
Relationship between academic achievement as measured in the PISA study and wellbeing indicators: preliminary findings

Ana Kozina and Mojca Štraus

What is wellbeing?

Wellbeing is a complex, multidimensional construct that cannot be properly measured by a sole indicator in a single domain (Borgonovi, & Pal, 2016; Camfield, Streuli, & Woodhead, 2009). There is a substantial amount of literature defining the wellbeing of children and adolescents in the educational context from the perspective of mental health (Thomas, Graham, Powell, & Fitzgerald, 2016), more specifically focusing on the absence of negative emotionality. However, the field of positive psychology stresses the importance of positive characteristics and emotional states in the development of one's wellbeing (Lerner, 2007). The multi-dimensionality of the construct and differences in theoretical focus behind it has given rise to several models that overlap to some extent. Due to the use of PISA data in the study, we will refer to the theoretical background as proposed by OECD (2017) and link it to some of the relevant models in the literature.

OECD (2017) defines student's wellbeing as psychological, cognitive, social and physical functioning and capabilities that students need to live a happy and fulfilling life. The domains are interrelated and are at the same time considered both as an outcome and as an enabling condition. Similarly, Konu et al. (2002) proposed a four-dimensional model of school wellbeing based on the Allardt's sociological conception of wellbeing: school conditions, social relationships, means for self-fulfilment, and health status. There is an overlap with OECD (2017) in three dimensions: psychological (self-fulfilment), social (social relationships) and physical (health). Additional school dimension conditions comprise of

surroundings and environment, school subjects and organization, schedules, group sizes, punishments, safety, services, health care, school lunches etc. and is conceptually similar to RICH (Kehle & Bray, 2004) dimension called resources (the appropriate allocation of resources, which result in a feeling of independence). RICH is another four-factor model of subjective wellbeing that constitutes of a balance among four highly interrelated dimensions: resources, intimacy, competence, and health. Shonert-Reichl and her colleagues (2013) define six broad dimensions that are important for the development of competence and wellbeing in middle childhood and adolescence: social and emotional development (optimism, happiness, empathy, pro-social behaviour, worries, sadness), connectedness, school experiences, after school time use and academic skills and achievement. The EPOCH model (based on Seligman's PERMA model, Seligman, 2011) focuses on positive characteristics that lead to greater wellbeing and positive outcomes: engagement, perseverance, optimism, connectedness and happiness (Kern, Benson, Steinberg, & Steinberg, 2016). Similarly, positive youth development (PYD), a strengths-based framework of developmental processes, strategies, and systems that promote the development of positive assets in youth, includes five core assets: competence, confidence, character, caring, and connection (the 5 Cs; Lerner, 2007). When taking a closer look, we can locate most of the dimensions mentioned in the four broader categories proposed by OECD (2017).

The *psychological dimension* of wellbeing includes a student's sense of purpose in life, self-awareness, affective states and emotional strength. It is supported by self-esteem, resilience, motivation, self-efficacy, hope and optimism and hindered by anxiety, stress, depression and distorted views of self and others (OECD, 2017). In Konu's model (2002) this refers to self-fulfilment and in Shonert-Reichl (2013) to social and emotional development. In the field of positive psychology, a tripartite model of subjective wellbeing comprises of three components: frequent positive emotions, infrequent negative emotions, and overall life satisfaction (Diener, Heintzelman, Kushlev, Tay, Wirtz, & Oishi, 2017). When tested in a school environment among adolescents, the results indicated a four-factorial model, comprised of positive emotions, negative emotions, fear-related negative emotions, and school satisfaction (Long, Huebner, Wedell, & Hills, 2012). In the EPOCH model, the psychological dimension is comprised of engagement, perseverance, optimism and happiness. And in the PYD perspective, this would refer to confidence and character.

The *social dimension* includes the students' relationships with significant others: their family, their peers, their teachers; and the students' feelings about their social life outside of school (OECD, 2017).

The relationships are understood as central to wellbeing (Suldo, Riley, & Shaffer, 2006) and have most consensus among different models. In their study, Konu and her colleagues (2002) established that teachers and students perceive wellbeing as a multidimensional concept, with the main aspect of relationships (especially student–teacher relationship). The relationships are included also in Konu’s model (social relationships), RICH model (intimacy), EPOCH model (connection), PYD model (connectedness, caring) and Shonert-Reichl dimensions (connectedness and after school activities). The social factors in Konu’s definition includes also school climate, group dynamics, bullying, cooperation with homes and management styles in addition to relationships. Shonert–Reichl puts the school climate, school belonging, bullying together with academic self-concept and future goal in the dimension school experiences.

The *cognitive dimension* refers to the cognitive foundations students need to participate in society as lifelong learners, effective workers and engaged citizens (OECD, 2017). The cognitive dimension can be found also in Shonert-Reichl dimensions (academic skills and achievement) and in the PYD perspective (competence) but not in others.

The *physical dimension* of student’s wellbeing refers to the students’ health and adoption of a healthy life style. Konu (Konu et al., 2002) also refers to health status (students’ report of their symptoms and illnesses) as an important indicator of wellbeing. Health is an indicator also in the RICH model where it refers to an individual’s awareness of health promoting practices (Kehle & Bray, 2004).

How are wellbeing dimensions and indicators related to academic achievement?

