

IMPLICIT THEORIES OF INTELLIGENCE AND ACADEMIC ACHIEVEMENT: REVIEW OF TWO STUDIES IN LATVIA

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Abstract

Growth mindset has become popular in the field of psychology and education all around the world. In the Baltic States this concept is relatively new. This research compiles results of two different studies that, for the first time in the Baltic States, analyse the concept of “implicit theories of intelligence” (ITI) and its factors – growth and fixed mindset, and investigate the relations between ITI and academic achievement of students. Data of two different samples of secondary school adolescents is used. Sample 1 consisted of students ($N_1=258$) aged between 14 and 18, 134 females ($M=15.13$; $SD=1.29$) and 124 males ($M=15.40$; $SD=1.20$) studying in 7th-12th grade in two Latvian schools. Sample 2 consisted of students ($N_2=165$), 80 females and 85 males, aged between 15 and 19 ($M=16.75$; $SD=.90$) studying in 10th-12th grade in five Latvian schools. Measures: The Revised Implicit Theories of Intelligence Scale, The Implicit Theories of Intelligence Scale for Children, and The College Academic Self-Efficacy Scale. The results of the study in Sample 1 ($N_1=258$) showed significant positive relations between growth mindset and academic achievement, and gender specific difference in views of intelligence. The results of the study in Sample 2 ($N_2=165$) identified positive relations between ITI and students' achievement in Mathematics. The regression analysis ($N_2=165$) showed that ITI predict academic achievement in Mathematics at a significant level. The findings suggest discrepancies with the previous studies. The construct needs to be explored further.

Keywords: *academic self-efficacy, academic achievement, gender differences, growth and fixed mindset, intelligence theories, school students.*

Introduction

Over the past two decades Implicit Theories of Intelligence (ITI) (growth mindset) have gained popularity in the field of psychology and education. The construct of “Implicit theories of intelligence” was proposed by Carol Dweck (Dweck & Legget, 1988) and nowadays is closely studied in different continents in association with academic achievement of students (Costa & Faria, 2018). Programme for International Student Assessment (PISA) 2018 Results Report Volume (III) define the growth mindset as an indicator of cognitive well-being of students (OECD, 2020). Studies show that holding growth mindset is documented as a benefit for all students, particularly for those facing academic difficulties and having disadvantaged backgrounds (Claro et al., 2016).

According to a number of studies, instilling a growth mindset in students can result in greater academic achievement (Blackwell et al., 2007; Paunesku et al., 2015; Sriram, 2014). The results of

experimental studies also show positive relations between growth mindset (incremental belief) and students' achievement in school (Pepi, et. al., 2006; Robins & Pals, 2002; Stipek & Gralinski, 1996; as cited in Alesi et al., 2016). Implicit theories are a significant factor that predicts achievement in a situation when students deal with academic tasks (Dweck, 2006). Meta analytic review indicates relations between implicit theories and academic achievement of students (Costa & Faria, 2018).

Students' growth mindset positively predicts their engagement and achievement in Mathematics (Bostwick et al., 2017), higher results in final tests (Blackwell et al, 2007; Yeager & Dweck, 2012; as cited in Rissanen et al., 2019) and better achievement in reading (Alesi et al., 2016; Blackwell et al., 2007; Pepi et al., 2004). At the same time, some authors state a conflicting opinion about mindset and achievement in Mathematics, i.e. in Mathematics students more often use fixed mindset than growth mindset (Beach & Dovemark, 2007; Jonsson et al., 2012; Ilhan & Cetin, 2013; as cited in Todor, 2014).

