The Relationship between Academic Achievement, Self-Efficacy, Implicit Theories and Basic Psychological Needs Satisfaction among University Students

SCHOLARONE™
Manuscripts

The Relationship between Academic Achievement, Self-Efficacy, Implicit Theories and

Basic Psychological Needs Satisfaction among University Students

Abstract

There is limited research regarding university students' academic achievement and what

influences it. We argue that university students' academic achievement could be influenced

by different factors to those observed for schoolchildren. We investigated whether university

students' beliefs about intelligence ('implicit theories'), self-efficacy and basic psychological

needs satisfaction could explain their academic achievement. 203 students completed

measures of implicit theories, self-efficacy and basic psychological needs, and provided their

course grades via an online survey tool. Structural equation modelling was used to analyse

the data. University students' implicit theories were indirectly associated with their academic

achievement via self-efficacy. Basic psychological needs satisfaction was positively

associated with self-efficacy and there was an indirect relationship between basic

psychological needs satisfaction and academic achievement. Theories regarding the

relationship between implicit theories and academic achievement need to be amended to

account for the role of self-efficacy and basic needs satisfaction for adult learners.

2

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Introduction

There has been much attention paid to the literature on implicit theories of ability (also known as 'growth mindset') and the promise of this simple conceptualisation for better understanding some of the barriers to children's academic engagement and achievement. Specifically Carol Dweck (2000) proposed that students may hold either an incremental mindset or an entity mindset (also referred to as 'growth' and 'fixed' mindset). This theoretical position proposes that individuals who believe in an entity theory of ability or who have 'fixed mindset' see ability as a stable trait: that is, 'able' individuals are successful, and those with less ability cannot substantially influence their academic outcomes. In contrast, individuals with incremental or growth mindsets believe that is it possible to develop ability through conscious effort and learning (Dweck, 2010). The relationship between these implicit theories of ability and academic achievement has been tested empirically and there is some evidence that they could be causally linked. For example, Blackwell, Trzesniewski and Dweck (2007) found that incremental beliefs were not only associated with better academic achievement among 7th-grade schoolchildren, but when children's fixed mindsets were changed to growth mindsets, their grades improved relative to controls.

However, there is less research regarding the relationship between mindset and university students' academic achievement, and the results from this literature are less encouraging. Bahník and Vranka (2017) found no relationship between academic achievement and implicit theories in a sample of more than 5,000 university students. However, their participants' concurrent academic achievement was not tested – instead the analysis was based on the results of a scholastic aptitude test taken before university admission. Similarly, Macnamara and Rupani (2017) found that incremental beliefs among university students had no significant relationship to academic outcomes. However, Macnamara and Rupani assessed the highest level of education achieved by their participants,

3

and as such, the implicit theories of their participants were not assessed while they were studying, but retrospectively.

We argue that perhaps one of the reasons why the literature on university students' implicit theories of intelligence is equivocal is because mindset might only influence the academic achievement of adult students indirectly, for example by influencing their self-regulation, which in turn influences their academic achievement. This is because adult students (unlike schoolchildren) are not participating in mandatory education and have a greater need for self-motivation in order to complete their work. For example, Burnette, O'Boyle, VanEpps, Pollack and Finkel's (2013) meta-analysis found that implicit theories were related to academic achievement mostly indirectly via self-regulatory processes. Therefore, the first aim of this study was to investigate whether implicit theories affect university students' academic achievement directly, or indirectly through other psychological factors. In this paper we focus on two such factors which seem of particular relevance to those undertaking study at university level: self-efficacy and basic psychological needs satisfaction.

Self-efficacy refers to a person's beliefs about his / her own ability to perform and achieve goals (Bandura, 1997). Self-efficacy is shaped by learning from ones' environment through several cognitive processes, which then leads to ones' beliefs about one's own performance. These beliefs then guide one's actions, and the higher self-efficacy one possesses, the better one deals with everyday situations (e.g. Wright, Jenkins-Guarnieri & Murdock, 2013), and self-efficacy has long been considered a predictor of academic achievement (e.g., Feldman & Kubota, 2015; Vuong, Brown-Welty & Tracz, 2010). Self-efficacy is different from implicit theories of ability, in that implicit theories are beliefs regarding the nature of ability in general, whereas self-efficacy is a belief regarding one's own ability. As Bandura (1997) explained, self-efficacy might guide one's actions in adverse

4

situations, as a belief in one's own ability is constant. Therefore, self-efficacy should be considered a possible mediating factor between implicit theories of belief and academic achievement. Taberno and Wood (1999) found that implicit theories can influence academic achievement in an indirect way. They found that university students who had incremental beliefs could develop a stronger sense of self-efficacy, which in turn impacted academic achievement.

