Pedagogical Contexts 2019, No. 2(13)
www.kontekstypedagogiczne.pl
ISSN 2300-6471
pp. 129–143
DOI: 10.19265/KP.2019.213129

ORIGINAL PAPER
Received: 11.07.2019
Accepted: 2.09.2019

Cosette Fox
ORCID iD: 0000-0003-0006-1033
Holy Cross College, USA
cfox@hcc-nd.edu

Maria Barrera
ORCID iD: 0000-0002-7387-2024
Holy Cross College, USA
mbarrera@hcc-nd.edu

Lucy Campos
ORCID iD: 0000-0002-1070-8948
Holy Cross College, USA
lcampos@hcc-nd.edu

Felicia Reid-Metoyer
ORCID iD: 0000-0001-6510-532X
Holy Cross College, USA
freidmetoyer@hcc-nd.edu

Relationship between Implicit Theories, Grit and Academic Achievement in School-Age Children

Związek między teoriami pośrednimi, wytrwałością i osiągnięciami naukowymi u dzieci w wieku szkolnym

Keywords:
Implicit Theories of Intelligence, Growth Mindset of Intelligence, Growth Mindset of Personality, Grit, Academic Achievement

Summary: Research on implicit theories of intelligence has focused on academic achievement, elucidating the benefits of adopting a growth mindset for students of all ages. However, few studies 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 and sixth-grade boys and girls. Our hypothesis was that a relatively higher grit and/or 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. The results of this study reveal a benefit to having a growth mindset of personality on English and Reading. A growth mindset of intelligence correlated positively with Math, English and standardized scores of Math and Language. 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.

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

Streszczenie: Badania nad teoriami pośrednimi koncentrowały się do tej pory głównie na osiągnięciach naukowych, wyjaśniały korzyści wynikające z nastawienia na rozwój w ocenie uczniów w każdym wieku. Niewiele badań dotyczyło jednak korzyści wynikających z pojmowania osobowości w sposób wzrostowy lub tych związanych z wytrwałością w nauce. Dlatego niniejsze studium koncentruje się na zbadaniu związku między wytrwałością, teoriami pośrednimi i osobowością, w kontekście ich wpływu na wyniki w nauce u chłopców i dziewcząt w piątej i szóstej klasie szkoły podstawowej. 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. Badanie wskazuje na korzystny wpływ, jaki nastawienie na rozwój osobowości wywarło na wyniki z języka angielskiego i czytania. Nastawienie na rozwój inteligencji natomiast koreluje dodatnio z matematyką, angielskim i ustandaryzowanymi wynikami z matematyki i języka. Wytrwałość nie miała wpływu na wyniki w nauce. Nasze wyniki sugerują, że instytucje edukacyjne skorzystałyby z promowania nastawienia na rozwój inteligencji i osobowości u swoich uczniów.

Effect of implicit theories of intelligence and personality on academic achievement

According to implicit theories of intelligence (Dweck, 2006), an individual's perception of the malleability of their intelligence can contribute to the difference between a highly motivated individual and a struggling individual, especially in the academic setting (Gal & Szamoskozi, 2016; Costa & Faria, 2018). While individuals with a growth mindset view intelligence as a malleable trait that can be improved upon through a learning process, individuals with fixed mindset view intelligence as a fixed, constant trait. Because of these contrasting perspectives, those who believe that intelligence is unchanging struggle when facing difficulties that challenge them (O'Dell, 2017; Salekin, Lester & Sellers, 2012; Dweck, 2000).

