality attributes (e.g. hardworking, diligent, wise), practical skills, as well as achievements (Patricia, 2014). In short, the non-Western term "intelligence" encompasses a broader set of attributes than the Western notion. This does not mean that non-Western people do not have mindsets about intelligence. Rather, this construct may need to be measured at a more specific level, e.g. academic ability, rather than "intelligence" in general. A preliminary study in the Indonesian context found that beliefs about general

intelligence is only weakly correlated with beliefs about academic ability in various domains (Patricia & Aditomo, 2014).
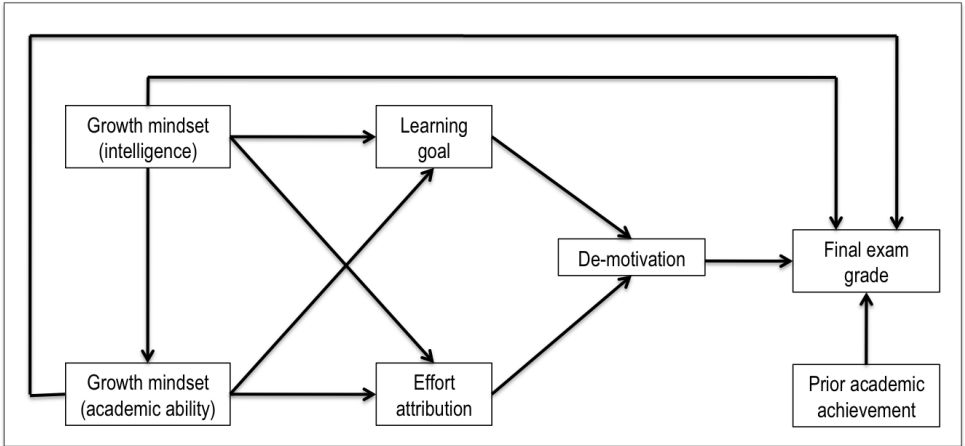


*Figure 1*. Conceptual model of the relationships between mindset, motivational factors, and academic achievement.

Based on the previous discussion, this study tested the model presented in Figure 1. Growth mindsets should be positively related to learning goal and effort attribution, both of which in turn should be negatively related to de-motivation. The more de-motivated students become, the lower their subsequent course grade should be. In addition, growth mindsets is postulated to predict higher course grade directly. The following research questions are posed: (a) Do (growth) mindsets about intelligence and academic ability positively predict the adoption a learning goal, effort attribution, and subsequent course performance, while negatively predict de-motivation, after controlling for prior academic ability? (b) Do learning goal, effort attribution, and de-motivation mediate the relationships between mindsets about intelligence/ability with subsequent course performance? (c) Do the relationships between mindsets, motivational factors, and subsequent course performance become more pronounced for students who experienced setback?

## Method

### Procedure and participants

To address the research questions, two surveys were conducted with second semester university students enrolled in an introductory behavioural statistics course. The university is a mid-sized private teaching institution in a large metropolitan city in Indonesia, primarily catering for undergraduate education. The statistics course was chosen because data from previous semesters show it had a relatively high proportion of students who fail. Thus, it allowed for the identification of a sufficiently large number of students who experienced "setbacks". In this context, academic setback was operationalized in this study as failing to score more than 66 in the mid-term exam, which was the minimum score for a satisfactory final grade ("B") set by the university. Because the mid-term exam contributed 40% to the course grade, obtaining a score of 66 or lower would jeopardize one's chance of passing with a satisfactory grade. Thus, this cut off represented a meaningful threshold for the students.

The surveys were conducted in class after lecture sessions. Students were informed that their participation was voluntary, and that their identity would be kept confidential; volunteers were provided with a small bag of snacks. The first survey was conducted at the beginning of the semester and included measures of ability mindsets and learning goals. The second approximately one week after the mid-term examination grades were announced and included measures of effort attribution and de-motivation. Mid-term and final examination grades were obtained from the course instructor, while first semester GPA (as index of prior academic ability) was obtained from the university register. Of the 169 enrolled students, 123 participated in both surveys. The participants were mostly female (81%), in their late adolescence (mean age: 18.67 years; SD: .74), and came from a variety of ethnic groups (roughly 80% from Chinese-Indonesian and Javanese backgrounds, with the remaining coming from seven minority ethnic groups).