In addition to that, controversial results are presented in academic achievement and implicit theories between different genders (Grant & Dweck, 2003; Macnamara & Rupani, 2017). Females demonstrate higher level of fixed belief in comparison with males who more often possess growth mindset (Hendriks, 2012; Diseth et al., 2014), though, female students more often demonstrate higher scores in school than males (Dweck, 2006a; Marcenaro–Gutierrez et al., 2018). Gender related differences in achievement vary between ages, e.g., differences in achievement in Mathematics are stronger in late adolescence age (Huang, 2013), particularly, in Mathematics male students report higher results (Louis & Mistele, 2012; Pajares, 1997; as cited in Todor, 2014). Gender specific differences in viewing intelligence originate in the way how parents praise their children – boys are usually praised for process, that provokes development of growth mindset (Dweck & Simmons, 2014; as cited in Macnamara & Rupani, 2017), though, girls are praised for their intellectual abilities – that is the reason why girls do not want to be challenged (Dweck, 1999). The moderator effect analysis' results conducted within meta analytic study show that the link between implicit theories and students' achievement was not moderated by gender (Costa & Faria, 2018).

Another meta analytic study demonstrates that individuals holding growth mindset possess higher level of self-efficacy (Payne et al., 2007; as cited in Cottrell, 2018), though individuals with lower level of self-efficacy possess fixed belief about malleability of intelligence (Komarraju & Nader, 2013; as cited in Zander et al., 2018).

Implicit theories appear to operate similarly in extremely different cultural settings (Hong et al., 1999). Students from Asia and Oceania demonstrated positive relations between growth mindset and achievements. Unlike on the Eastern continent, in Europe studies show that fixed mindset positively correlated with higher academic results (Costa, A. & Faria L., 2018). In Baltic countries there were not any studies conducted in reference to academic achievement of students. This research intends to fill this gap and responds to the interest of academics and researchers in searching for potential determinants and predictors of academic achievement. It also presents a relatively new concept of “implicit theories of intelligence” (ITI) and its factors – growth mindset (incremental belief) and fixed mindset (entity belief).

Implicit Theories of Intelligence – Construct Development

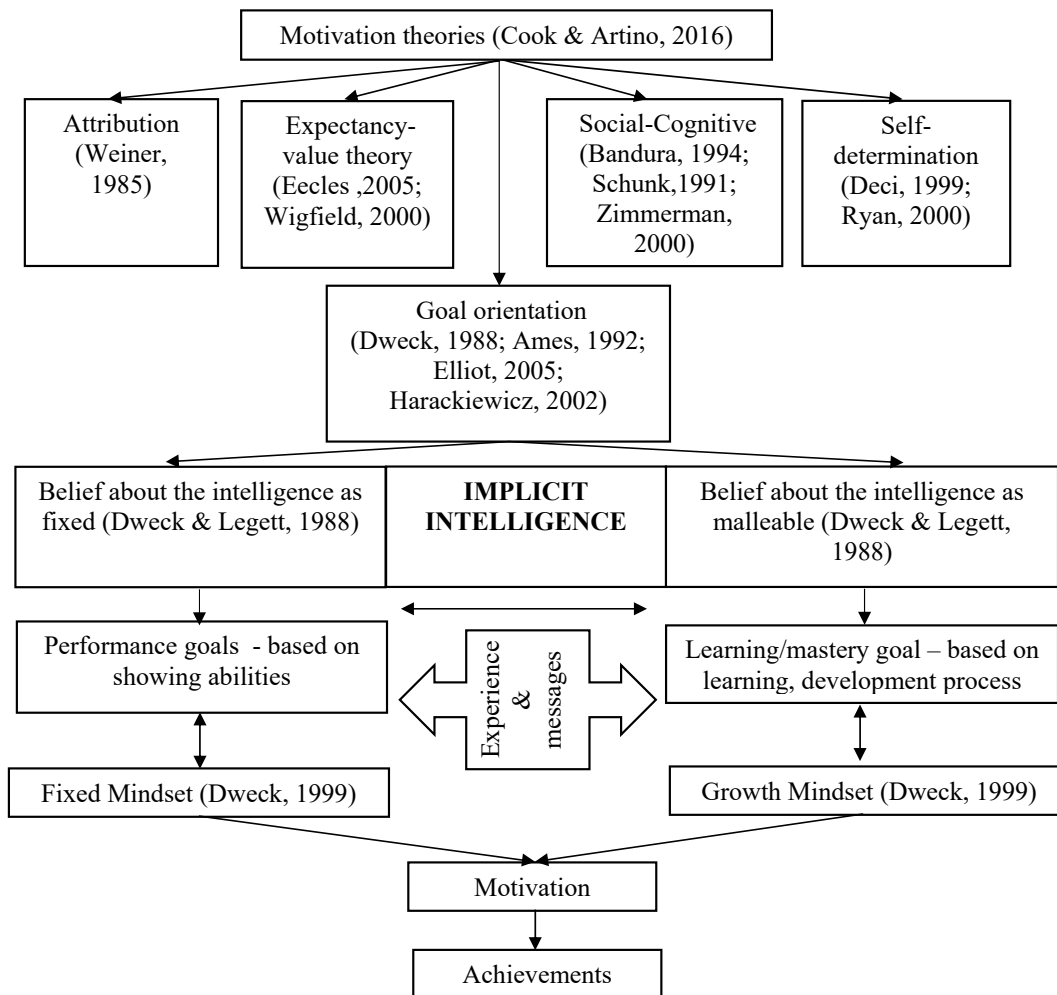
Basic beliefs of students are connected to complex meaning systems and often are unconscious, therefore, they are called “implicit” (Aronson, et al., 2002; Chen, et. al., 2008; Knee et al., 2003; Ommundsen, 2001; Tamir et al., 2007; as cited in De Castella & Byrne, 2015). Implicit theories uniquely determine students' beliefs about intelligence being malleable and differ from self-efficacy and self-concept ability that assess students' belief about their current operational capacity (Bandura, 1997; Marsh, 1990; as cited in De Castella & Byrne, 2015).