Unlike schoolchildren, university students may also be taking care of themselves without the support of their parents and friends for the first time, which can change their psychological state (e.g. Guay, Ratelle & Canal, 2008). BPNS theory suggests that we need to satisfy basic psychological needs of *competency, relatedness* and *autonomy* (Deci & Ryan, 2000; Deci & Ryan, 2008). *Competence* represents the ability to perform and to control outcomes. *Autonomy* represents the need to be able to control one's life. *Relatedness* represents a connection to others. It is suggested that competency, relatedness and autonomy are fundamental needs, which, if not satisfied, can affect students' functioning. For example, Cordeiro, Paixao, Lacante and Luyckx (2015) argued that if these needs are not fulfilled, individuals are more prone to low wellbeing and depression, which can then affect achievement. Similarly, Trenshaw, Revelo, Earl & Herman (2016) found that students who had higher BPNS had higher academic achievement, and relatedness was especially important. Autonomy has also been linked to course drop out (Hardré & Reeve, 2003; Ratelle, Larose, Guay & Senecal, 2005). Theoretically speaking, BPNS should have an effect on self-efficacy; if BPNS is not fulfilled, cognitive functioning, and consequently self-efficacy should be affected (Bandura, 1997). For that reason, BPNS is proposed as a factor that drives self-efficacy

Rationale

5

We argue that BPNS could be a predictor of how one thinks about oneself and one's abilities. Specifically, self-efficacy could be affected by whether basic psychological needs are satisfied (Diseth et al., 2012). No research to date has tested a model that considers both self-efficacy and BPNS with regards to accounting for individual differences in academic achievement among university students. As BPNS is a construct that directly affects inner motivation (Levesque, Zuehlke, Stanek & Ryan, 2004), it could be that it will influence self-efficacy, rather than having a direct effect on students' academic achievement.

As a result, we predicted that:

1. University students' implicit theories will be indirectly related to academic achievement via self-efficacy.

2. The more that an individual's basic psychological needs are satisfied, the higher that person's self-efficacy will be.

3. There will be an indirect relationship between BPNS and academic achievement via self-efficacy.

University students from a range of UK universities were asked to participate in a survey. Their grades, self-efficacy, implicit theories of ability and how well their basic psychological needs were satisfied were measured. The present study is exploratory as this paper represents the first study to consider these multiple factors in a single analysis.

Method

Design

A cross-sectional correlational design was employed to test the stated hypotheses. For the analysis, confirmatory factor analysis and structural equation modelling was used, as the model (see Figure 1) consisted of two latent constructs. Structural equation modelling was used as it can address the hypotheses in the most efficient and accurate way, unlike other

6

techniques. It also allows the testing of higher constructs such as BPNS, which has three subscales, without breaking it into 3 parts and testing them separately. This way, BPNS can be treated as a whole, where hypotheses, as well as factor loadings and measurement model, can be tested simultaneously in a more coherent way. The final model (see Figure 1) consisted of two latent variables, namely, implicit theories and BPNS, and 2 observed variables, namely, academic achievement and self-efficacy.

Participants

203 participants (males = 51, females = 148, and 4 not specified) were recruited using purposeful sampling. It should be noted that 100 to 150 participants are sufficient to test hypotheses with 4 latent variables and for the model to reach convergence (Sideridis, Simos, Papanicolaou & Fletcher, 2014; Iacobucci, 2010; Gerbing & Anderson 1985). In fact, Iacobucci (2010) suggested, based on a series of experiments, that whether the sample size is 100 or 1000, the fit indices remain unchanged. Of the 203 participants 82.7% (n=168) were British, 9.4% (n=19) originated from one of the EU states, 6.4% (n=13) were from rest of the world, and 0.9% (n=2) participants were of dual nationality. Participants' ages ranged between 18 and 59 years (mean = 24.6, SD = 7.5). Participants were recruited from a number of UK universities (all were current students in various year of study), by emailing school directors and lecturers asking if they would like to help with the study by sending a survey link to students and asking them to participate in the study. For this reason, response rate was not recorded. There were no exclusion criteria, and the only requirement (inclusion criterion) was for participants to be studying at undergraduate or postgraduate level at the time they completed the survey.

Instruments

Self-efficacy scale (SES)

7

The SES was obtained from the International Personality Item Pool web page (Goldberg, 1999), and originates from the revised version of the NEO Personality Inventory (Costa & McCrae, 1992). It contained 10 questions regarding self-efficacy, and it assessed level of self-belief in one's ability to succeed. An example question would be "Complete tasks successfully". The scale was scored on a 5-point Likert scale ranging from 1 (very inaccurate) to 5 (very accurate) where the higher participants scored, the higher their self-efficacy was regarding their abilities, and the total scale score was treated as a continuous in the analysis. Four questions (7, 8, 9, 10) were in reverse form and were reverse scored before the analysis. SES has been shown to have a good internal consistency (α = .78), convergent validity, discriminant validity and criterion validity (Maples, Guan, Carter & Miller, 2014).

