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Beneficial Effects of Growth Mindset of Intelligence and Growth Mindset of Personality on Academic Achievement in School-Aged Children

Korzystne skutki nastawienia na rozwój inteligencji i nastawienia na rozwój osobowości na osiągnięcia w nauce u dzieci w wieku szkolnym

Keywords: implicit theories of intelligence, growth mindset of intelligence, growth mindset of personality, grit, academic performance

Summary: Multiple research studies revealed the benefits of adopting a growth mindset of intelligence for students of all ages. However, few studies have investigated the advantage of having a growth mindset of personality or having grit on academic performance. Therefore, this study investigated the influence of grit and implicit theories of intelligence and personality on academic performance in fifth through eighth-grade students. Our hypothesis is that a relatively higher level of grit as well as a growth mindset would result in better academic success. Students were tested in their respective classrooms using

questionnaires for grit, mindset of intelligence and mindset of personality. Quarter grades and standardized scores were obtained for all students on topics such as English, reading, language, math and science. Growth mindset of intelligence and growth mindset of personality provided a selective advantage academically to students on classroom grades and on standardized testing, particularly in verbal areas such as English, reading and language. Furthermore, mindset of intelligence predicted significant change in standardized math scores. Grit did not affect academic performance. Our results suggest that educational institutions would benefit from mindset interventions promoting a growth mindset of intelligence and personality in students.

Słowa kluczowe: pośrednie teorie inteligencji, nastawienie na rozwój inteligencji, nastawienie na rozwój osobowości, wytrwałość, osiągnięcia naukowe

Streszczenie: Liczne badania naukowe ujawniły korzyści płynące z przyjęcia nastawienia na rozwój inteligencji dla uczniów w każdym wieku. Jednak niewiele badań przeprowadzonych do tej pory dotyczyło korzyści wynikających z nastawienia na rozwój osobowości lub wytrwałości w nauce. Dlatego też niniejsze studium koncentruje się na zbadaniu związku między wytrwałością, teoriami pośrednimi i osobowością, w kontekście ich wpływu na wyniki w nauce uczniów klas od piątej do ósmej. Badanie zakładało, że relatywnie większa wytrwałość i nastawienie na rozwój przełoży się na sukces naukowy. Uczniowie badani byli za pomocą kwestionariuszy dotyczących wytrwałości, nastawienia na rozwój inteligencji i nastawienia na rozwój osobowości; następnie poddano analizie ich oceny kwartalne i ustandaryzowane wyniki w nauce z takich przedmiotów jak angielski, czytanie, język, matematyka i przedmioty ścisłe. Badanie wskazuje na korzystny wpływ, jaki nastawienie na rozwój inteligencji i nastawienie na rozwój osobowości miało na wyniki z języka angielskiego i czytania. Co więcej, nastawienie na rozwój inteligencji przełożyło się na znacznie wyższe wyniki z matematyki. Wytrwałość nie miała wpływu na wyniki w nauce. Poniższe badanie wskazuje na to, że instytucje edukacyjne skorzystałyby z promowania nastawienia na rozwój inteligencji i osobowości u swoich uczniów.

Implicit Theories

What determines whether a student is resilient and motivated or struggling and helpless? Carol Dweck's implicit theories of intelligence can explain how an individual can have differing perspectives that may influence the way they respond to challenges (Dweck, 2006). Those who hold a fixed mindset perceive their intelligence as unchangeable and static, while those who hold a growth mindset perceive their intelligence as malleable and fluid. Because of the perceived inability to expand or improve their intelligence, those who believe that intelligence is unchanging struggle when facing difficulties that challenge them (O'Dell, 2017; Salekin, Lester & Sellers, 2012; Dweck, 2000). Similarly, individuals with a growth mindset of personality believe that personality can be changed or improved while those with a fixed mindset perceive personality as unchangeable. This discrepancy between such mindsets of personality may influence social aggression, social interaction, forgiveness and self-esteem (Li, Zhao & Yu, 2019; Renaud & McConnell, 2007; Ng & Tong, 2013; Yeager, Miu, Powers & Dweck, 2013; Yeager, Trzesniewski & Dweck, 2013; Yeager, 2017; Embree, 1986; Wang, 1997).