A large portion of existing research on the implicit theories of intelligence focused on academic achievement, elucidating the benefits of adopting an incremental mindset for students of all ages. Bostwick, Collie, Martin and Durksen (2017) explored the effect of a growth mindset on mathematical achievement of Australian students in secondary schools. They observed a positive relationship between growth mindset and growth orientation, which in turn was positively associated with higher academic achievement. Renaud-Dube, Guay, Talbot, Taylor and Koestner (2015) reported that a growth mindset and intrinsic academic motivation are associated with a student's intentions to stay in school. Individuals with growth mindset are also more likely to have constructive coping mechanisms when dealing with academic challenges, as was shown through a different study with Taiwanese eighth-grade students (Shih, 2011). Having a growth mindset of intelligence at the beginning of seventh grade predicted higher math grades earned by the end of eighth grade (Blackwell, Trzesniewski & Dweck, 2007). Other studies in this area further confirmed the beneficial effects of a growth mindset of intelligence on a variety of measures of academic achievement, such as final exam course grades in mathematics and social sciences, mathematical ability and perceived academic performance (Tempelaar, Rienties, Giesbergs & Gijselaers, 2015; Shively & Ryan, 2013; Shih, 2011; Ahmavaara & Houston, 2007; Leondari & Gialamas, 2002). On the other hand, a recent meta-analysis examining the effect of implicit theories of intelligence and its related interventions on academic achievement argues that such relationship is weak and is mainly limited to students with low socioeconomic status or students who are academically at risk (Sisk, Burgoyne, Sun, Butler & Macnamara, 2018). The lack

of a strong effect of implicit theories of intelligence on academic achievement according to this recent meta-analysis might be because educators' mindsets, in addition to students' mindsets, can have an effect on academic achievement. A recent study analyzed college faculty mindset, whether growth or fixed, in addition to their various identities, and then assessed student performance, motivation and experience accordingly. Students taught by professors with fixed mindsets performed more poorly in STEM courses than those taught by professors with growth mindsets. This study suggests that an educator's implicit theories of intelligence influence the experience, motivation and performance of students academically (Canning, Muenks, Green & Murphy, 2019). The association between poor performance and faculty mindset was significantly higher in Latinos, Blacks and Native Americans than in White or Asian students (Canning et al., 2019).

Like implicit theories of intelligence, implicit theories of personality are beliefs that either see personality as malleable or as static (Dweck, 2006). Most studies on implicit theories of personality investigated the benefit of a growth mindset about personality on social aggression, social interaction, forgiveness and self-esteem (Li, Zhao & Yu, 2019; Renaud & McConnel, 2007; Ng & Tong, 2013; Yeager, Miu, Powers & Dweck, 2013; Yeager, Trzesniewski & Dweck, 2013; Yeager, 2017; Embree, 1986; Wang, 1997). Very few studies have examined the relationship between implicit theories of personality and academic performance (Yeager, Lee & Jaimeson, 2016; Scott, Johnson, Spitzer, Trzesniewski, Powers & Dweck, 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 theory 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 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, Powers and Dweck found that the interventions promoting a growth mindset of personality improve overall grades for students that already held a fixed mindset of personality but not for those who already held a growth theory of personality (Scott et al., 2014). 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 academic gap between native students and newcomers (Tovar-García, 2017). In a study done with adolescents, 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).

Gender differences in implicit theories

To our knowledge, very few studies have reported gender differences in implicit theories of intelligence. We know so far that gender differences influence the effect of implicit theories of thoughts, emotions and behavior in adolescents. Early adolescents were specifically chosen because of the developmental window that occurs during the ages of 10–14, especially for girls (Schleider & Weisz, 2016). Research showed that for all categories – thoughts, emotions and behavior – girls developed stronger entity theories than boys (Schleider & Weisz, 2016). This longitudinal study also noted that girls who had more severe emotional or behavioral issues experienced a greater development of fixed mindset of thought, emotion and behavior throughout the six-month study. On the contrary, there was no correlation between emotional or mental problems and fixed or growth mindset beliefs for boys. One possible explanation for this gender effect is that teenage girls may experience relatively more interpersonal stress because of the significant biological changes occurring during this transition phase. Therefore, early adolescent girls might be more likely to develop negative reactions to stressors, such as hopelessness and

rumination, that are associated with an entity theory (Schleider & Weisz, 2016; Yeager et al., 2014).

Studies investigating the effect of implicit theories of personality and the effect of grit on academic performance are sparse. Even sparser are studies looking at gender effects in relation to implicit theories and grit. Accordingly, we decided to investigate in one study the effect of grit and implicit theories of intelligence and personality on academic performance in fifth and sixth-grade boys and girls. Our hypothesis was that a relatively higher grit and/or a growth mindset would result in better academic success.

Methodology

Participants. Fifth-grade (N = 19) and sixth-grade (N = 15) students from a private school in the state of Indiana participated in the research study. For both grades combined, the age range was 10–12 years of age, with 80% Caucasians, 6% African American/Black, 9% Hispanic/Latino and 5% not declaring ethnicity. Parental consent was received prior to collecting data. Students also gave verbal assent before filling the questionnaires.