Academic achievement as well as achievement in literacy domains and wellbeing form reciprocal relationship. Academic achievement is one of the sources of wellbeing (the cognitive part) and at the same time greater wellbeing influences and fosters academic achievement (all dimensions are interrelated). Research findings show that students with the presence of positive wellbeing and the absence of psychopathological symptoms have the most advantageous academic achievement; they display increased participation within and outside the classroom, have a greater belongingness to school and are more invested in school. Vulnerable students (those with low subjective wellbeing and high psychopathological symptoms) have lower self-esteem, decreased motivation for learning, less engagement in school and lower academic achievement (Antaramian, Huebner, Hills, & Valois, 2010). In a longitudinal study, Quinn and Duckworth (2007) examined the relation between academic achievement and wellbeing. Their

findings suggest reciprocal causality, as fifth grade academic achievement predicted sixth grade wellbeing, and children who scored higher in wellbeing at the beginning of the sixth grade earned higher final grades when controlling for cognitive abilities. Furthermore, students with higher wellbeing were more likely to improve their grades.

Due to the multidimensional nature of wellbeing, the researchers focused on one dimension or on one indicator and its relationship with academic achievement. For instance, perceived academic competence has been proven to be a significant predictor of life satisfaction (Chang, McBride-Chang, Stewart, & Au, 2003; Huebner, Gilman, & Laughlin, 1999). It is even a stronger predictor of life satisfaction compared to positive affect, negative affect (Long & Huebner, 2014) and subjective wellbeing (frequently referred also as happiness). The majority of studies report positive, though modest, life satisfaction and academic achievement correlations (Ng, Huebner, & Hills, 2015). Even more specifically academic achievement was found to be the most notable determinant of life satisfaction in the school domain (Suldo, Frank, Chappel, Albers, & Bateman, 2014). In a comparative study of 30 nations Kirkcaldy, Furnham, and Siefen (2004) tested the relationship between the results of the PISA study and subjective wellbeing/happiness). They found that subjective wellbeing/happiness significantly and positively correlates with mathematical literacy ($r = 0.59$), reading literacy ($r = 0.63$), and science literacy ($r = 0.57$). They also established that negative affect (anxiety, depression, sadness) is negatively related to all literacies, respectively ($r = -0.44$; $r = -0.52$; $r = -0.43$). However, studies in particular nations fail to achieve such strong correlations (Suldo et al., 2006). Students with higher scores on subjective wellbeing also tend to have more parent support and peer support for learning and better teacher–student relationships than students with low subjective wellbeing – regardless of psychopathological status (Antaramian et al., 2010). As already mentioned above, the negative emotionality is associated with lower academic achievement. For instance, numerous studies have showed the negative associations between anxiety and academic achievement (Duchesne & Ratalle, 2010; Mazzone, Ducci, Scoto, Passaniti, D'Arrigo & Vitiello, 2007). Garvik, Idsoe and Bru (2014) discovered that symptoms of depression are a risk factor of school disengagement and intention to skip school, but as the associations are weak, the authors presume the most depressed students keep their school engagement. Students who have decreased emotional engagement tend to be more depressed than their peers with higher emotional engagement. It is very likely that depression keeps one from being connected in school (Li & Lerner, 2011).

Another set of studies analysing indicators of wellbeing and academic achievement focused on positive emotionality and optimism. Positive emotional expectations are associated with the use of active and problem focused coping strategies (Chemers, Hu, & Garcia, 2001). Individuals with higher levels of optimism tend to have greater motivation and persistence (Anderman, 2002; Haynes, Ruthig, Perry, Stupnisky, & Hall, 2006), higher efficacy, higher academic expectations and tend to have more positive challenge-threat evaluations (Chemers et al., 2001). There is, however, evidence that highly optimistic first year college students perform worse than their low optimistic peers. Too much optimism might be problematic for individuals in transition from high school to college (Haynes et al., 2006). As far as self-concept is concerned due to its multidimensional nature, it is an academic specific self-concept that has the strongest association with academic achievements (Ghazvini, 2011) and influences on students' effort, engagement, persistence in classroom activities; intrinsic motivation; help-seeking behaviour; and course selection (Bong & Skaalvik, 2003). For instance, Ghazvini (2011) found that academic self-concept positively predicts achievements in literature and mathematics.

As for the relationship part of wellbeing and its relationship with academic achievement, the research has focused on the important others, such as peers, friends, parents, teachers. Peers are important throughout development, especially in the period of adolescence. For instance, friendships in the preschool period are an important predictor of later academic achievement (Ladd, 1990 cited in Peklaj & Pečjak, 2015), but some authors propose the best period for studying the relationship between academic achievement and peer relationships is early adolescence (ages 12–15 years), as at that time along with rapid pubertal change, early adolescents experience an increasing desire for autonomy, focus on peers and social acceptance and are increasingly self-conscious (Johnson, Johnson, & Roseth, 2012). Similarly, the study of Jacobson & Burdsal (2012) found that adolescents' relationships with peers influence academic performance, but they report on the small effects in this type of studies. Students who have a reciprocated friendship in middle school show higher levels of pro-social behaviour and academic achievement (Wentzel, McNamarra Barry, & Caldwell, 2004).