Effect of Implicit Theories on Academic Achievement

Moreover, only a few studies have examined the relationship between implicit theories of personality and academic performance (Yeager, Lee & Jaimeson, 2016; Scott et al., 2014). By administering an implicit theories of personality intervention to ninth graders, Yeager, Lee and Jaimeson (2016) were able to examine the effect of a growth mindset on their academic performance throughout the school year. In both the fall and spring semesters, the students who underwent the intervention and, hence, developed a growth mindset of personality had higher core course GPAs than the students in the control groups, therefore identifying a benefit of a growth mindset of personality on academic performance. More specifically, Scott et al. (2014) found that the interventions promoting a growth mindset of personality improve overall grades for students who previously held a fixed mindset of personality, but not for those who already held a growth mindset of personality. Thus, holding the belief that an individual's personality can change plays a crucial role in influencing and maintaining academic performance, especially in students who originally think otherwise.

Grit and Academic Achievement

Grit is a skill that deals with resilience and perseverance (Duckworth, 2016). The concept of grit is relatively new and, therefore, a limited number of studies have investigated its relationship to academic achievement. Grit is often associated with overcoming difficult challenges such as moving to a new country at a young age. Consequently, grit was found to help explain the lack of an academic gap between native students and newcomers (Tovar-García, 2017). In a study done with adolescents in grades 7–12, high levels of grit predicted academic performance (Cosgrove, Chen & Castelli, 2018). The skills and deliberate practice associated with grit contributed to greater academic success and the completion of long-term goals in Korean college students (Suran & Young Woo, 2017). Students who completed medical school in four years were found to have higher grit scores than those who completed their studies in five years (Miller-Matero, Martinez, MacLean, Yaremchuk & Ko, 2018). When an educational intervention on the topic of grit was implemented, it was found that gritty individuals tended to select more difficult tasks and score higher on standardized tests (Alan, Boneva & Ertac, 2016).

As mentioned above, studies investigating the effect of implicit theories of personality and the effect of grit on academic performance are scarce. Even scarcer are studies that examined implicit theories of intelligence, implicit theories of personality and grit in one investigation. Accordingly, we decided to investigate in one study the effect of grit and implicit theories of intelligence and personality on academic performance in fifth, sixth, seventh and eighth-grade students in a private school. Our hypothesis is that a growth mindset of intelligence and a growth mindset of personality would predict academic performance and result in better academic success in students on verbal and quantitative areas of studies. Based on the few studies showing the benefits of grit, we also hypothesized that grit would predict academic performance in verbal and quantitative academic areas.

Methods

Participants. Forty-six students participated in this study after the [blinded] College IRB committee approved the study. Fifth graders (N = 19), sixth graders (N = 15), seventh graders (N = 7) and eighth graders (N = 5) from a small private school in the state of Indiana participated in the research study.

For all grades combined, the age range was 10–14 years of age, with declared ethnicities of 87% Caucasian, 7% Hispanic/Latino, 4% African American/Black and 2% not declaring ethnicity. Income was measured in categories and the median was the category of $90,000 to $100,000 income per year.

The fifth-grade students who participated in the study consisted of eleven females and eight males (Figure 1). The sixth-grade students who participated in this study consisted of eight females and seven males (Figure 2). The seventh-grade students who participated in this study consisted of three females and four males and all five of the eighth-grade participants were females (Figure 3).

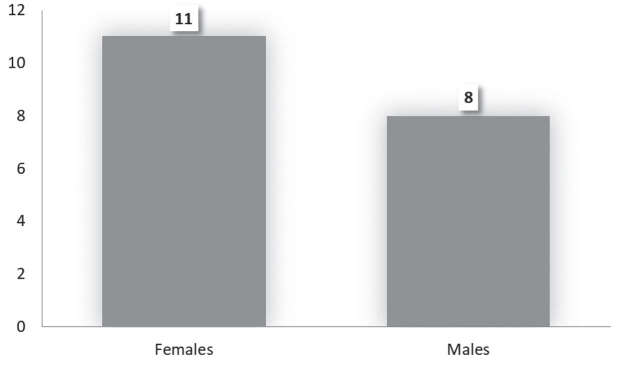

Figure 1.
Male and female frequency in fifth graders.
Source: own research.