Implicit theories of intelligence have long history (Dweck & Leggett, 1988; Dweck et al., 1995; Kelly, 1995, as cited in Ferguson, 2017; Tempelaar et al., 2015). Implicit theories are individual beliefs about intelligence being malleable or fixed (Dweck, 2006). These beliefs can determine whether individuals pursue performance (willingness to look smart) or learning (desire to get smarter and learn) goals (Dweck & Leggett, 1988; Dweck, 1999). One of the models explaining the development

of the construct is presented in Figure 1. It schematically describes that implicit theories are rooted in motivation theories of goal orientation, that was used by Dweck and Legget (Dweck & Legget, 1988; Dweck, 1999) to develop the concept of implicit theories.

Figure 1

Implicit theories of intelligence - development model (Ādamsonē, 2020)



According to Dweck and colleagues (Dweck & Leggett, 1988; Dweck, 1999), who conducted numerous studies with students in the school environment, there are two different views of understanding intelligence - either being fixed (entity belief) or malleable (incremental belief). Within the time, beliefs are affected by individual experience and feedback received from others, e.g., regarding their success, failure, intellectual abilities, etc. Furthermore, beliefs determine individual goals to be either learning or performance oriented. Later, Dweck defined those beliefs as growth and fixed mindsets, thus, expanding the meaning of Mindset concept. Mindset/belief creates motivation that further determines achievement (Dweck, 1999). An individual holding entity or fixed mindset are tended to believe that intellectual abilities and skills are relatively stable (Dweck, 1999). Individuals holding incremental or growth mindset tend to believe that intelligence is malleable or changeable with an effort (Dweck, 1999).

Measures used to investigate the mindset orientation require people to report their theories about themselves or other people in general and are used to respectively predict the judgments people make about their own intelligence or of others (De Castella & Byrne, 2015; Dweck, 1999, 2016).

Research Aim

The purpose of the research was to analyse the concept of “implicit theories of intelligence” and its factors – growth and fixed mindset, investigate the relations between implicit theories and academic achievement of students, and study gender specific differences in views of intelligence. Having taken into consideration, the above theoretical assumptions and findings of previous research, conducted by Dweck and other researchers in school environment, two major studies ($N_1=258$, $N_2=165$) were conducted for the first time in the Baltic countries. To analyse the construct of implicit theories, data of two different samples ($N_1=258$, $N_2=165$) of students from seven Latvian public schools has been used.