Implicit theories of Intelligence scale (ITIS)

ITIS was taken from Dweck (2000) and measured how one thinks of intelligence and whether intelligence is stable or malleable. ITIS consists of 8 statements such as "Your intelligence is something about you that you can't change very much" and was scored on a 6-point Likert scale ranging from 1 (strongly agree) to 6 (strongly disagree). Four statements (3, 5, 7, 8) were in reverse form and were reverse scored before the analysis. The higher participants scored, the more likely they held incremental beliefs. ITIS has shown to have a good internal consistency (alpha ranged from .88 to .89) and validity (Levy, Stroessner & Dweck, 1998; Grant & Dweck, 2003).

Basic psychological needs satisfaction scale (BPNS)

The BPNS scale (Deci & Ryan, 2000; Gagné, 2003) was obtained from the self-determination theory web page (SDT, 2018). It contained 21 statements that measured basic psychological needs needed for optimal functioning and motivation, and it consisted of three subscales: *autonomy* (7 statements), *competence* (6 statements) and *relatedness* (8 statements). Each statement was scored on a 7-point Likert scale ranging from 1 (not at all

8

true) to 7 (very true) where the higher the participants scored, the higher their psychological needs were met. Nine statements were in reverse form and were reverse scored before the analysis. The total scale score for each subscale was calculated. The BPNS scale has shown to have a good internal consistency $\alpha = .69$ for autonomy, $\alpha = .71$ for competence, and $\alpha = .86$ for relatedness (Gagné, 2003). Moreover, Wei, Shaffer, Young and Zakalik (2005) reported an internal consistency of $\alpha = .90$ for the overall score.

Academic achievement

Participants reported their grades from term one of the academic year they undertook the survey in (2017/2018). Before the analysis, all the grades were converted into percentages using numerical equivalents used in most UK universities. Grade percentages for each student were averaged to obtain each participant's final percentage, and this was used for the analysis.

Procedure

Ethical approval for this research was granted by the University Ethics Committee and the research was conducted in line with British Psychological Society ethical guidance for conducting research with human participants. Our participants took part in the study online through a Qualtrics link; participation was voluntary, and participants were not reimbursed for participation. Prior to the survey, information was provided that explained what the study was about. All participants had to be over the age of 18 and give informed consent, after which they were given instructions about how to complete the survey. They provided basic demographic information, answer questions regarding their studies, provide grades achieved in term one of the current academic year, and fill in the four questionnaires. At the end, participants were debriefed.

Analytic Strategy

9

Structural equation modelling (SEM) was performed using the R programming language (R Core Team, 2013), where the Lavaan package (Rosseel, 2012) was used. SPSS (IBM Corp., 2013) was also used for basic data cleaning and organisation purposes.

The first step in the analysis was to obtain Cronbach's alpha for each scale to ensure that they had good internal consistency. The second step was to perform a Confirmatory Factor Analysis (CFA) to test the structure of the BPNS and ITIS scales. That is, BPNS should load into three factors, namely, competence, relatedness and autonomy (Cordeiro, Paixão, Lens, Lacante & Sheldon, 2016), and ITIS should load into two factors (De Castella & Byrne, 2015). Even though Dweck (2000) suggests that one-factor solution should be the best fit, other researchers have reported that the ITIS shows a better fit and higher structure when it is split into two factors, namely, incremental and entity beliefs (De Castella & Byrne, 2015). SES was not tested as extensive literature research suggests a one-factor structure for the scale. The third step in the analysis was to perform CFA to ensure that the measurement model was satisfactory as indicated by the fit indices and factor loadings for latent variables (see Fig. 1 where latent variables are in a circle, and observed variables are in rectangles). Moreover, the covariance between all variables was inspected. The fourth step was to perform SEM to test the first hypothesis. Finally, the Casual Step Approach test was performed, to see whether there was an indirect relationship between the implicit theories latent construct and academic achievement through self-efficacy, and between BPNS latent construct and academic achievement via self-efficacy.

To assess model fit in either CFA or SEM, five goodness of fit indices were used and were based on Weston and Gore's (2006) cut-off recommendations. These were: Comparative Fit Index (CFI) value >.90; Tucker-Lewis Index (TLI) value >.90; The Root Mean Square Error of Approximation (RMSEA) value < .08; Standardized Square Root Mean Residual (SRMR) value <.08; and Chi-squared ($\chi2$) with non-significant value. The Full Information Maximum

10

Likelihood (FIML) estimator, which is an extension of the Maximum Likelihood (ML) estimator, was used due to missing data in the sample (Beaujean, 2014). Throughout the analysis, only factor loadings and structural paths in standardised form are reported, to permit for comparison between variables, and how they vary, based on one standard unit of increase. In the analysis, factor loadings are signified by λ, and structural paths by β.