**Instruments**

**Mindset about intelligence.** This scale was based on items from Dweck's work (Dweck, 2006; Dweck, et al., 1995). Three items measured the belief that intelligence is malleable (e.g. "You can substantially change how intelligent you are") and another three measured the belief that intelligence is fixed (e.g. "Your intelligence is something about you that you can't change very much"). The fixed mindset items were reversed to create a composite growth mindset score. Internal consistency for the six items was found to be adequate (Alpha: .73).

  **Mindset about academic ability**. Two scales assessing beliefs about whether academic ability in general (5 items) and in mathematics (5 items) were created for this study. Each scale referred to a vignette describing an individual who had low academic ability (e.g. "In elementary and junior high schools, Doni was believed to lack in academic ability. His class grades and standardized examination results were always poor."). The items then asked respondents to rate how likely it is that the individual, through effortful study, can develop his/her ability to achieve or excel in his/her subsequent academic career (e.g. "... to become a valedictorian in high school?"). An exploratory factor analysis indicated that the ten items formed one dimension (accounting for 68.13% of the variance, with factor loadings ranged from .78 to .88). Thus, the ten items were averaged to yield a single score reflecting mindset about academic ability (Alpha: .95).

  **Learning goal.** This scale was adapted from items measuring mastery goal orientation in the Patterns of Adaptive Learning Scales (Midgley, et al., 2000). The items were slightly reworded to refer to the specific course context (e.g. "One of my main goals in this course is to learn as much as I can"). Midgley et al. (2000) reported good internal consistency for the scale (Alpha: .85). Internal consistency for the sample in this study was also satisfactory (Alpha: .88).

  **Effort attribution.** Two items were used to measure whether students feel they improve their achievement and understanding through effort ("I will obtain better grades if I study more for this course" and "I will understand the materials for this course better if I try harder"). Internal reliability was adequate (Alpha: .78).

**Demotivation.** Four items were used to assess whether students felt less motivated to learn and study in the statistics course, compared to the beginning of the semester (e.g. "Compared to the beginning of the semester, I now allocate less time and energy for this course" and "Compared to the beginning of the semester, my motivation to learn in this course has diminished"). Internal reliability for the scale was good (Alpha: .89).

**Analyses**

Correlation and partial correlation (controlling for prior academic ability) were used to examine the relationship between growth mindset and subsequent academic achievement. Path analysis using multiple regressions was used to estimate the mediating roles of the motivational variables. Path analysis procedures outlined by Keith (2006) were followed.

**Results**

Table 1 presents the descriptive statistics for the variables examined in this study, for the total sample as well as for students who obtained lower and higher mid-term exam scores. As would be expected, students who obtained lower mid-term scores also had lower prior academic ability (first semester GPA) and subsequently obtained lower scores in the final examination. The two subsamples, however, did not seem to differ in terms of any of the other variables.

**Correlations between mindsets, motivation, and course performance**

To answer the first research question, zero order and partial correlations between the variables were computed. The correlation pattern was mostly consistent with theory (see Table 2). Mindset about intelligence and mindset about academic ability were positively correlated. Growth mindset about academic ability positively predicted both learning goal and effort attribution, negatively predicted de-motivation, but did not predict subsequent course performance. Contrary to theory, however, growth

mindset about intelligence did not correlate with any of the motivational mediators. Furthermore, it negatively predicted mid-term examination score.