Based on the above-mentioned theoretical assumptions and previous research findings, the following research questions have been defined for this research:

Sample 1 ($N_1=258$):

Are there relations between implicit theories and academic achievement of students?

Are there gender specific differences in implicit theories of intelligence?

Sample 2 ($N_2=165$)

Are there relations between implicit theories, academic self-efficacy and academic achievement?

Which factors (academic self-efficacy, implicit theories, gender) are greater predictors of students' academic achievement?

Research Methodology

Research Sample

Sample 1 consisted of adolescents ($N_1=258$) aged between 14 and 18, 134 females ($M=15.13$; $SD=1.29$) and 124 males ($M=15.40$; $SD=1.20$) studying in 7th – 12th grade in two Latvian schools. The average score of female participants ranged between 4-10 points, and overall score was 7.08 ($M=7.08$; $SD=1.27$). Male participants average score ranged between 4 and 9 points; the overall mean score was 6.59 ($M=6.59$; $SD=1.23$).

Sample 2 consisted of adolescents ($N_2=165$), 80 females (48.50%) and 85 males (51.50%), aged between 15 and 19 ($M=16.75$; $SD=.90$) studying in 10th-12th grade in five Latvian secondary schools. Mean total score of the sample in the fall term was 6.62 ($M=6.62$; $SD=1.05$), average score in Mathematics – 5.76 ($M=5.76$; $SD=1.77$), average score in Latvian – 6.10 ($M=6.10$; $SD=1.55$). Initially 229 questionnaires were completed by students, but only 165 questionnaires were valid for further analysis.

Note: Latvian score system in schools ranges from 1 to 10, where 1 is minimum and 10 is maximum.

Procedure

Both studies were conducted in the school environment, i.e. in Latvian public schools during the lessons time, considering permission and agreement procedure, confidentiality, and the principle of voluntary engagement. In the Study ($N_1=258$) students from two schools were approached. Students from five public schools took part in the Study ($N_2=165$). The participants were informed about the procedure and the aim of the study.

Measures

The revised implicit theories of intelligence (self-theory) scale (Ādamsone, 2020; De Castella & Byrne, 2015) was used in Study ($N_1=258$) in order to measure students' beliefs about their own

intelligence ($\alpha = .78$). In the Study ($N_2=165$) two measures were used: *Implicit Theories of Intelligence Scale for Children (ITIS)* (Blackwell et al., 2007; Gudakovska, 2020) to measure students' general beliefs about malleability of intelligence ($\alpha = .79$), and *College Academic Self-efficacy Scale (CASES)* (Gudakovska, 2020; Irbīte, 2019; Owen & Froman, 1988) to measure students' academic self-efficacy ($\alpha = .91$). In order to measure academic achievement, in both studies socio demographic questionnaires were developed to collect information about the average scores in the second half of the fall school semester in the following subjects: Mathematics, the Latvian language, and a mean total score in all subjects together.

Data Analysis

The collected data was analysed using MS Excel (2016) for Mac and SPSS 22.0. Data was analysed using descriptive and analytic statistics methods. The internal consistency (Cronbach's α s) of all measurement scales was calculated. Methods used: Spearman correlations, regression analysis (ANOVA), Mann-Whitney Test.

Research Results

Relations between Implicit Theories of Intelligence and Academic Achievement of Students

In order to investigate relations between implicit theories of intelligence and academic achievement of students ($N_1=258$), calculation of Spearman correlations was performed. The results are presented in Table 1.

Table 1

Spearman's correlation coefficient between implicit intelligence and academic achievement results

	1	2	3	4
1.ITI	--			
2. Fixed mindset	.86**	--		
3. Growth mindset	-.79**	-.41**	--	
4. Academic achievement	-.21**	-.24**	.11	--

Note. $N_1=258$; ** $p < .01$

The results of the calculation (Table 1) show statistically significant relations between the academic achievement and the total value of implicit theories ($r_s = -.21$; $p < .01$). One of its factors – fixed mindset ($r_s = -.24$; $p < .01$) correlates negatively with academic achievement.