Results

Participants who did not provide grades were excluded from the study (n = 20). The normality of the data was tested in the R programming language. Specifically, the GVLMA function (Pena & Slate, 2006) was used, where global test values were measured as well as skewness, kurtosis and heteroscedasticity. Eight outliers were detected and excluded from the study. Subsequently, the test was re-run and all the normality assumptions were acceptable.

Moreover, the variance inflation factor (VIF) test was performed to check multivariate normality as this factor is important when using the FIML estimator. All VIF values were between 1 and 2.2, which is an acceptable level.

Missing data were inspected, and participants who did not complete two or more questionnaires (n = 4) were excluded from further analysis. At the end, 171 participants' data were analysed where missing data was less than 10% (Schlomer, Bauman & Card, 2010). SES accounted for 2.3% (n = 4) of missing data and BPNS for 6.4% (n = 11) of missing data. ITIS had no missing data. Table 1 shows the mean and standard deviation for each variable. It should be noted that a sample of 100 to 150 participants is sufficient to test hypotheses with four latent variables and for the model to reach convergence (e.g. see Sideridis, Simos, Papanicolaou & Fletcher, 2014; Iacobucci, 2010).

Based on data from the participants in the current study all scales showed good internal consistency: ITIS (8 items) α = .90, SES (10 items) α = .82, and BPNS α = .87

11

overall, and .79, .67 and .78 for autonomy (7 items), competency (6 items) and relatedness (8 items), respectively. Internal consistency of scales was close to those reported by previous research (see Instruments section).

Confirmatory Factor Analysis (CFA) was performed to see which structure of ITIS and BPNS scales was most appropriate. First, the BPNS scale was evaluated only with one factor and then with a three-factor structure. As it can be seen in Table 2, the model with three factors had better fit indices, however, neither of them had satisfactory fit indices to proceed to the next step. For that reason, factor loadings were evaluated. It was found that some of the items had small factor loadings <.40, and for that reason, 9 items were deleted. After deleting 9 items, fit indices improved indicated that the three-factor solution was a better fit than the one-factor solution. Next, the ITIS factor structure was evaluated as other researchers have found that splitting the scale into two factors (incremental and entity) is a better solution than one factor (De Castella & Byrne, 2015). Fit indices for ITIS can be found in Table 2, and as can be seen, the two-factor solution was better than the one-factor solution.

CFA was performed, and fit indices were good: $\chi^2(10) = 18.64$, p = .045; CFI = .96; TLI = .93; RMSEA = .07; SRMR = .05. Factor loadings and covariance for the measurement model, are shown in Figure 1.

A structural equation model was generated and overall the model had good fit indices: $\chi^2(11) = 18.76$, p = .07; CFI = .97; TLI = .94; RMSEA = .07; SRMR = .06. As illustrated in Figure 2, we found that implicit theory beliefs significantly predicted self-efficacy ($\beta = .19$, p<.01), as did BPNS ($\beta = .37$, p<.001), and self-efficacy significantly predicted academic achievement ($\beta = .26$, p<.01). We also found that implicit theories did not significantly predict academic achievement ($\beta = -.04$, p = .62).

12

The indirect relationship between implicit theories and academic achievement via self-efficacy had good fit indices: $\chi2(11) = 20.01$, p = .07; CFI = .97; TLI = .94; RMSEA = .07; SRMR = .06. It was found that an indirect effect of ITIS on academic achievement through self-efficacy was observed (β = .01, p = .62 for a direct relationship between ITIS and academic achievement, and β = .05, p = .04 for an indirect relationship via self-efficacy).

Furthermore, when a path between BPNS and academic achievement was added, model fit indices remained good: $\chi2(10) = 18.64$, p = .05; CFI = .96; TLI = .93; RMSEA = .07; SRMR = .06. An indirect effect of BPNS on academic achievement via self-efficacy was supported (β = -.03, p = .73 for a direct relationship between BPNS and academic achievement, and β = .05, p = .04 for an indirect relationship via self-efficacy).

Discussion

We examined whether implicit theory beliefs, self-efficacy and basic psychological needs satisfaction (BPNS) can explain individual differences in UK university students' concurrent academic achievement. As expected, and in line with other studies (e.g., Bahník & Vranka, 2017; Macnamara & Rupani, 2017), implicit theories were not directly related to adult students' academic achievement. Instead, we found that implicit theories indirectly influenced academic achievement via self-efficacy. Specifically, incremental beliefs were related to enhanced self-efficacy, which were then positively related to academic achievement. In contrast, participants' entity beliefs were associated with lower self-efficacy, which was then negatively associated with academic achievement.

The indirect relationship between academic achievement and implicit theories found in this study represents a challenge to theoretical narratives such as those associated with child populations, which suggest that implicit beliefs will directly influence academic achievement. Based on our findings, we argue that a modification of Dweck's model is

13

required for adult learners, which identifies the important role of basic psychological needs satistisfaction and self-efficacy. Additional studies exploring the relationship between implicit theories and university students' academic achievement should measure indirect as well as direct relationships, as if this is omitted, it might provide a misleading conclusion (e.g. see, Macnamara & Rupani, 2017). However, they should also be conducted longitudinally, rather than concurrently, as was the case in this study.