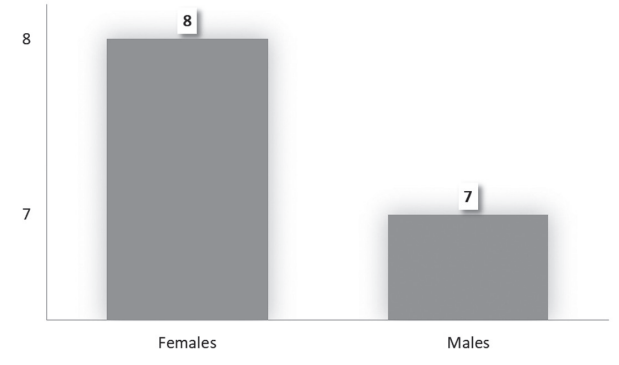

Figure 2.
Male and female frequency in sixth graders.
Source: own research.

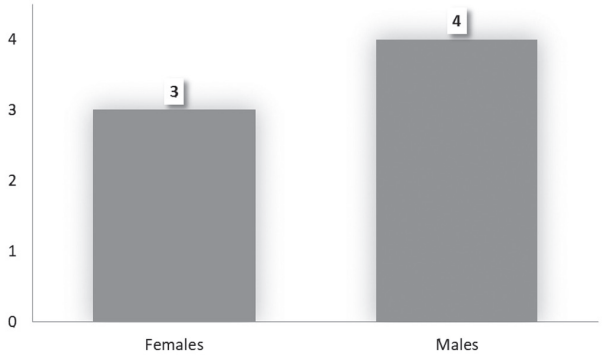

Figure 3.
Male and female frequency in seventh graders.
Source: own research.

Measures

Theories of Intelligence Scale for Children (TIS). This is a 6-item questionnaire assessing general beliefs in children 10 and older about the fixedness or malleability of intelligence and consists of two subscales: fixed and growth mindsets (Dweck, 2006). The test is constructed using a 5-point Likert scale ranging from (1) *strongly agree* to (5) *strongly disagree*. The incremental items (questions 4, 5 and 6) were reverse scored and the average of all items was calculated. Higher scores are indicative of more incremental mindset of intelligence.

Implicit Theories of Personality for Children (ages 9 and older). This 6-item questionnaire assesses the individuals' mindset about the fixedness or malleability of personality and consists of two subscales: fixed and growth mindsets (Dweck, 2006). Items use a 6-point Likert scale ranging from (1) *strongly agree* to (6) *strongly disagree*. The incremental items (questions 4, 5 and 6) were reverse scored and the average of all items was calculated. Higher scores are indicative of a more growth mindset of personality.

Grit Scale (SPS). The scale used to measure grit is made of 12 items based on a 5-point Likert scale ranging from (5) *very much like me* to (1) *not like me at all*. Scores for questions **1, 4, 6, 9, 10** and **12** were reversed, and then scores of all items were averaged. Higher scores are indicative of more grittiness.