Gender Specific Differences in Implicit Theories of Intelligence

Considering existing theoretical assumptions about gender having a moderator effect, gender specific differences in views of intelligence were investigated by performing Mann-Whitney test in Study ($N_1=258$).

Table 2

Descriptive statistics and Mann-Whitney U test results in group of females and males

Variables	Gender						U	p
	Females (n=134)			Males (n=124)				
	M	SD	Mdn	M	SD	Mdn		
ITI	20.40	6.06	21.00	18.91	5.79	18.50	6970.50	.02
Fixed Mindset	11.08	3.87	11.00	9.96	3.78	10.00	6915.00	.02
Growth Mindset	18.69	3.42	19.00	19.05	3.28	20.00	7749.50	.34

Note. Signs: M – Mean, SD – standard deviation, Mdn - median, U - criterion of Mann-Whitney

The results of the analysis show (Table 2) that in the female sample, total value of implicit theories and value of its factor - fixed mindset is higher than in the male sample. In the male sample value of the growth mindset factor is higher than in the female sample. Analysing the results (Table 2) of Mann-Whitney test, can be concluded that there are statistically significant differences in medians of the total value of the implicit theories (female $Mdn = 21$ and male $Mdn = 18.50$; $p < .05$) and the fixed mindset value (female $Mdn = 19.00$ and male $Mdn = 20.00$; $p < .05$). Although the highest value of growth mindset is not statistically significant, it indicates similarities to the previous studies (Henderson & Dweck, 1990; as cited in Hendriks, 2012).

Relations between Implicit Theories, Academic Self-efficacy and Academic Achievement

In order to investigate relations between implicit theories of intelligence, academic self-efficacy and academic achievement in sample ($N_2=165$), calculation of Spearman correlations was performed. Results are presented in Table 3.

Table 3

Spearman's correlation coefficient between implicit intelligence, academic self-efficacy and academic achievement

Variables	Average grade per semester	Average grade in Mathematics	Average grade in Latvian language
ITI	.08	.22**	.10
Academic self-efficacy	.58**	.47**	.39**

Note. $N_2 = 165$; ** $p < .01$.

The results of the calculation (Table 3) show statistically significant positive relations between the implicit theories and the academic achievement in Mathematics ($r_s(165) = .22$, $p < .01$). The academic self-efficacy correlates positively with the academic achievement - the average score ($r_s(165) = 0.58$, $p < 0.01$), achievement in Mathematics ($r_s(165) = .47$, $p < .01$) and Latvian ($r_s(165) = .47$, $p = .20 > .05$).

The results (Table 3) show that Mathematics is the only area which is relevant to analyse further for predictive relations between implicit theories, academic self-efficacy and academic achievement as there are statistically significant relations identified with both the implicit theories and the academic self-efficacy.

Predictive Relations between Implicit Theories (ITI), Academic Self-efficacy, Gender and Academic Achievement

Linear regression analysis with stepwise method was performed to examine which factors (academic self-efficacy, ITI, gender) are greater predictors of the academic achievement of students ($N_2=165$) in Mathematics (Table 4). Gender was included as a controlled variable and a possible predictor. In the process of performing analysis it was excluded as there were no significant relations identified between gender and academic achievement.

Table 4

Regression analysis of students' academic achievement in Mathematics prediction

Independent variable	B	B SE	β	F	R ²
1. step				42.83***	.21
Academic self-efficacy	1.51	.23	.46***		
2. step				24.49***	.23
Academic self-efficacy	1.44	.23	.44***		
ITI	.35	.16	.16*		

Note. $N_2=165$; * $p<.05$; ** $p<.01$; *** $p<.001$; SE - standard error. B - unstandardised regression coefficient; β - standardised regression coefficient; F - F-test value; R² -the coefficient of determination

This analysis offered two models (Table 4). The first model included only one significant factor – an academic self-efficacy, which predicted 21% of the academic achievement's variations in Mathematics ($F(165)=42.83$, $p<.001$, $R^2=.21$). The second model included two factors, i.e. an academic self-efficacy and implicit theories. Both factors together predicted 23% of academic achievement's variations in Mathematics ($F(165)=24.77$, $p<.001$, $R^2=.26$). The added value of the implicit theories is 2% ($\Delta R^2=.03$).