Fifth-grade students who participated in the study consisted of 11 females and 8 males (Figure 1). Sixth-grade students who participated in this study consisted of 8 females and 7 males (Figure 2).

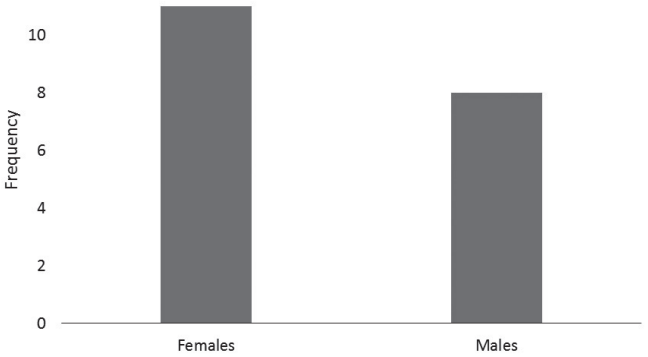

Figure 1.
Male and Female frequency in fifth graders.
Source: own research.

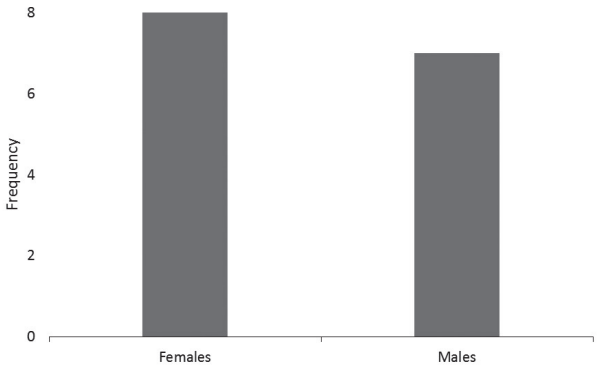

Figure 2.
Male and Female frequency in sixth graders.
Source: own research.

Measurements and Procedures. The study was approved by the Holy Cross 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 signed consent forms and the demographic questionnaires prior to testing the children. Students were given three questionnaires: 12-Item Grit Scale (Duckworth, 2016), Implicit Theories of Intelligence Scale (ITIS) for children (Dweck, 2006), and Implicit Theories of Personality Scale for children (Dweck, 2006). Questionnaires were given 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 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 and Pearson *r* correlations at an alpha level of 0.05.

Results

No significant effect of implicit theories of intelligence (Figure 3) and no effect of grit (Figure 4) was found across both grades on any of the quarter grades or NWEA scores. As shown in Figure 5, t test analysis showed a marginally significant benefit to having a growth mindset of personality on quarter English grades $t(32) = -1.79$, $p = 0.08$ for fifth and sixth-grade students combined. Fifth graders with a growth mindset of personality also had higher scores on quarter Reading grades $t(17) = -2.38$, $p = 0.03$ (Figure 6). This could not be confirmed for sixth-grade students, as Reading is not a subject they are evaluated on. Fifth and sixth-grade students with a growth mindset of personality had higher scores for implicit theories of intelligence $t(32) = -2.16$, $p = 0.04$ than students with a fixed mindset of personality as shown in Figure 7. No effect of implicit theories of personality on grit was found. In order to rule out any gender differences in implicit theories, grit or academic performance, we compared boys and girls across both grades on implicit theories of intelligence, implicit theories of personality, grit, quarter grades and NWEA scores and found no statistically significant difference between fifth and sixth-grade boys and fifth and sixth-grade girls.

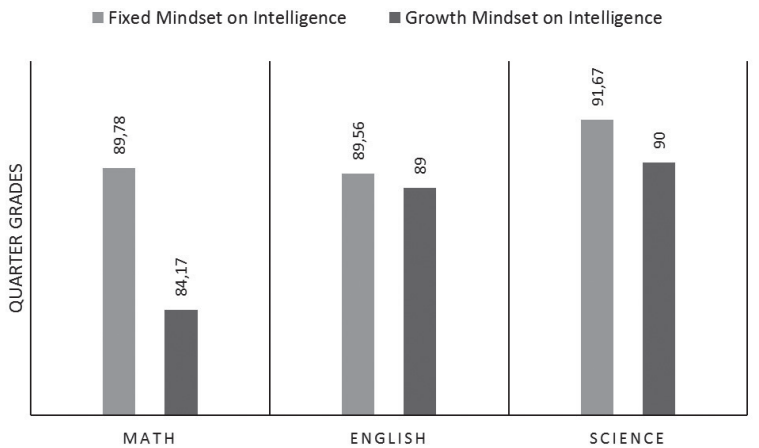

Figure 3.
No effect of implicit theories of intelligence on quarter grades for fifth and sixth-grade students, $p > 0.05$.
Source: own research.