Along with peer relationships, teacher-student relationships matter as well, as students spend a large amount of time in school. In his meta-analysis, White (2007) integrated the results of a large amount of studies from 1948 to 2004, which examined teacher-student relationship and its' effect on cognitive, behavioural, and affective students' outcomes. The average

correlation of positive teacher-student relationship and positive student outcomes is 0.36. In another meta-analytic study, Roorda, Koomen, Split and Oort (2011) investigated the associations between the affective qualities of teacher-student relationships and students' school engagement and academic achievement. They integrated the results of 99 studies, which included students from preschool to high school. Associations for positive relationships with engagement were $r = .39$, and $r = -.32$ for negative relationships, whereas associations of relationships with academic achievement were small to medium ($r = .15$ for positive, and $r = -.18$ for negative relationship). The results have shown that the effects of negative relationships were stronger in primary than in secondary school, and are in concordance with Murray's (2009) assumption that there may be a shift in the importance of specific aspects of teacher-student relationship during students' development. Negative dimensions of the relationships are supposedly more influential than positive in the school adjustment of younger children, whereas positive relationships are more influential for adolescents. The effects of different components of parental involvement (such as parental aspirations for children's education, parent-child communication about school, home structure, and parental participation in school-related activities) are different between students in elementary and middle schools, and the strength of the association of parental involvement and academic achievement declines from elementary to middle school (Singh, Bickley, Trivette, Keith, Keith, & Anderson, 1995).

On a school level, the predictor of school belongingness positively predicts academic achievement (Anderman, 2002) and is moderated by the connection between teacher-student relationships and positive school-related affect (Roeser, Midgley, & Urdan, 1996). The characteristics and overall evaluation of the school climate is also related to academic achievement (Kozina, Rožman, Vršnik Perše, & Rutar Leban, 2008). The research (Høigaard, Kovač, Øverby, & Haugen, 2015) has shown that when students perceive the school climate as task-oriented, academic achievement is increased through increased academic efficacy. On the contrary, when the students perceive the school climate as ability-oriented, they typically displayed lower levels of academic self-efficacy and also academic achievement.

Studies focusing on both academic achievement and health, show significant links between low academic achievement and low self-rated health (Bird & Markle, 2012; Van Ryzin, Gravely, & Roseth, 2009). The results of meta-analyses (Bradley & Green, 2013) support strong positive (mutually reinforcing) associations between academic achievement and health related behaviours. Longitudinal studies have also found that

academic achievement functions as a predictor of future health (Cole, Jacquez, & Maschman, 2001). More specifically Taras (2005) has identified significant relationships between specific health related behaviours (physical inactivity; unhealthy dietary behaviours) and academic achievement. Similarly, Roberts, Freed and McCarthy (2010) showed that aerobic fitness level of schoolchildren predicts performance on standardized tests across ethnic groups, even when controlling for parent education as a covariate. Nutrition is an important factor as well, obese students receive significantly lower grades than normal-weight peers in middle school, community college and university, even when controlled for demographic variables, intelligence, personality and overall wellbeing (MacCann & Roberts 2013).

Present study

In the present study, we will analyse the relationships described above between wellbeing and literacy achievement in a Slovene sample of students with a focus on the predictive power of selected wellbeing indicators for PISA achievement (mathematics, science and reading literacy). The paper addresses the following research question:

Which specific indicators of non-cognitive wellbeing dimensions (psychological, social, health) are significant predictors of mathematics, science and reading literacy as measured in PISA study?

Since we are focusing on the academic achievement and school context additional research question is formed:

Which indicators of wellbeing related to the school context (school experiences) are significant predictors of mathematics, science and reading literacy as measured in PISA study?

Method

Participants

In Slovenia, the sample of students for the PISA study mostly comprise of students in the first year of upper-secondary education programmes. The international definition of the PISA target population, for which the international comparisons are derived, is a generation of 15-year-olds in education (OECD, 2017). The sample of students who participated in PISA 2015 (6,406 students, whereof 2,901 are girls and 3,505 boys, their average age: 15.7 years) was invited for the additional data collection on student wellbeing approximately a year later. Of the total PISA 2015 sample 2,802 students (1,460 girls and 1,342 boys) responded to the additional

Wellbeing questionnaire. A smaller response rate is seen to be a consequence of a time gap of one year between the PISA and the additional Wellbeing 2016 study. By using the same identification number in both studies, the data on wellbeing was linked to the PISA 2015 data. Basic comparisons of the achievements of the wellbeing subsample of students with the full PISA 2015 sample of students in Slovenia showed the subsampled students achieved somewhat higher on the PISA test (520 vs. 505 scale points in reading, 520 vs. 510 scale points in mathematics and 527 vs. 513 scale points in science) together with somehow higher values of background variables such as the socio-economic and cultural status. An analyses of other characteristics of the sample did not reveal any major differences between the PISA 2015 sample and the Wellbeing 2016 subsample. We concluded that the Wellbeing sample represents somewhat better the higher end of the literacy achievement distributions but misses a part of the distribution with lower achievement in the literacy domains.

Instruments

PISA Literacy Tests

Proficiency in reading, mathematical and scientific literacies was measured in PISA 2015, based on the internationally agreed assessment frameworks (OECD, 2016), with a 2-hour test in which items of the same domain were organized into four 30-min clusters that were rotated into several different forms with each student taking one form of combinations of clusters. Items ranged from easy to difficult in order to assess the full range of proficiency in the student population. The test was administered on computer. After one hour students were allowed a short break before continuing the test for the second hour.

Based on students' responses on the test, their scores were constructed into plausible values using Item Response Theory scaling as well as multiple imputation methods (for details see PISA 2015 Technical Report (OECD, 2017)).