In the sample ($N_2=165$), academic achievement in Mathematics is most strongly predicted by academic self-efficacy (21%). The implicit theories of intelligence predict slightly more than 2% of the academic achievement in Mathematics. A higher value of the academic self-efficacy ($\beta = .44$, $\beta > 0$) and higher value of the implicit theories (growth mindset) ($\beta = .16$, $\beta > 0$) together predict higher achievement in this subject. Both factors have a significant level of prediction. 77% of students' achievement in Mathematics is predicted by other factors that are not included in this study.

Discussion

The current research has attempted to review two studies ($N_1=258$, $N_2=165$) where the authors have investigated relations between implicit theories of intelligence and students' academic achievement and studied gender specific differences in views of intelligences. The results are significant for future studies.

First of all, the findings of the research indicate some significant contradictions. The study in sample ($N_1=258$) shows a negative correlation between fixed mindset and academic achievement. It confirms the theory and coincides with the results of the previous study (De Castella & Byrne, 2015) where the authors noted that the academic achievement correlates positively with growth mindset and negatively - with fixed mindset.

The academic achievement in Mathematics positively correlates with the implicit theories in the second study ($N_2=165$). Significant relations between implicit theories, academic self-efficacy and the students' academic achievement in Mathematics, and lack of significant relations between implicit theories and academic achievements - average score and achievements in Latvian, corresponds to Dweck's previous statement (Dweck, 2016) that individuals might possess divergent implicit beliefs in different fields. This might explain the results of the study. The controversial results do not allow to draw absolute conclusions about the situation in the Baltics and Europe. Moreover,

results of both studies (n_1 , n_2) contradict the results of the meta analytic study (Costa & Faria, 2018) where the findings suggest that in Europe academic achievement is positively influenced by fixed thinking, which can also be explained by gender differences.

The results of this research coincide more with the results of the studies conducted in regions other than Europe. Therefore, the authors suggest conducting further studies to confirm or deny identified relations. The assumption of the authors is that the discrepancies in the results can be explained by the different measures used in the reviewed studies. In the research paper of De Castella and Byrne (De Castella & Byrne, 2015), it is stated that a self-belief scale more significantly predicts academic achievements than a general scale. The discrepancies can also be explained by the students' age. In accordance with the previous research, the implicit theories may dominate differently in different ages (Huang, 2013).

In the future studies it is advisable to include investigation of differences between genders. The differences are identified in one of the studies reviewed in this article and previous studies of other authors (Dweck, 2006a; Hendriks, 2012; Marcenaro-Gutierrez et al., 2018) where it is suggested that female students are tended to demonstrate higher achievements, but more often possess fixed mindset. Though, male students often demonstrate lower achievements, but possess growth mindset. It is also relevant to mention that academic achievements can be influenced by factors other than gender, e.g., attitude towards a particular subject, studies in general and a personality type (Fallan & Opstad, 2016). Therefore, while conducting a study on implicit theories and academic achievement it is suggested to control these variables, that might better explain the results and differences in academic achievements.

The results of the regression analysis show that implicit theories and academic self-efficacy significantly predict students' academic achievement in Mathematics, 2% and 21% respectively. It confirms that implicit theories are one of the factors that can improve academic achievements. The results of the study ($N_2=165$) show the influence of implicit theories only on the achievement in Mathematics, but not in Latvian and the average score of academic achievements. Further studies are necessary to investigate predictive power of implicit theories on achievement in different subjects and overall average score.