Table 1
*Mean and standard deviations for the main variables*

| Variable | Lower mid-term score (n = 41) | | Higher mid-term score (n = 82) | | Total sample (N = 123) | |
|---|---|---|---|---|---|---|
| Prior academic ability (GPA, 0-4) | 2.45 | (.60) | 3.25 | (.58) | 2.99 | (.70) |
| Mindset about intelligence | 4.17 | (.67) | 3.92 | (.80) | 4.00 | (.77) |
| Mindset about academic ability | 4.48 | (.87) | 4.47 | (.72) | 4.47 | (.77) |
| Learning goal | 5.02 | (.70) | 4.87 | (.74) | 4.92 | (.73) |
| Effort attribution | 5.11 | (.77) | 5.32 | (.62) | 5.25 | (.68) |
| De-motivation | 3.05 | (1.01) | 3.16 | (1.12) | 3.13 | (1.08) |
| Mid-term exam score (0-100) | 56.24 | (6.47) | 80.60 | (9.79) | 72.48 | (14.50) |
| Final exam score (0-100) | 60.88 | (8.74) | 79.48 | (10.54) | 73.28 | (13.28) |

*Note*. All variables measured in a scale of 1 to 6 except mentioned otherwise.

Table 2

*Zero-order (figures in the upper half of the matrix) and partial correlations controlling for prior GPA (figures in bold in the lower half of the matrix) between the main variables*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Mindset (intelligence) | | .357** | -.078 | .139 | -.072 | -.194* | -.125 |
| Mindset (academic ability) | **.359**** | | .203* | .473** | -.198* | -.001 | .038 |
| Learning goal | **-.077** | **.203*** | | .283** | -.290** | .027 | .056 |
| Effort attribution | **.146** | **.474**** | **.283**** | | -.293** | .172* | .128 |
| De-motivation | **-.066** | **-.199*** | **-.291**** | **-.299**** | | -.091 | -.134 |
| Mid-term exam | **-.179*** | **-.007** | **.027** | **.179*** | **-.191*** | | .826** |
| Final exam score | **-.081** | **.053** | **.076** | **.128** | **-.301**** | **.630**** | |

*Note*. * $p < .05$; ** $p < .01$, two tailed.

## Motivational variables as mediators between mindsets and performance

To answer the second research question, path analysis using multiple regression was conducted, following procedures recommended by Keith (2006, pp. 212-253). To estimate paths toward final exam grade, it was regressed on prior academic ability, de-motivation, growth mindset about intelligence, and growth mindset about academic ability. To estimate paths towards de-motivation, it was regressed on learning goal and effort attribution. To estimate paths toward learning goal and effort attribution, each was regressed on growth mindset about intelligence and growth mindset about academic ability. Finally, to estimate the path towards growth mindset about academic ability, it was regressed on growth mindset about intelligence. The results are displayed in Figure 2.

The results show that neither of the two growth mindsets (about intelligence and about academic ability) had any direct effects on final examination grade. Growth mindset about intelligence did not predict learning goal or effort attribution. However, it did predict growth mindset about academic ability, which was positively associated with both learning goal and effort attribution. These two constructs were negatively linked with

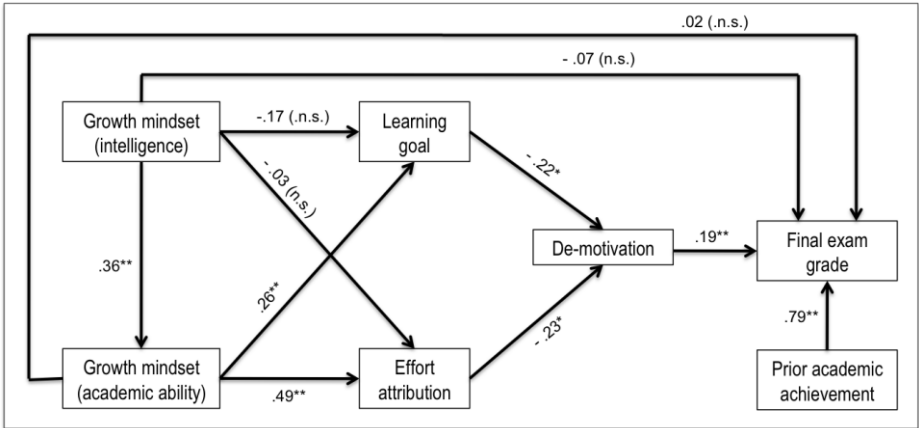de-motivation, which in turn was negatively associated with final examination grade.