Procedures

The study was approved by the [blinded] College Institutional Review Board and by the principals of the private school. Parents received a packet including a consent form describing the study and a demographic questionnaire pertaining to their children and to the family. The researchers collected parents-signed consent forms and the demographic questionnaires prior to testing the children. Participants gave verbal assent before being tested in their classrooms. Students were given three questionnaires: the 12-item Grit Scale (Duckworth, 2016), the Implicit Theories of Intelligence Scale (ITIS) for children (Dweck, 2006), and the Implicit Theories of Personality Scale for children (Dweck, 2006). The questionnaires were administered in a classroom setting under the supervision of the researcher and teachers. The school third-quarter grades on math, English and science and the Northwest Evaluation Association (NWEA) fall standardized test scores for math, reading and language were obtained from the school administration for all grades. NWEA scores are measured in Rasch UnIT (RIT) units. The test was administered once in the fall and once in the spring, but this study only considered the fall scores. Testing was done in the third and fourth quarter of the school year. Quarter grades for all grades were measured using the same grading scheme ranging from zero to one hundred points. Quarter reading grades were obtained for the fifth-grade students only because reading is not a subject tested in class in older grades. Using a median split procedure, we separated students into Low Grit / High Grit groups, Fixed Mindset of Intelligence / Growth Mindset of Intelligence groups and Fixed Mindset of Personality / Growth Mindset of Personality groups. We used SPSS to run t-tests, Pearson *r* correlations and Linear Regression analysis at an alpha level of 0.05.

Results

Due to the small sample size for each grade, we ran statistical analysis including all students in all grades. As mentioned above, participants were assigned to Low Grit / High Grit groups, Fixed Mindset of Intelligence / Growth Mindset of Intelligence groups and Fixed Mindset of Personality / Growth Mindset of Personality groups. We investigated the effect of mindset of intelligence, mindset of personality and grit on quarter grades in English, math and science as well as on NWEA math, reading and language scores in all students. We also

analyzed the effect of these independent variables on quarter reading scores in the fifth-grade students. In order to rule out any gender differences in implicit theories, grit or academic performance, we compared boys and girls across all grades on implicit theories of intelligence, implicit theories of personality, grit, quarter grades and NWEA scores and found no statistically significant difference between males and females.

As shown in Figure 4, the analysis of the effect of mindset of intelligence on academic performance showed that students with a growth mindset of intelligence (M = 93.20, SD = 6.09) scored higher on class quarter English grades t (44) = -2.21, p = 0.033 than students with a fixed mindset of intelligence (M = 92.00, SD = 11.31). Furthermore, students with a growth mindset of intelligence (M = 229.18, SD = 12.94) performed better than students with a fixed mindset (M = 219.14, SD = 13.84) on NWEA standardized scores in reading t (41) = -2.46, p = 0.018, and on NWEA standardized scores in language (Growth Mindset group: M = 227.91, SD = 8.76; Fixed Mindset group: M = 219.76, SD = 12.27), t (41) = -2.52, p = 0.016), as shown in Figure 5. No effect of mindset of intelligence was found on math or science quarter grades or on NWEA math scores.

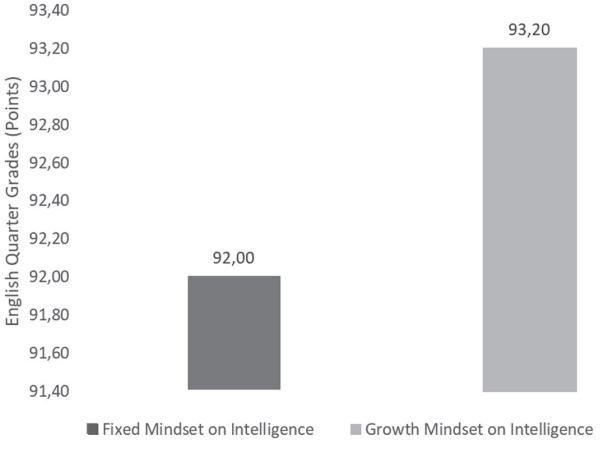

Figure 4.
Higher quarter English grades in students with growth mindset than fixed mindset of intelligence, $p < 0.05$.
Source: own research.