Finally, it is relevant to highlight the differences between the implicit theories and self-efficacy. Growth mindset refers to the belief that one's ability can change over time, as a result of practice, perseverance and effort. Self-efficacy is persons' belief that they can do what is necessary to perform a concrete task or achieve a result. Self-efficacy is a belief that a person can complete some task, but growth mindset is a belief that intelligence is malleable, and a person can change it (Dweck, 2006). One more aspect differentiating both constructs is that implicit theories can uniquely determine students' beliefs about the malleability of intelligence, but self-efficacy is an ability to assess perceptions of current operational abilities (Bandura, 1997; De Castella & Byrne, 2015; Marsh, 1990;). The findings of both studies emphasize the assumption that the role of implicit theories in educational environment will significantly grow over the time.

Research Limitations

The research has its limitations. First of all, only two studies have been reviewed involving different schools – the results do not reflect the situation in the whole country. Moreover, it is not possible to generalise and apply the results to the European or the Baltic States level as only one country was involved in the research. Secondly, different measures were used in Studies (N_1 and N_2). The age in the students' samples was different. Furthermore, measurement of the academic achievement in the longer term was not included. Socio-demographic factors, that might influence results and explain students' achievement, were not controlled. Finally, the measurements used in the research encompass subjective responses, which decreases the level of results objectivity.

Conclusions

The interest of academics and researchers in searching for potential determinants and predictors of academic achievement for a long time has been one of the key research issues in the field

of psychology and education. This research has analysed a relatively new factor “implicit theories of intelligence” and its two factors - growth and fixed mindset - that refer to an individual belief about malleability of intelligence and determine academic outcomes.

The findings of the research suggested that the construct of implicit theories along with academic self-efficacy is as a significant factor that predicts the academic achievement of the students in Mathematics. Although a predictive power of the academic self-efficacy is stronger (21%) than of the implicit theories (slightly more than 2%), the results are significant to assume that the implicit beliefs about malleability of intelligence might determine academic achievements of students in this subject, and, therefore, has to be further studied. It is relevant to mention, that the academic achievements were partly predicted by the self-efficacy and the implicit theories, which means that 77% of students’ achievement in Mathematics are predicted by other factors that are not included in this study, e.g. the type of personality, gender, socio-demographic factors, motivation and other.

The results of the studies have revealed relations between implicit theories and academic achievements that do not coincide with each other. The relations to overall average score have been identified in one study, but findings of another study have suggested relations only with average score in Mathematics. Further research is needed to investigate a possible effect of the implicit theories on the academic achievement of students, including relations to overall achievement (average score) and achievements in different subject. There are already studies conducted in the field, indicating differences in effect of implicit theories on academic achievement in different subjects (Mathematic, Science, the native language, Social Sciences), age and grade related differences, and gender differences in viewing intelligence on different geographical continents.

This research has found out that there are relations between the implicit theories and the academic achievement but has not investigated the longitudinal effect of the implicit theories’ intervention on the academic achievement over an academic year. The implicit theories are affected within the time and experience an individual obtains, therefore, there is a need to conduct studies with longitudinal and experimental design in order to more explicitly investigate the dynamics of change and relations with the academic achievement.

Moreover, the research has not analysed the role of the teacher, their mindset and the way how they praise students, but the authors assume that these variables might influence the judgments that the students make about their own intelligence and the one of the others. As the feedback received from the others affects the implicit beliefs, to further research how the mindset possessed by the teacher influences the implicit beliefs of the students.

To sum up, the authors would like to assume that, despite all the discrepancies in the findings, further research on the implicit theories in educational environment is crucial to explore the potential of the construct, and further develop efficient support systems for students’ learning, increase the rates of academic achievements and decrease the number of students dropping out from schools in the Baltic States.

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Received: April 10, 2020

Accepted: June 09, 2020

Cite as: Adamsone, I., Gudakovska, N., & Svence, G. (2020). Implicit theories of intelligence and academic achievement: Review of two studies in Latvia. *Problems of Psychology in the 21st Century, 14*(1), 7-17. <https://doi.org/10.33225/ppc/20.14.07>

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