Part of our analysis considered whether BPNS is related to self-efficacy in university students. We found a positive relationship between basic psychological needs scores and self-efficacy, supporting previous research findings (e.g., Diseth et al., 2012). Moreover, we found that autonomy loaded into the BPNS latent variable very strongly ($\lambda = .92$) which suggests that in order to have basic psychological needs satisfied university students must be able to have some control over their student experience. This links with a literature which has found autonomy to be linked to increased likelihood of students failing to complete their studies (Hardré & Reeve, 2003). Although, Trenshaw et al. (2016) previously found relatedness to be the most important factor, they did find that autonomy and relatedness were more important than competency needs, which was also found here.

We found that BPNS had no direct effect on academic achievement among university students, only an indirect one, via self-efficacy. Studies investigating BPNS rarely report a direct relationship with academic achievement (e.g., Cordeiro et al., 2015). However, BPNS, has not been previously considered to be potentially an indirect predictor of academic achievement in the way observed here. It can be argued, that if BPNS is not satisfied, students will have lower wellbeing (Cordeiro et al., 2015) and will be prone to lower mood (Gander, Proyer & Ruch, 2016), which can lead to lower self-efficacy (Diseth et al., 2012). Lower self-efficacy has been found previously to be related to poorer academic achievement (e.g., Feldman & Kubota, 2015).

14

Limitations

Although our sample size was big enough to test the hypotheses, it did not allow us to also assess whether demographic factors (e.g. age, gender, nationality and economic background), specific course being studies (e.g., business, psychology) and year of study influenced the data. It would be good to see how different course cohorts differ in terms of self-efficacy and mindset. As Dweck (2000) found, implicit theories are not the same in different areas of the life, and one can hold different beliefs regarding their abilities being changeable in different areas of life. Nonetheless, an important strength of this study was that participants were not from the same university but drawn from numerous universities. In further research, it would be good to see whether educators' implicit theories influence those of their students and their subsequent achievement. As Auten (2013) suggested, educators' implicit theories play an important role in students' academic achievement, how they perceive students, and even whether students finish their degree successfully.

Further studies should also address an important limitation of this initial exploratory study, which is the use of self-reported grades. Future studies would benefit from universities' help in providing accurate grades obtained by the students who would agree to take part in the study. Although, we expect that most of the participating students reported their true grades, we acknowledge the possibility that students may have misreported them. Also, some students reported more grades than others (because of variation in course content and structure across universities and courses) and so this introduces additional potential error into the dependent variable we used here.

Furthermore, Dweck (2015) observed that sometimes people state that they have a growth mindset but act otherwise. Similarly, Sun (2018) found that sometimes teachers associate themselves with incremental theory beliefs when asked, but in reality, they treat

15

their students as entity theorists would. It could be that what students report is not necessarily consistent with their actions, or they misrepresented or misunderstood their implicit theories of intelligence. For this reason, techniques for observing and interpreting students' behaviours or decision making in relation to implicit theories should be developed to triangulate scale-based responses. It was also noted by Lüftenegger and Chen (2017) that current implicit theory measures are not satisfactory and do not reflect participants' beliefs. They have suggested implicit association tests and the use of the virtual environments to determine the true implicit theories beliefs held by research participants.

Conclusion

This study found that the relationship between university students' implicit theories of intelligence and academic achievement is indirect via self-efficacy, and as such it differs from that of schoolchildren (e.g., Blackwell et al., 2007). It was also found that BPNS is related to enhanced self-efficacy. Moreover, it was found that BPNS is an important factor in explaining university students' academic achievement, not just because it enhances self-efficacy but because it also has an indirect effect on university students' academic achievement via self-efficacy. This study is the first to examine these factors in combination in relation to university students.

<div align="center">

References

</div>

Auten, M. A. (2013). Helping Educators Foster a Growth Mindset in Community College

    Classrooms. Walden Dissertations and Doctoral Studies. *ProQuest LLC*.

Bahník, Š., & Vranka, M.A. (2017). Growth mindset is not associated with scholastic

    aptitude in a large sample of university applicants. *Personality and Individual*

    Differences, 117, 139-143. https://doi.org/10.1016/j.paid.2017.05.046.

16

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist, 37(2),* 122-147. http://dx.doi.org/10.1037/0003-066X.37.2.122.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.

Beaujean, A.A. (2014). *Latent variable modeling using R: A step-by-step guide*. Routledge.

Blackwell, L.S., Trzesniewski, K.H., & Dweck, C.S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, *78(1),* 246-263. https://doi.org/10.1111/j.1467-8624.2007.00995.x.

Burnette, J.L., O'Boyle, E.H., VanEpps, E.M., Pollack, J.M., & Finkel, E.J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, *139(3),* 655-701. http://dx.doi.org/10.1037/a0029531.