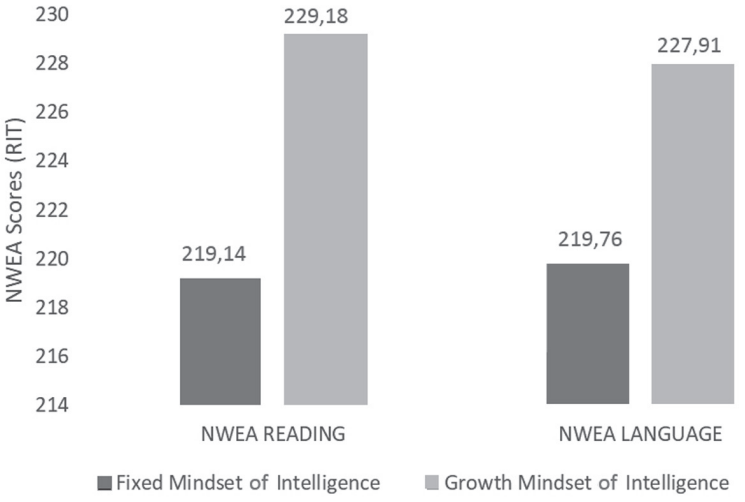

Figure 5.
Higher NWEA reading scores and NWEA language scores in students with growth mindset of intelligence vs. students with fixed mindset of intelligence, $p < 0.05$.
Source: own research.

In analyzing the effect of mindset of personality on academic performance, the fifth graders with a growth mindset of personality ($M = 93.43$, $SD = 3.36$) were found to have statistically significant higher quarter reading grades than those fifth graders with a fixed mindset of personality ($M = 86.71$, $SD = 10.87$), $t\,(17) = -2.60$, $p = 0.021$ as shown in Figure 6. We could not assess the effect of implicit theories of personality on quarter reading grades in the higher grades because reading is not assessed in sixth through eighth grade classrooms. Students in all grades combined with a growth mindset of personality ($M = 228.57$, $SD = 13.10$) performed better on NWEA reading scores than those with a fixed mindset of personality ($M = 220.18$, $SD = 14.21$), $t\,(41) = -2.01$, $p = 0.051$, as shown in Figure 7. However, this relationship was marginally significant. No effect of mindset of personality was found on English, math, or science quarter grades or on NWEA math or language scores. We analyzed the effect of grit on all academic performance measures and found no statistical significance on any of them.

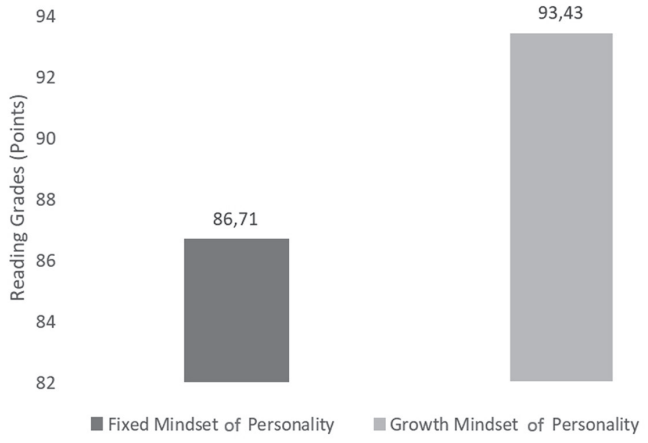

Figure 6.
Higher quarter reading grades in fifth-grade students with growth mindset of personality than fifth-grade students with fixed mindset on personality, $p < 0.05$.
Source: own research.

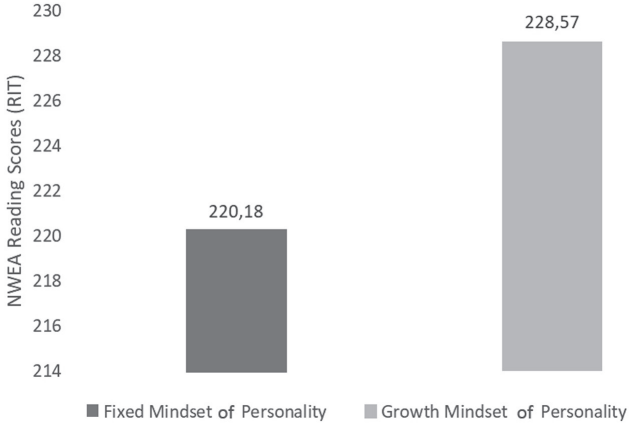

Figure 7.
Higher NWEA reading scores in students with growth than fixed mindset of personality, $p = 0.051$.
Source: own research.