PISA Background Questionnaires

In addition to the literacy test, PISA students also completed a 30 to 40 minute background questionnaire, which includes questions on their background, home and school environment, attitudes towards mathematics, science and reading, as well as their learning strategies (OECD, 2017). These data are of vital importance for the analysis of literacies and investigating the efficiency and equity in education systems.

In the paper, selected items from the PISA questionnaire were used in order to cross-validate the findings from the Wellbeing questionnaire.

One of the important background variables from the PISA database is socio-economic and cultural status, which is derived from three variables related to family background: parents' highest level of education, parents' highest occupation status, and home possessions, including books in the home. Since, in addition to socio-economic background, this index reflects cultural background of students it is called an index of socio-economic and cultural status (see, e.g. OECD, 2017 and forthcoming).

Wellbeing Questionnaire

The questionnaire was provided by the Australian Department of Education and Development (in collaboration with international partners). It consists of established tools for measuring wellbeing: EPOCH (Kern et al., 2016) and MDI (Shonert-Reichl et al., 2013). EPOCH (Kern et al., 2004) is a measure of adolescent's wellbeing and is based on Seligman's PERMA model (Seligman, 2011). The resulting model consists of five different positive characteristics that together support higher levels of wellbeing: engagement, perseverance, optimism, connectedness, and happiness. The measure consists of 20 items on a 5-point scale (1= almost never; 5= almost always). In the analyses, we used perseverance and engagement dimensions. MDI (Shonert-Reichl, et al., 2013) - Middle Years Development Instrument was designed to assess child wellbeing inside and outside of school on five dimensions: (1) Social and emotional development, (2) Connectedness to peers and to adults at school, at home, and in the neighbourhood, (3) School experiences, (4) Physical health and wellbeing, and (5) Constructive use of time after school. The questionnaires have been translated to Slovene and have been proved to be psychometrically adequate (Kozina & Čufar, 2017).

Procedure

Schools that participated in PISA 2015 were invited to take part in an additional Wellbeing study in 2016. The school that took part received informed consent from their students and their parents. The students that participated in the study responded to the online questionnaire using their PISA identification codes and under the supervision of their school coordinators during regular school lessons. There was no time limit for the questionnaire. For each model, ordinary least squares analyses were conducted. Bootstrap procedures were used to account for the effect of the two-stage sampling – students being sampled within previously sampled schools – on sampling variance and standard errors estimation. IBM SPSS 24.0 software was used for the analyses, with the addition of the syntax macros prepared through the IDB Analyzer software (IEA 2017),

which enabled calculations of population estimates and standard errors with the use of suitable sample weights and all ten plausible values of literacy achievement in the PISA database.

Results with discussion

Analyses were conducted using least-squares regression on four sets of models of predictors for reading, mathematical and scientific literacy achievement. The predictors in models are grouped according to their content: psychological, social, physical wellbeing and school experiences. Socio-economic and cultural status was added to all models in order to control for its well-known high impact on achievement. Sets of predictors in the models are presented together with the results of analyses. Testing of significance is carried out at 0.05 level.

The first set of predictors in the regression models for reading, mathematics and science achievement comprised of the constructs of perseverance, engagement, empathy, happiness, optimism, pro-social behavior and sadness or worrying.

With these predictors, 15 percent of variance in reading, 13 percent in mathematical and 16 percent of variance in scientific literacy was explained. In all three models, the strongest predictor shows to be socio-economic and cultural status. It is well known that this is an important predictor of achievement in literacy domains (OECD, 2017). For reading literacy, the regression coefficient of this predictor is 29.07 scale-points. This indicates that between two groups of students, having a one standard deviation difference of socio-economic and cultural status and being similar on other predictors, there is an average difference of 29.07 scale-points in reading literacy achievement; the group with higher socio-economic and cultural status having higher achievement in literacy domains. Furthermore, the value of standardized regression coefficient, beta, shows that this difference is approximately a third of the standard deviation in the reading literacy scores in the student population.

Further on empathy was shown to be a significant and positive predictor for achievement in all three literacy domains. Since the values of predictors were standardized, the value of regression coefficient 15.90 for empathy in the model for reading literacy means that for students, whose empathy scale values are one standard deviation apart while having similar values of other predictors, reading literacy achievements, on average, differ 15.90 scale-points; students with higher empathy scale-values also having, on average, higher achievement. The value of standardized regression coefficient shows that this accounts for approximately 18 percent of the standard deviation in reading literacy scores in the student

Table 1: Multiple regression analyses predicting math, science and reading literacy of Slovenian students from wellbeing psychological dimension indicators, Wellbeing 2016 study.