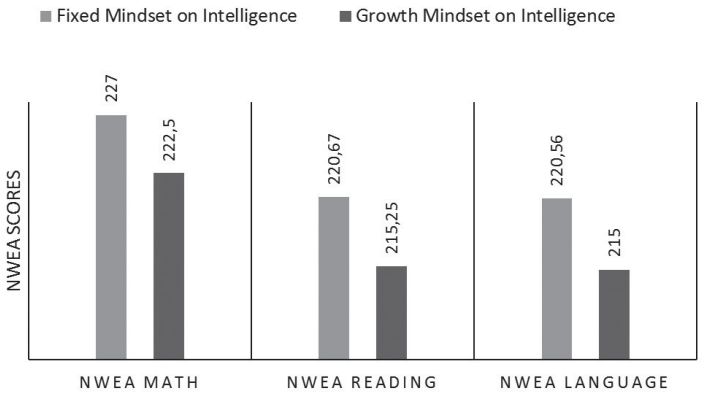

Figure 4.
No effect of implicit theories of intelligence on NWEA scores in fifth and sixth-grade students, $p > 0.05$.
Source: own research.

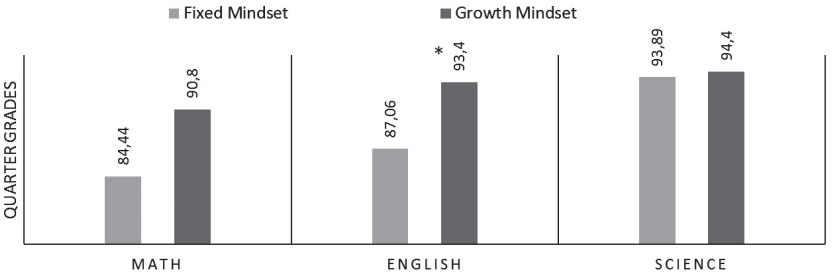

Figure 5.
Fifth and sixth-grade students with a growth mindset of personality have relatively higher quarter grades in English, *marginally significant, $p = 0.08$.
Source: own research.

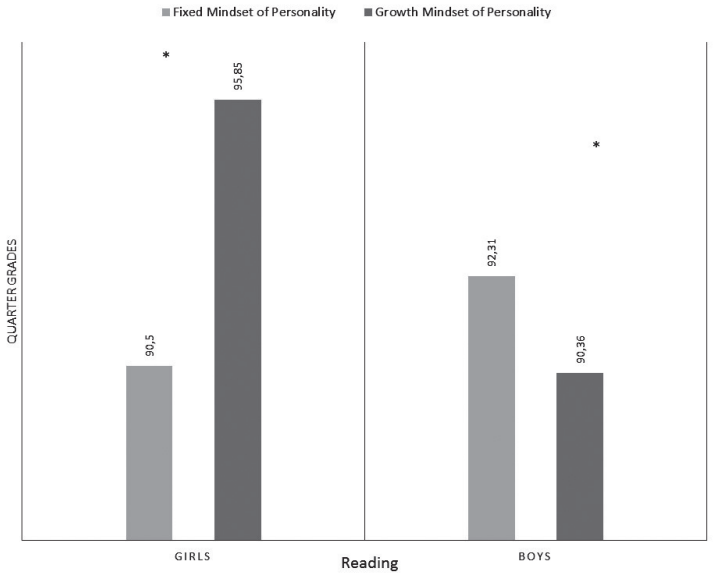

Figure 6.
Fifth-grade students with a growth mindset of personality had higher quarter grades on Reading than students with a fixed mindset of personality, $*p < 0.05$.
Source: own research.