As shown in Table 1, there were significant positive correlations between mindset of intelligence as well as mindset of personality and the various academic performance measures. All correlations listed in Table 1 were significant

at an alpha level of 0.05. For quarter grades, we found significant positive correlations between implicit theories and the following grades, thus implying that the more incremental the mindset, the higher the grades the students obtained. These significant positive correlations were between implicit theories of intelligence and quarter English grades (r = 0.422, p = 0.003, N = *46*), implicit theories of personality and quarter English grades (r = 0.298, p = 0.044, N = *46*) and implicit theories of personality and quarter reading grades in fifth graders only (r = 0.484, p = 0.036, N = *19*). Additionally, significant positive correlations were found between implicit theories of intelligence as well as implicit theories of personality and NWEA scores. This included significant positive correlations between implicit theories of intelligence and the following NWEA scores: NWEA math scores (r = 0.389, p = .001, N = *46*), NWEA reading scores (r = 0.496, p = .001, N = *46*), and NWEA language scores (r = 0.475, p = .001, N = *46*). Similarly, the implicit theories of personality were positively associated with NWEA reading scores (r = 0.416, p = 0.06, N = *46*) and NWEA language scores (r = 0.390, p = 0.036, N = *46*). Grit showed no significant correlations with any of the quarter grades or NWEA scores.

Table 1
Statistically Significant Pearson r Correlation Coefficient between Mindset of Intelligence, Mindset of Personality and Academic Performance

	English	Reading	NWEA Math	NWEA Reading	NWEA Language
Mindset of Intelligence	**0.42**		**0.39**	**0.49**	**0.47**
Mindset of Personality	**0.31**	**0.48**		**0.42**	**0.32**

Note: all correlations include all students in all grades except for the correlation between Mindset of Personality and quarter Reading grades where only fifth graders were considered, $p < .05$

Source: own research.

Consistent with the correlations results, simple linear regression analysis showed that Mindset of Intelligence predicted changes in quarter grades in English and NWEA scores of math, reading and language with significant regression equations as follows. For quarter English grades, $F(1, 44) = 9.543$, p = 0.003, R^2 = 0.18, participants' predicted quarter English grades are equal to 73.81 + 5.29 (Mindset of Intelligence) points when Mindset of Intelligence is measured in Mindset units. Concerning NWEA math scores, $F(1,41) = 7.26$, p = 0.01, R^2 = 0.15, participants' predicted quarter NWEA math scores are

equal to 201.01 + 8.98 (Mindset of Intelligence) RIT when Mindset of Intelligence is measured in Mindset units. Mindset of Intelligence also predicted changes in NWEA reading scores, $F(1, 41) = 13.36$, $p = 0.001$, $R^2 = 0.25$, participants' predicted quarter NWEA reading scores are equal to 187.61 + 11.60 (Mindset of Intelligence) RIT when Mindset of Intelligence is measured in Mindset units. Finally, Mindset of Intelligence predicted changes in NWEA language scores, $F(1, 41) = 11.93$, $p = 0.001$, $R^2 = 0.23$, participants' predicted quarter NWEA language scores are equal to 196.00 + 8.83 (Mindset of Intelligence) RIT when Mindset of Intelligence is measured in Mindset units.

A simple linear regression was also calculated to predict academic performance based on Mindset of Personality. Consistent with the correlation results, Mindset of Personality predicted changes in quarter grades in English and NWEA scores of reading and language with significant regression equations as follows. For quarter English grades, $F(1, 44) = 4.29$, $p = 0.044$, $R^2 = 0.09$, participants predicted quarter English grades is equal to 81.76 + 2.54 (Mindset of Personality) points when Mindset of Personality is measured in Mindset units. Mindset of Personality also predicted changes in NWEA reading scores, $F(1, 41) = 8.56$, $p = 0.006$, $R^2 = 0.17$. Participants predicted quarter NWEA reading scores is equal to 201.25 + 6.68 (Mindset of Personality) RIT when Mindset of Personality is measured in Mindset units. Finally, Mindset of Personality predicted changes in NWEA language scores, $F(1, 41) = 4.69$, $p = 0.036$, $R^2 = 0.10$. Participants predicted quarter NWEA language scores is equal to 209.82 + 4.09 (Mindset of Personality) RIT when Mindset of Personality is measured in Mindset units.