Reading literacy					t-value		Adjusted			
	B	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	521	(2.1)			247.50		0.15	(0.02)	0.15	(0.02)
Empathy	15.90	(2.29)	0.18	(0.02)	6.94	7.29				
Engagement	-0.45	(2.16)	-0.01	(0.02)	-0.21	-0.21				
Socio-economic and cultural status	29.07	(2.15)	0.33	(0.02)	13.51	13.58				
Happiness	-3.37	(2.43)	-0.04	(0.03)	-1.38	-1.38				
Optimism	-1.95	(2.19)	-0.02	(0.02)	-0.89	-0.89				
Perseverance	-0.70	(2.36)	-0.01	(0.03)	-0.30	-0.30				
Pro-social behaviour	-9.27	(2.07)	-0.10	(0.02)	-4.48	-4.49				
Sadness/Worries	5.89	(2.40)	0.07	(0.03)	2.45	2.46				

Mathematical literacy					t-value		Adjusted			
	B	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	522	(2.1)			249.11		0.13	(0.02)	0.13	(0.02)
Empathy	8.82	(2.06)	0.10	(0.02)	4.27	4.40				
Engagement	1.53	(2.18)	0.02	(0.02)	0.70	0.70				
Socio-economic and cultural status	28.14	(2.28)	0.32	(0.02)	12.35	13.02				
Happiness	1.69	(2.79)	0.02	(0.03)	0.61	0.60				
Optimism	-4.05	(2.81)	-0.05	(0.03)	-1.44	-1.44				
Perseverance	0.74	(2.66)	0.01	(0.03)	0.28	0.28				
Pro-social behaviour	-11.26	(2.08)	-0.13	(0.02)	-5.42	-5.40				
Sadness/Worries	0.59	(2.61)	0.01	(0.03)	0.23	0.23				

Scientific literacy					t-value		Adjusted			
	B	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	528	(1.9)			275.89		0.16	(0.02)	0.16	(0.02)
Empathy	11.90	(2.26)	0.13	(0.02)	5.25	5.43				
Engagement	1.35	(2.16)	0.01	(0.02)	0.62	0.63				
Socio-economic and cultural status	33.87	(2.20)	0.36	(0.02)	15.42	16.25				
Happiness	0.64	(2.75)	0.01	(0.03)	0.23	0.23				
Optimism	-3.97	(2.75)	-0.04	(0.03)	-1.44	-1.44				
Perseverance	0.11	(2.42)	0.00	(0.03)	0.05	0.05				
Pro-social behaviour	-13.49	(2.01)	-0.14	(0.02)	-6.70	-6.65				
Sadness/Worries	1.17	(2.52)	0.01	(0.03)	0.46	0.46				

Notes. Significant predictors are in bold.

population. For mathematical literacy the regression coefficient for empathy shows that there is an average difference of 8.82 scale-points in literacy achievement between students whose empathy scale values are one

standard deviation apart while values of other predictors are similar and that this accounts for approximately 10 percent of standard deviation in mathematical literacy in the population of students. For scientific literacy, the difference is 11.90 scale-points.

The results are in line with the research findings (Zorza, Marino, Lemus, Mesas, 2013) indicating positive relationship between empathy and academic achievement with the positive path between empathy (perspective taking and emphatic concern) through social competence to academic achievement (empathic concern having stronger links to social competence and academic achievement compared to perspective taking). Even-though empathy in our study positively predicts achievement in literacy domains, pro-social behaviour, however, is a negative predictor of all three domains. For reading literacy the regression coefficient of this predictor is -9.27. Students, whose pro-social behaviour scale values are one standard deviation apart while values of other predictors are similar, have a difference of reading literacy scores, on average, of 9.27 scale-points; the scores of students reporting less pro-social behaviour being higher. From the standardized regression coefficient, beta, it can be seen that this amounts for approximately 10 percent of the standard deviation of reading literacy in the population. For mathematical literacy, the difference in scores between such two groups is 11.26 score-points, representing approximately 13 percent of the standard deviation of mathematical literacy scores in the population, and the difference for scientific literacy of 13.49 score-points representing approximately 14 percent of the standard deviation of these literacy scores in the population. Similarly, as for reading, pro-social behaviour is a negative predictor for mathematical and scientific literacy achievements – students reporting less pro-social behaviour having higher literacy scores. This is contradictory to other research findings (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000). Students who report higher empathy show higher academic performance and at the same time students who are less prone to pro-social behaviour show lower academic performance. These findings, although contradictory, show stability through all three domains and call for additional and more in-depth research on the matter.

For reading literacy, one other predictor was seen to be significant; the construct of sadness and worries. For students whose sadness and worries scale values are one standard deviation apart, the difference in reading literacy achievement is, on average, 5.89 scale-points, whereas students with higher sadness and worries values also have, on average, higher literacy scores. The results are not congruent with the research showing higher levels of anxiety being related to lower academic achievement (Mazzone,

et al., 2007). Interestingly, this predictor is not significant in our models for mathematical and scientific literacy. This can be explained with understanding reading also as a form of avoidant behaviour (that is a characteristic of anxious students), which would then be reflected in higher reading literacy. Although this hypothesis would need to be tested, the findings are congruent with similar studies conducted using TIMSS data where spending more spare time reading was related to higher anxiety (Kozina, 2011). In PISA 2015 though more specific test-anxiety is significantly negatively associated with achievement in all three domains. A one standard deviation increase in test-anxiety is associated with a 4 score-point decrease in reading literacy, a 17 score-point decrease in mathematics literacy and a 16 score-point decrease science literacy.