Caspi, A., Roberts, B.W., & Shiner, R.L. (2005). Personality development: Stability and change. *Annual Review of Psychology, 56*, 453-484. https://doi.org/10.1146/annurev.psych.55.090902.141913.

Cordeiro, P.M., Paixão, M.P., Lens, W., Lacante, M., & Luyckx, K. (2015). Cognitive-motivational antecedents of career decision-making processes in Portugese high school students: A longitudinal study. *Journal of Vocational Behavior*, *90*, 145-153. https://doi.org/10.1016/j.jvb.2015.08.005.

Cordeiro, P., Paixão, P., Lens, W., Lacante, M., & Sheldon, K.M. (2016). Factor structure and dimensionality of the balanced measure of psychological needs among Portuguese high school students: Relations to well-being and ill-being. *Learning and Individual Differences*, *47*, 51-60. https://doi.org/10.1016/j.lindif.2015.12.010.

Costa, P.T. Jr., & McCrae, R.R. (1992). Revised NEO Personality Inventory (Neo-PI-R) and NEO Five-Factor Inventory (NEO-FFI): Professional manual. *Odessa, FL: Psychological Assessment Resources*.

17

De Castella, K., & Byrne, D. (2015). My intelligence may be more malleable than yours: The revised implicit theories of intelligence (self-theory) scale is a better predictor of achievement, motivation, and student disengagement. *European Journal of Psychology of Education, 30(3),* 245-267. https://doi.org/10.1007/s10212-015-0244-y.

Deary, I.J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence, 35(1*), 13-21. https://doi.org/10.1016/j.intell.2006.02.001.

Deci, E.L., & Ryan, R.M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11(4),* 227-268. https://doi.org/10.1207/S15327965PLI1104_01.

Deci, E.L., & Ryan, R.M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology, 49(1),* 14-23. http://dx.doi.org/10.1037/0708-5591.49.1.14.

Diseth, Å., Danielsen, A.G., & Samdal, O. (2012). A path analysis of basic need support, self-efficacy, achievement goals, life satisfaction and academic achievement level among secondary school students. *Educational Psychology*, *32*(3), 335-354. https://doi.org/10.1080/01443410.2012.657159.

Diseth, Å., Meland, E., & Breidablik, H.J. (2014). Self-beliefs among students: Grade level and gender differences in self-esteem, self-efficacy and implicit theories of intelligence. *Learning and Individual Differences, 35,* 1-8. https://doi.org/10.1016/j.lindif.2014.06.003.

Dweck, C.S. (2000). *Self-Theories: Their Role in Motivation, Personality, and Development*. Essays in Social Psychology.

Dweck, C.S. (2010). Mindset. (2017, December 5). Retrieved from https://mindsetonline.com/whatisit/about/

18

Feldman, D.B., & Kubota, M. (2015). Hope, self-efficacy, optimism, and academic

achievement: Distinguishing constructs and levels of specificity in predicting college

grade-point average. *Learning and Individual Differences, 37*, 210-216.

https://doi.org/10.1016/j.lindif.2014.11.022.

Furr, M. (2011). *Scale construction and psychometrics for social and personality psychology*.

SAGE Publications Ltd.

Gander, F., Proyer, R.T., & Ruch, W. (2016). Positive psychology interventions addressing

pleasure, engagement, meaning, positive relationships, and accomplishment increase

well-being and ameliorate depressive symptoms: a randomized, placebo-controlled

online study. *Frontiers in psychology*, 7, 686-698.

https://doi.org/10.3389/fpsyg.2016.00686.

Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial

behavior engagement. *Motivation and Emotion, 27*, 199-223.

https://doi.org/10.1023/A:1025007614869.

Grant, H., & Dweck, C.S. (2003). Clarifying achievement goals and their impact. *Journal of

personality and social psychology, 85(3)*, 541-553. http://dx.doi.org/10.1037/0022-

3514.85.3.541.

Gerbing, D.W., & Anderson, J.C. (1985). The effects of sampling error and model

characteristics on parameter estimation for maximum likelihood confirmatory factor

analysis. *Multivariate Behavioral Research, 20*, 255-271.

https://doi.org/10.1207/s15327906mbr2003_2.

Goldberg, L.R. (1999). The Curious Experiences Survey, a revised version of the

Dissociative Experiences Scale: Factor structure, reliability, and relations to

demographic and personality variables. *Psychological Assessment, 11*, 134-145.

http://dx.doi.org/10.1037/1040-3590.11.2.134.

19

Guay, F., Ratelle, C.F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role

of self-determination in education. *Canadian Psychology, 49(3),* 233-240.

http://dx.doi.org/10.1037/a0012758.

Hardré, P.L., & Reeve, J. (2003). A motivational model of rural students' intentions to persist

in, versus drop out of high school. *Journal of Educational Psychology, 95*, 347-356.

http://dx.doi.org/10.1037/0022-0663.95.2.347.