*Figure 2*. Path analysis results at the whole sample level. Figures show standardized regression weights (beta).  * p< .05; ** p< .01 (two-tailed tests).
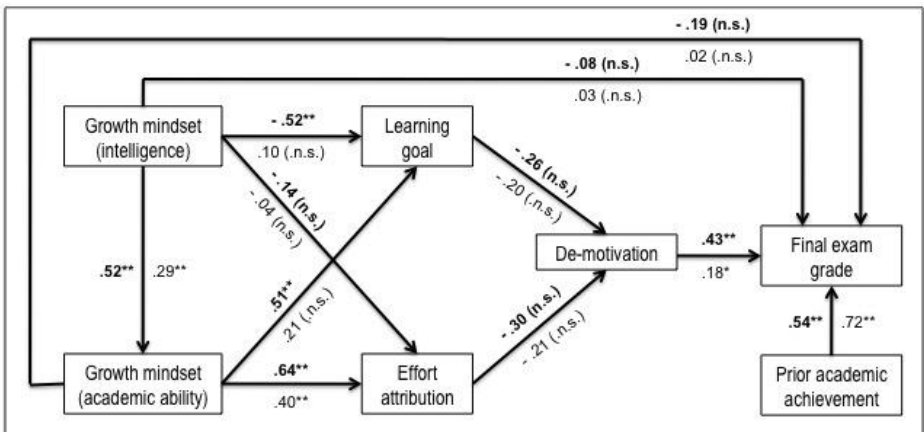


*Figure 3*. Path analysis results for the subsamples. Figures show standardized regression weights (beta). Figures in bold represent students who experienced setbacks in the mid-term exam. * p< .05; ** p< .01 (two-tailed tests).

**Comparing students who did and did not experience setback**

To answer the third research question, the path analysis procedure repeated for the two subsamples of students who obtained lower and higher mid-term exam scores (Figure 3). Comparing students who obtained lower and higher scores in the mid-term exam, the overall pattern of relationships appeared similar. However, the effect sizes were generally larger for the students who obtained lower scores in the mid-term exam. This is more obvious with regards to the effects of growth mindset about academic ability on both learning goal and effort attribution; and also the effect of de-motivation on final grade examination. The previously significant paths from learning goal and effort attribution towards de-motivation became not statistically significant, although the link between effort attribution and de-motivation approached statistical significance (p = .056). This could be attributed to the decrease in sample size and thus statistical power. A notably unexpected finding was that growth mindset about intelligence was negatively related with learning goal (beta: - .52, p<.01) among students with lower mid-term exam scores.

**Discussion**

Theory and prior research suggest that students' belief about whether intelligence is malleable has an important role in their motivational dynamics in achievement situations (Blackwell, et al., 2007; Davis, et al., 2011; Dupeyrat & Marine, 2005; Dweck, 2006; King, et al., 2012). Such beliefs are referred to in this article as mindsets about intelligence and ability. The present study tested a conceptual model regarding the role of mindsets in an actual academic setting among a non-Western sample of university students. The model postulates learning goal (i.e. studying for the purpose of developing one's knowledge/skills) and effort attribution (i.e. ascribing course outcomes to effort) as factors that mediate the effect of mindset on subsequent motivation level and performance in a difficult course. In the present study, mindset about intelligence was examined at two different levels: belief about general intelligence and about academic ability.

Correlation and partial correlation analyses results (Table 2) indicated that growth mindset did not have direct impact on subsequent academic achievement (grades in the final examination). This was true for both growth mindset about intelligence and about academic ability. Growth mindset about academic ability was correlated with all of the motivational variables in the predicted directions. The belief that academic ability can be improved is positively associated with learning goals (studying for the purpose of developing new knowledge and skills) and with effort attribution (the tendency to attribute outcomes of the mid-term exam to effort); and negatively with de-motivation (feeling less motivated and diminished energy for studying in the course). De-motivation predicted lower final exam score (r=.301, p<01), but this association was found only after controlling for prior academic ability. Thus it seems that prior ability suppressed the effect of de-motivation on subsequent achievement. Only when the effect of prior ability is accounted for (i.e. when comparing individuals with equal prior ability) does de-motivation come into play.