It is interesting that in the models for all three domains, none of the other constructs showed significant associations with achievement. Even though, we would, according to scientific literature and research from the USA on either elementary, upper secondary or college samples (e.g. Dotterer & Lowe, 2011; Fredricks, Blumenfeld, & Paris, 2004; Haynes, et al., 2006; Lewis, et al., 2011; Wang & Holcombe, 2010), expect happiness, optimism as well as perseverance and engagement to be positively related to academic achievement. As known from other studies, persistence for instance is associated with adaptive coping strategies. The findings of a study conducted by Skinner, Pitzer and Steele (2016) suggest that adaptive ways of coping (especially strategizing, help-seeking, and self-encouragement) may contribute to increased persistence over the school year and, to a lesser extent, protect against giving up when facing academic challenges. Maladaptive ways of dealing with problems (e.g. projection and self-pity) supposedly undermine persistence. The PISA 2015 database also includes some of the wellbeing indicators that are related to the psychological dimension. Students were asked in a PISA 2015 background questionnaire about their overall satisfaction with their life. The students responded on the scale from 0 to 10, 10 representing the highest level of this satisfaction. Slovenian 15-year-olds reported satisfaction with life at a similar level, as was the average in OECD countries. In relation to achievement in literacy domains, this PISA indicator was shown to be a significant predictor of mathematics and science literacy of the student population analyzed in this paper, however with only a small, 2 score-point increase in literacy associated with a one standard deviation increase in the predictor.

A second set of predictors for reading, mathematical and scientific literacy in the regression analyses comprised of constructs of several dimensions of connectedness; connectedness to teachers, home, neighbourhood,

peers and the frequency of intimate friendships. For control, the socio-economic and cultural status was also included in the model.

Table 2: Multiple regression analyses predicting math, science and reading literacy of Slovenian students from wellbeing social dimension indicators, Wellbeing 2016 study.

Reading literacy				t-value	t-value	Adjusted				
	B	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	521	(2.1)			253.08		0.12	(0.02)	0.12	(0.02)
Connectedness - friendship intimacy	6.10	(2.72)	0.07	(0.03)	2.25	2.26				
Connectedness - home	-0.89	(2.35)	-0.01	(0.03)	-0.38	-0.38				
Connectedness - neighbourhood	-8.25	(2.20)	-0.09	(0.02)	-3.74	-3.74				
Connectedness - peers	-0.67	(2.72)	-0.01	(0.03)	-0.25	-0.24				
Connectedness - teachers	1.27	(2.15)	0.01	(0.02)	0.59	0.59				
Socio-economic and cultural status	29.86	(2.05)	0.34	(0.02)	14.54	14.56				

Mathematical literacy				t-value	t-value	Adjusted				
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	522	(2.0)			255.06		0.12	(0.02)	0.11	(0.02)
Connectedness - friendship intimacy	0.03	(2.6)	0.00	(0.03)	0.01	0.01				
Connectedness - home	-0.30	(2.34)	0.00	(0.03)	-0.13	-0.13				
Connectedness - neighbourhood	-8.47	(1.98)	-0.10	(0.02)	-4.28	-4.26				
Connectedness - peers	1.71	(2.45)	0.02	(0.03)	0.70	0.70				
Connectedness - teachers	4.57	(2.16)	0.05	(0.02)	2.12	2.14				
Socio-economic and cultural status	28.59	(2.28)	0.33	(0.02)	12.56	13.30				

Scientific literacy				t-value	t-value	Adjusted				
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	528	(1.8)			285.95		0.14	(0.02)	0.14	(0.02)
Connectedness - friendship intimacy	-0.74	(2.66)	-0.01	(0.03)	-0.28	-0.28				
Connectedness - home	-0.10	(2.51)	0.00	(0.03)	-0.04	-0.04				
Connectedness - neighbourhood	-9.35	(2.07)	-0.10	(0.02)	-4.51	-4.52				
Connectedness - peers	2.74	(2.45)	0.03	(0.03)	1.12	1.12				
Connectedness - teachers	4.20	(2.22)	0.04	(0.02)	1.89	1.90				
Socio-economic and cultural status	34.39	(2.16)	0.37	(0.02)	15.95	16.86				

Notes. Significant predictors are in bold.

With included social dimension predictors, 12 percent of variance in achievement in literacy domains was explained for reading and mathematics and 14 percent for science. As in the previous model, the strongest predictor is socio-economic and cultural status in all three domains. The values of the regression coefficient for this predictor are also similar to the values in the previous model.

Across all three domains, connectedness to the neighbourhood is a significant predictor of achievement in literacy domains. This predictor is negative; students who reported higher levels of connectedness to the neighbourhood on average achieved lower scores on the three literacy assessments than their counterparts. For reading literacy the regression coefficient of -8.25 score-points indicates that students reporting a one standard deviation higher scale value of connectedness to the neighbourhood on average scored 8.25 score points lower on the reading literacy assessment than their counterparts with lower scale value of connectedness to the neighbourhood but similar values of other predictors. Standardized regression coefficient (beta) indicates that this represents approximately 9 percent of the overall standard deviation in the reading literacy scores in the student population. For mathematical and scientific literacies, the regression coefficients of this predictor were similar; students reporting a one standard deviation higher scale values of connectedness to the neighbourhood on average scored 8.47 points lower in mathematics and 9.35 points lower in science than their counterparts reporting lower scale values of connectedness to the neighbourhood but having values of other predictors similar. In both, mathematics and science literacies, the difference in scores represents approximately 10 percent of overall standard deviation of the respective scores in the population. One would expect that students that feel more connected to their important others have higher achievement in literacy domains as well, but this was not the case in our data. As we can see from the data, low achieving students are more related to important figures outside school (in the neighbourhood). One hypothesis would be that due to the low literacy achievement they feel less connected to their school and school peers and more to their neighbourhood peers. This is supported also with our results showing that having more intimate friendships is related to higher literacy in reading and feeling more connected to teachers in the school is a predictor of higher achievement in math. Students reporting more frequent intimate friendships score on average, 6.10 points higher in reading than their counterparts with less intimate friendships. This accounts for approximately 7 percent of the overall standard deviation of reading scores in the population. Similarly, connectedness to teachers predicted mathematics literacy with the change of 4.57