Iacobucci, D. (2010). Structural equations modeling: Fit indices, sample size, and advanced

topics. *Journal of Consumer Psychology*, *20*(1), 90-98.

https://doi.org/10.1016/j.jcps.2009.09.003.

IBM Corp. released in 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY:

IBM Corp.

Kline, R.B. (2015). *Principles and practice of structural equation modeling*. Guilford

publications.

Levesque, C., Zuehlke, A.N., Stanek, L.R., & Ryan, R.M. (2004). Autonomy and competence

in German and American university students: A comparative study based on self-

determination theory. *Journal of Educational Psychology*, 96(1), 68-84.

http://dx.doi.org/10.1037/0022-0663.96.1.68.

Levy, S.R., Stroessner, S.J., & Dweck, C.S. (1998). Stereotype formation and endorsement:

The role of implicit theories. *Journal of Personality and Social Psychology, 74(6),*

1421-1436. http://dx.doi.org/10.1037/0022-3514.74.6.1421.

Lüftenegger, M., & Chen, J.A. (2017). Conceptual issues and assessment of implicit

theories. *Zeitschrift für Psychologie*, *225*(2), 99-106. http://dx.doi.org/10.1027/2151-

2604/a000286.

Macnamara, B.N., & Rupani, N.S. (2017). The relationship between intelligence and mindset.

Intelligence, 64, 52-59. https://doi.org/10.1016/j.intell.2017.07.003.

20

Maples, J.L., Guan, L., Carter, N.T., & Miller, J.D. (2014). A test of the International

Personality Item Pool representation of the Revised NEO Personality Inventory and

development of a 120-item IPIP-based measure of the five-factor model.

Psychological Assessment, 26(4), 1070-1084. http://dx.doi.org/10.1037/pas0000004.

Pena, E.A and Slate, E.H (2006). Global validation of linear model assumptions

J.\ Amer.\ Statist.\ Assoc., 101(473):341-354.

R Core Team (2013). R: A language and environment for statistical computing. R Foundation

for Statistical Computing, Vienna, Austria. Retrieved from URL http://www.R-

project.org/

Ratelle, C.F., Larose, S., Guay, F., & Senecal, C. (2005). Perceptions of parental involvement

and support as predictors of college students' persistence in a science curriculum.

Journal of Family Psychology, 19, 286-293. http://dx.doi.org/10.1037/0893-

3200.19.2.286.

Roberts, B.W., & Mroczek, D. (2008). Personality trait change in adulthood. *Current*

Directions in Psychological Science, 17, 31-35. https://doi.org/10.1111/j.1467-

8721.2008.00543.x.

Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modelling. *Journal of*

Statistical Software, 48(2), 1-36.

Schlomer, G. L., Bauman, S., & Card, N.A. (2010). Best practices for missing data

management in counseling psychology. *Journal of Counseling psychology*, *57*(1), 1-

10. http://dx.doi.org/10.1037/a0018082.

SDT. (2018, January 25) Retrieved from http://selfdeterminationtheory.org/basic-

psychological-needs-scale/

Sideridis, G., Simos, P., Papanicolaou, A., & Fletcher, J. (2014). Using structural equation

modeling to assess functional connectivity in the brain: Power and sample size

considerations. *Educational and psychological measurement, 74(5),* 733-758. https://doi.org/10.1177/0013164414525397.

Tabernero, C., & Wood, R.E. (1999). Implicit theories versus the social construal of ability in self-regulation and performance on a complex task. *Organizational behavior and human decision processes*, *78*(2), 104-127. http://dx.doi.org/10.1006/obhd.1999.2829.

Trenshaw, K.F., Revelo, R.A., Earl, K. A., & Herman, G.L. (2016). Using self-determination theory principles to promote engineering students' intrinsic motivation to learn. *International Journal of Engineering Education*, *32*, 1194-1207.

Vuong, M., Brown-Welty, S., & Tracz, S. (2010). The effects of self-efficacy on academic success of first-generation college sophomore students. *Journal of college student development, 51(1),* 50-64. http://dx.doi.org/10.1353/csd.0.0109.

Wei, M., Shaffer, P.A., Young, S.K., & Zakalik, R.A. (2005). Adult attachment, shame, depression, and loneliness: The mediation role of basic psychological needs satisfaction. *Journal of Counseling Psychology*, *52*(4), 591-601. http://dx.doi.org/10.1037/0022-0167.52.4.591.

Weston, R., & Gore Jr, P.A. (2006). A brief guide to structural equation modelling. *The counselling psychologist, 34(5)*, 719-751. https://doi.org/10.1177/0011000006286345.

Wright, S.L., Jenkins-Guarnieri, M.A., & Murdock, J.L. (2013). Career development among first-year college students: College self-efficacy, student persistence, and academic success. *Journal of Career Development, 40(4),* 292-310. https://doi.org/10.1177/0894845312455509.