This correlation pattern suggests that while growth mindsets did not have any direct effect on academic achievement, it may have an indirect effect via learning goal, effort attribution, and/or de-motivation. This is supported by the path analysis results (Figure 2). More specifically, it seems that growth mindset about academic ability prompts students to adopt a learning goal and attribute outcomes to effort, which in turn buffered against de-motivation. De-motivation then has a negative impact on subsequent achievement. This mediational model is based on theory but has rarely been tested in actual academic settings. Thus, the present study adds to the limited evidence regarding the roles of goal and attribution in mediating the influence of growth mindset on achievement in real and challenging academic situations (Blackwell, et al., 2007).

The path analysis results (Figure 2) also indicate that learning goal and effort attribution were equally important in the motivational dynamics that influences academic achievement. Learning goal (also often referred to as mastery goal) has been found to be correlated with a host of motivational, cognitive, and meta-cognitive variables (Wolters, Fan, & Daugherty, 2013). However, previous research has also found that learning goal is only weakly associated with academic achievement (for a meta-analysis, see Hulleman, et

al., 2010, p. 437). Thus, consistent with the findings of this study, it seems that the effect of learning goal on achievement is mediated by motivational and cognitive processing variables (Grant & Dweck, 2003).

It needs to be noted that the theoretical predictions did not bear out with respect to the role of growth mindset about intelligence, which was linked to neither learning goals, nor to effort attribution (Figure 2). Growth mindset about intelligence is positively associated with mindset about academic ability, but only moderately so (r=.357, p<.01), suggesting that they are two distinct constructs. It seems that to the extent that growth mindset about intelligence has an influence on subsequent academic achievement, it occurs through the more domain-specific mindset about academic ability. This does not undermine Dweck and colleagues' theoretical framework. Rather, this more likely points to the differing meanings of intelligence across cultural groups. Some studies have found that non-Western individuals ascribe a wider meaning to the concept of intelligence, encompassing ethics, morality, and practical skills (Patricia & Aditomo, 2014; Yang & Sternberg, 1997b). Therefore researchers who wish to measure belief about cognitive ability (which is more specifically relevant for academic work) among non-Western samples should consider using more domain-specific items.

Comparing between students who experienced vs. did not experience setback in their mid-term exam, the overall motivational dynamics seemed similar (see Figure 3). However, the paths from growth mindset about academic ability towards learning goal and effort attribution became stronger. This could also be observed for paths from effort attribution towards de-motivation, and from de-motivation towards final exam grade. The link from learning goal leading into de-motivation also showed the same pattern (stronger for students who experienced setback), although this was not statistically significant. These results support the postulate that mindsets about intelligence and ability become more important in the face of challenge in actual academic settings. Thus, this study extends previous laboratory-based studies which experimentally manipulated the level of challenge that children experience. Recall that in this study, setback was operationalized as failing to obtain a satisfactory passing score in the mid-term exam. In other words, it was negative feedback about students' current level of competence. For these students, passing the course satisfactorily