scale-points and 5 percent of the standard deviation of mathematics scores between students reporting average and student reporting one standard deviation higher value of connectedness to teachers. Connectedness to home and connectedness to peers were not significant predictors. From PISA 2015 database, an indicator of emotional support from parents as perceived by the students can be compared with the results in model. For the population of 15-year-olds in Slovenia who participated in our study, this indicator is significantly related to achievement in all three domains. A one standard deviation increase of this predictor is associated with a 15 score-point increase in reading, a 9 score-point increase in mathematics and a 12 score-point increase in science literacy in PISA 2015. However, we need to take into account that these associations are not controlled for any of the other predictors that are included in our model.

In order to explain the variation in reading, mathematical and scientific literacy achievements from physical predictors, the constructs of body image, sense of overall health, quality of nutrition and time of going to sleep were used as predictors (together with the socio-economic and cultural status as controlling variable).

The model explained 12 percent of variation in reading and mathematical literacies scores, respectively, and 15 percent of variation in scientific literacy scores. Apart from the socio-economic and cultural status, nutrition and sleep showed significant and positive predictors in all three domains.

The time of going to sleep is a positive predictor in the sense that students who reported going to bed later had, on average, higher scores. A one standard deviation change in the time of going to bed is associated with 6.14 to 7.31 score-points change in literacy scores representing 7 to 8 percent of overall standard deviation in these scores (other predictors being held constant). Going to bed late is a reflection of the developmental period of adolescence and the change in the sleeping patterns (Eccles & Goodman, 2002) but of course going to bed late can be related to studying late (but we do not have information on the reasons they are going to bed late). Sleep quality is however a very strong predictor of wellbeing (Ridner, Newton, Staten, Crawford, & Hall, 2015) and going late to sleep needs to be taken into account when planning school lessons (e.g. starting later in the day) as suggested by Eccles (Eccles and Goodman, 2002).

Besides the quality of sleep, nutrition is also significantly related to wellbeing. A one standard deviation increase in the values of quality of nutrition is associated with 7.62 to 10.31 score-points change in literacy scores representing 9 to 12 percent of overall standard deviation in these scores (other predictors being held constant). The quality of nutrition

Table 3: Multiple regression analyses predicting math, science and reading literacy of Slovenian students from wellbeing health dimension indicators, Wellbeing 2016 study.

Reading literacy					t-value		Adjusted			
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	521	(2.1)			251.91		0.12	(0.02)	0.12	(0.02)
Body image	-2.19	(1.83)	-0.02	(0.02)	-1.20	-1.20				
Socio-economic and cultural status	27.69	(2.18)	0.31	(0.02)	12.72	12.81				
Overall health	-1.13	(1.90)	-0.01	(0.02)	-0.60	-0.60				
Nutrition	7.62	(2.30)	0.09	(0.03)	3.31	3.31				
Sleep	6.14	(2.45)	0.07	(0.03)	2.51	2.49				

Mathematical literacy					t-value		Adjusted			
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	522	(2.0)			256.08		0.12	(0.02)	0.12	(0.02)
Body image	-0.02	(2.01)	0.00	(0.02)	-0.01	-0.01				
Socio-economic and cultural status	26.31	(2.36)	0.30	(0.03)	11.15	11.63				
Overall health	3.32	(1.89)	0.04	(0.02)	1.76	1.75				
Nutrition	10.12	(2.56)	0.12	(0.03)	3.96	4.02				
Sleep	7.05	(2.36)	0.08	(0.03)	2.99	2.98				

Scientific literacy					t-value		Adjusted			
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	528	(1.8)			287.90		0.15	(0.02)	0.15	(0.02)
Body image	-1.30	(1.88)	-0.01	(0.02)	-0.69	-0.69				
Socio-economic and cultural status	32.07	(2.28)	0.34	(0.02)	14.07	14.84				
Overall health	3.07	(2.01)	0.03	(0.02)	1.53	1.52				
Nutrition	10.10	(2.40)	0.11	(0.03)	4.21	4.24				
Sleep	7.31	(2.40)	0.08	(0.03)	3.05	3.02				

Notes. Significant predictors are in bold.

is related to health and therefore in line with the research establishing positive relationship between health and academic achievement (Bird & Markle, 2012; Ryzin, Gravely, & Roseth, 2009). Overall health and body image did not show significant as predictors in our model.

In fourth set of models, the variation in reading, mathematical and scientific literacy scores is analyzed using predictors of academic self-concept, sense of belonging to school, frequency of bullying in the school, having goals for one's future, motivation to have good grades in school (extrinsic motivation), and school climate. Socio-economic and cultural status is again used for controlling.

Table 4: Multiple regression analyses predicting math, science and reading literacy of Slovenian students from wellbeing indicators and concept related to school experiences, Wellbeing 2016 study.