Discussion

The results of this study reveal a beneficial effect of a growth mindset of intelligence and a growth mindset of personality on academic performance in students in the fifth to eighth grades. These results confirm part of our hypothesis. We also hypothesized that higher grit would predict academic performance, but our results did not support this hypothesis. Grit did not affect performance in any of the areas investigated in this study. Our results specifically showed that relative to fixed mindset, students with a growth mindset of intelligence fared better in English grades, standardized reading and standardized language assessment. Our results also revealed that possessing a growth mindset about others' personality contributed to better performance in reading grades and

standardized reading assessment. Regression analysis shed more light on these relationships between implicit theories and academic performance by showing that mindset of intelligence and mindset of personality predict significant changes in English and standardized verbal testing in reading and language. Strikingly, mindset of intelligence also predicted up to fifteen percent change in standardized math scores. Those relationships were further supported by significant positive correlations between both mindsets and these academic areas.

In accordance with our results, previous studies (Blackwell, Trzesniewski & Dweck, 2007; Bostwick, Collie, Martin & Durksen, 2017) have also highlighted the influence of a growth mindset of intelligence and personality on academic performance. Yeager, Lee and Jamieson (2016) suggested that a growth mindset may reduce threat-type reactions that negatively affect cognitive performance, leading to improved short-term and long-term academic performance. Accordingly, in our study, we observed beneficial effects of a growth mindset of intelligence and a growth mindset of personality on quarter classroom grades and on standardized scores that reflect long-term academic goals. However, those benefits were mainly for verbal subjects such as English, reading and language. The limited effect of a growth mindset observed in math and the lack of it in science is in agreement with Canning, Muenks, Green and Murphy suggesting that stereotypes surrounding STEM courses may potentially influence teachers' own mindsets and, as a result, affect students' motivation and performance (2019). The same study reported that ethnic minority students benefited the most academically in STEM courses from teachers with growth mindset. The current study did not measure teachers' mindset. Moreover, our results revealed that mindset of intelligence did predict a considerable percentage of change in standardized math scores in a predominately white middle class student population of a private school. This is worth mentioning because Sisk, Burgoyne, Sun, Butler and Macnamara (2018) suggested that a growth mindset's academic benefits are limited to students from low socioeconomic status. Our results suggest that promoting a growth mindset of intelligence in students would not only be beneficial for verbal academic performance but also for quantitative areas such as Math.

Our results revealed no effect of grit on academic achievement. Grit has been shown previously to improve academic achievement (Alan, Boneva & Ertac, 2016; Cosgrove, Chen & Castelli, 2018). Even though these few studies have shown an academic advantage to grit, the latter is mainly known to be associated with passion and perseverance, including persistence in the face of

challenges (Duckworth, 2016). There is a possibility that the reason why our results show an effect of incremental mindset on academic achievement but not an effect of grit is due to the fact that the implicit theories scales we used were tailored to children in the age range of our subjects but the 12-item grit scale we used was not and, therefore, might have lacked sensitivity. Another weakness of this study is the small sample size in the grades tested. In order to increase the sample size, and in order to have a sample that is more representative of the general student population, we would like to extend the study to the public school system and to a variety of other grades.

In conclusion, growth mindset of intelligence and growth mindset of personality provided a selective advantage academically to students on classroom grades and on standardized testing, particularly in verbal areas such as English, reading and language. Furthermore, mindset of intelligence predicted significant change in standardized math scores. Grit did not affect academic performance. Our results suggest that educational institutions would benefit from mindset interventions promoting a growth mindset of intelligence and personality in their students.

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