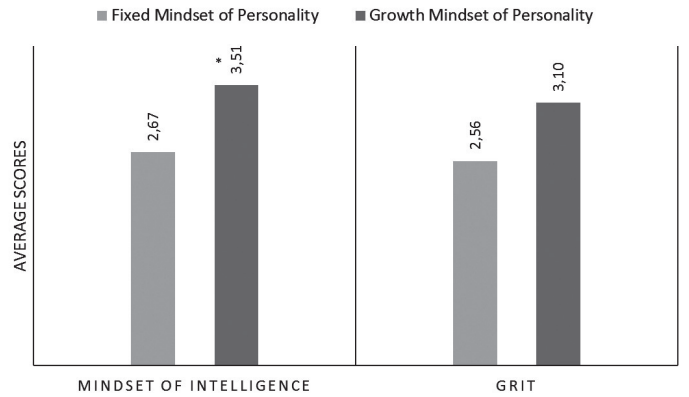

Figure 7.
Fifth and sixth-grade students with a growth mindset of personality had relatively higher scores of implicit theories of intelligence, $*p < 0.05$, but not grit, $p > 0.05$.
Source: own research.

As shown in Table 1, there were significant positive correlations between fifth and sixth-grade students' implicit theories and various variables pertaining to academic performance. All correlations listed in Table 1 were significant at an alpha level of 0.05, including significant positive correlations between quarter Math grades and implicit theories of intelligence (r = 0.37, p = 0.03) and quarter English grades and implicit theories of intelligence (r = 0.47, p = 0.005). Mindset of intelligence also correlated positively with NW Math scores (r = 0.38, p = 0.03) and with NW Language (r = 0.47, p = 0.007). Mindset of personality was positively correlated with quarter English grades (r = 0.37, p = 0.03) and with quarter Reading grades in fifth-grade students only (r = 0.48, p = 0.04). No correlations were found between grit and academic performance in any subjects.

Table 1
Statistically Significant Pearson r Correlation Coefficient between Mindset of Intelligence, Mindset of Personality and Academic Performance in Fifth and Sixth-Grade Students

	Math N = 34	English N = 34	Reading N = 19	NW Math N = 34	NW Language N = 34
Mindset of Intelligence	0.37	0.47		0.38	0.47
Mindset of Personality		0.37	0.48		

Note: $p < .05$
Source: own research.

Discussion

The results of this study reveal a beneficial effect of a growth mindset of intelligence and personality on academic performance in fifth and sixth-grade students. A growth mindset of personality was found to be beneficial for classroom English and Reading scores. A growth mindset of intelligence was positively correlated with classroom Math, English grades and standardized Math and language scores. This is in accordance with our hypothesis. We also hypothesized that higher grit would result in better academic performance, but our results did not confirm this hypothesis. Grit did not affect performance on any of the subject topics investigated in this study. Students with more

incremental mindset of personality had more incremental mindset of intelligence but not grit.

In accordance with our results, previous studies (Blackwell et al., 2007; Bostwick et al., 2017) have also highlighted the influence of a growth mindset in personality and intelligence on academic performance. Just as Yeager, Lee and Jamieson (2016) suggest, a growth mindset of personality may reduce threat-type reactions that negatively affect cognitive performance, leading to higher short-term and long-term academic performance. Accordingly, in our study, we observed beneficial effects to growth mindset of intelligence and personality on quarter grades and standardized scores that reflect long-term academic goals. The limited effect of a growth mindset observed in our study on Math and the lack of effect on Science is in agreement with Canning et al.'s conclusion suggesting that the stereotypes surrounding STEM courses may potentially influence teachers' own mindsets and eventually, student motivation and performance (2019). Therefore, the positive association between a growth mindset of intelligence and mathematical achievement is not diminished, but instead limited.

Our results revealed no effect of grit on academic achievement. Grit has been shown previously to improve academic achievement (Alan et al., 2016; Cosgrove et al., 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 both 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 elementary and secondary school.

In conclusion, an incremental mindset of intelligence and personality seem to give a selective advantage academically to fifth and sixth-grade students. Grit did not affect academic performance. Future studies need to investigate the effect of combined mindset and grit interventions in students to see if installing a growth mindset and increasing grit might provide an additive academic advantage and if that effect is affected by gender.

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