Table 1
Descriptive statistics for Implicit theories, BPNS, SES and academic achievement.

Variables	Number of questions (scale range)	N	Mean (SD)
Implicit theories	8 (1 – 6)	171	17.35 (3.86)
BPNS			
Competence	6 (1 – 7)	160	9.80 (2.65)
Autonomy	7 (1 – 7)	160	25.15 (5.14)
Relatedness	8 (1 – 7)	160	27.78(4.47)
Self-efficacy	10 (1 – 5)	167	37.53 (5.48)
Academic achievement	%	171	66.90 (6.40)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 2

Implicit theories of Intelligence and BPNS scales' fit indices for various structures of the scales.

	Chi-square (p-value)	Degrees of freedom	CFI	TLI	RMSEA	SRMR
ITIS						
1 factor	226.01 (p<.001)	20	.76	.66	.25	.09
2 factors	118.9 (p<.001)	19	.88	.83	.17	.08
BPNS scale's fit indices with original 21 items						
1 factor	608.75 (p<0.001)	189	.63	.59	.12	.10
3 factors	537.65 (p<0.001)	186	.69	.65	.10	.09
BPNS scale's fit indices with revised 12 items						
1 factor	181.79 (p<.001)	54	.81	.77	.12	.08
3 factors	135.78 (p<.001)	51	.88	.84	.10	.06
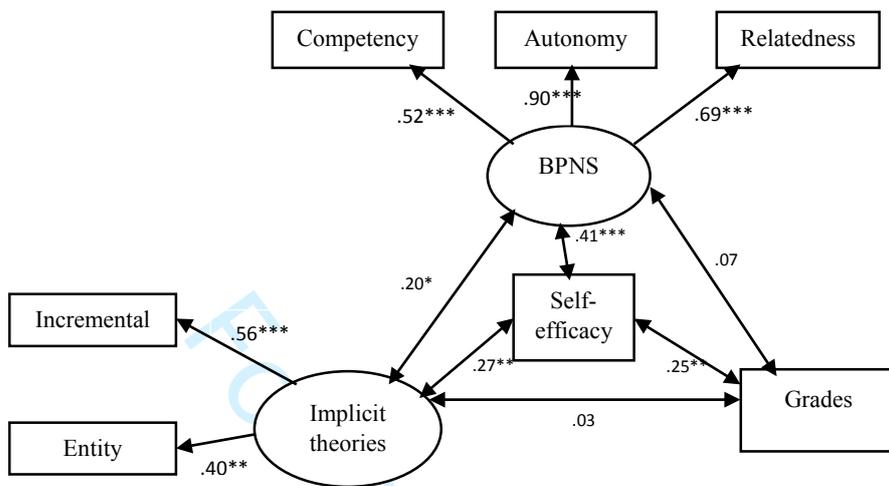
Fig. 1. Measurement model's covariance and factor loadings. *p<.05, **p<.01 and ***p<.001
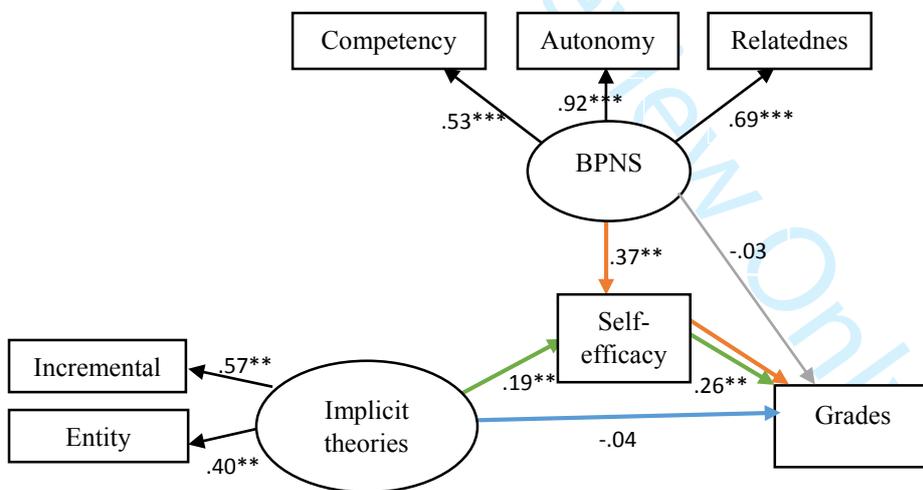
Fig. 2. Structural equational modelling analysis on full model. Blue arrow represents a direct relationship between implicit theories and grades, green arrows represent the indirect relationship between implicit theories and grades, the orange arrows represent BPNS's effect on self-efficacy, and the grey arrow represents added path between BPNS and grades to test the direct and indirect relationship between BPNS and grades.
*p<.05, **p<.01 and ***p<.001.