became more challenging. A growth mindset about intelligence and academic ability, through the adoption of a learning goal and effort attribution, buffered against the potentially de-motivating situation.
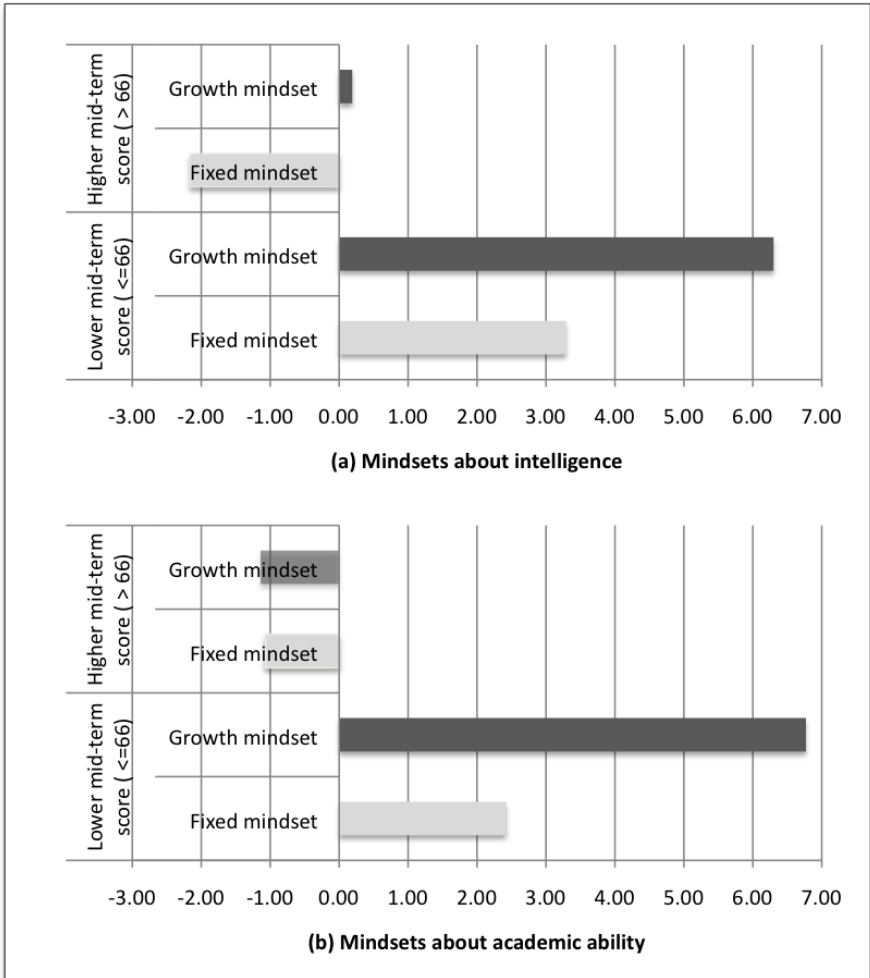


*Figure 4*. Score changes from mid-term to final exam for students obtaining lower and higher mid-term scores, based on their mindset about *intelligence* (panel a) and mindset about academic ability (panel b).

This point is further illustrated by additional analysis comparing the score improvement (from mid-term to final examination) of students who have stronger and weaker growth mindsets. In this analysis, the sample was further categorized using median split based on their mindset about intelligence and about academic ability. The results show that, on average, those with stronger growth mindsets were able to make higher gains from the mid-term to the final exam (Figure 4). These are descriptive results and inferential tests indicate that the differences are not statistically significant, probably due to the small sample size. These results nonetheless are consistent with Blackwell et al.'s study (2007), which contrasted students who strongly endorsed growth mindset items vs. those who strongly disagreed with them. These authors found that strong endorsement of a growth mindset predicted a more positive trajectory in mathematics performance across two years of junior high school. The difference was small, but as they point out, small differences could have large consequences in the long run (Blackwell, et al., 2007).

## Conclusion and Limitations

Setbacks are a normal part of almost every students' academic career, and how one's respond to such events can be consequential for subsequent achievement. While academic achievement is determined by a multitude of causes, this study supports the idea that there are psychological factors which influence students' response to setbacks and performance. In this study, the psychological factors were those postulated by Dweck and colleagues' (Dweck, 1986; Dweck & Leggett, 1988) theory of motivation: the goals that student set for their study, the attributions they make about important outcomes/events, and the effort and interest they feel following those events. Furthermore, underlying these more situational factors is a more fundamental self-belief, referred to here as mindsets about intelligence and academic ability. These self-beliefs provide a framework or meaning system (Hong, et al., 1999) with which students interpret their experiences. The motivational dynamics become even more consequential when students are faced with setbacks or are in a challenging situation.

The present study is limited by its relatively small sample size. This prevented the use of more powerful statistical techniques such as structural equations modelling (SEM), which are more appropriate for testing complex conceptual models such as the one proposed in this study. Further studies should attempt to replicate the findings by comparing students who experience setbacks vs. who did not, but in a larger sample, or across different course contexts. Another limitation is that the measurement of mindset about academic ability may have tapped into other constructs. The instrument asked how likely a fictional character (described as having little academic aptitude) could, through effort, develop the ability to achieve or excel in his/her future studies. By asking respondents to make future-oriented statements, the items could have measured not only mindset about ability, but also constructs such as optimism. Given that mindset about academic ability seems to be distinct from mindset about intelligence, especially in non-Western samples, future studies could explore this construct further.

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