Reading literacy				t-value	t-value	Adjusted				
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	521	(2.0)			254.63		0.17	(0.02)	0.17	(0.02)
Academic self-concept	11.06	(2.27)	0.13	(0.03)	4.87	4.91				
School belonging	-7.04	(2.19)	-0.08	(0.02)	-3.21	-3.24				
Bullying	-10.52	(1.81)	-0.12	(0.02)	-5.80	-5.76				
Socio-economic and cultural status	26.11	(2.14)	0.30	(0.02)	12.21	12.19				
Future goals	-2.34	(2.29)	-0.03	(0.03)	-1.02	-1.01				
Motivation for grades	-1.51	(1.78)	-0.02	(0.02)	-0.85	-0.85				
School climate	14.79	(2.21)	0.17	(0.02)	6.70	6.70				

Mathematical literacy				t-value	t-value	Adjusted				
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	522	(2.0)			256.20		0.17	(0.02)	0.17	(0.02)
Academic self-concept	13.46	(2.05)	0.15	(0.02)	6.56	6.66				
School belonging	-3.53	(2.45)	-0.04	(0.03)	-1.44	-1.45				
Bullying	-7.80	(1.81)	-0.09	(0.02)	-4.31	-4.22				
Socio-economic and cultural status	24.90	(2.26)	0.28	(0.02)	11.01	11.47				
Future goals	-5.72	(1.91)	-0.07	(0.02)	-2.99	-2.93				
Motivation for grades	-5.74	(1.88)	-0.07	(0.02)	-3.06	-3.05				
School climate	14.67	(2.55)	0.17	(0.03)	5.75	5.74				

Scientific literacy				t-value	t-value	Adjusted				
	b	(SE)	beta	(SE)	(b)	(beta)	R ²	(SE)	R ²	(SE)
(Constant)	528	(1.8)			291.40		0.21	(0.02)	0.21	(0.02)
Academic self-concept	15.85	(2.14)	0.17	(0.02)	7.39	7.57				
School belonging	-4.75	(2.42)	-0.05	(0.03)	-1.96	-1.97				
Bullying	-9.50	(1.92)	-0.10	(0.02)	-4.96	-4.91				
Socio-economic and cultural status	30.16	(2.18)	0.32	(0.02)	13.81	14.35				
Future goals	-5.68	(1.92)	-0.06	(0.02)	-2.96	-2.89				
Motivation for grades	-6.57	(1.80)	-0.07	(0.02)	-3.65	-3.65				
School climate	15.44	(2.40)	0.17	(0.03)	6.43	6.30				

Notes. Significant predictors are in bold.

For reading and mathematical literacies, the included predictors explain 17 percent of the variance in scores respectively and scientific literacy 21 percent. Apart from socio-economic and cultural status being again the strongest predictor of up to a third of standard deviation in scores for all these domains, academic self-concept proved to be a relatively strong and positive predictor. Self-concept is a reflection of an individual's actual

abilities in a specific domain and the internalizations of the feedback obtained from significant others (Harter, 2006). Self-concept (e.g. academic self-concept) moderates effort and motivation to be active in certain fields (e.g. school attendance, learning). In the model for explaining the variation in reading literacy scores, the value 11.06 of the academic self-concept regression coefficient shows that the scores of students with one standard deviation higher values of academic self-concept are, on average, 11.06 points higher than the scores of their counterparts with lower values of academic self-concept while having similar values on other predictors. This change in reading scores represents 13 percent of overall standard deviation of the scores in the population.

In the model, for explaining the variation in mathematical literacy scores, the value of the regression coefficient for academic self-concept is 13.46 and 15.85 for scientific literacy. For mathematics, the change in scores represents 15 percent of the overall standard deviation in scores and for science 17 percent. This shows that the relative change in scores predicted by academic self-concept is the largest for scientific literacy among the three domains. The findings are in line with the research literature stating the positive relationship between academic self-concept and academic achievement (Avsec, 2007; Juriševič, 1999). Another relatively strong and positive predictor in the model is student's perception of school climate. This predictor shows similar associations with the scores in all three domains, all three regression coefficients of this predictor amount for 17 percent of the overall standard deviation of the scores in respective domains in the student population. The average scale-score changes associated with a one standard deviation change in the school climate are 14.79 points for reading, 14.67 points for mathematics and 15.44 points for science. A more positive school climate is related to higher academic achievement as proven also in research abroad (Brown, Anfara, & Rooney, 2004) and in Slovenia (Kozina et al., 2012).

Among the negative predictors, frequency of being exposed to bullying in the school showed as the strongest predictor. The drop in the scale-scores associated with a one standard deviation increase in exposure to bullying is from 9 to 12 percent of the standard deviation of the scores in the three domains. For reading the regression coefficient for this predictor is -10.52 which shows that students who reported a one standard deviation higher exposure to bullying have, on average, 10.52 score-points lower reading literacy results. This represents 12 percent of the overall standard deviation of the reading scores in the population. For mathematics, the regression coefficient -7.80 represents 9 percent of the standard deviation in mathematics scores and for science the coefficient -9.50 represents

10 percent of the standard deviation of the science scores in the population. In the PISA 2015 data, the indicator of the frequency of bullying was constructed from students' responses in the background questionnaire. Overall, Slovenian students reported that the frequency of bullying is similar to the average in OECD. The relation of this indicator to achievement for the population of students in our analysis is, as expected, negative and significant. A one standard deviation increase in the indicator is associated with approximately 10 score-points decrease in achievement (11 score-points in reading, 9 score-points in mathematics and 10 score-points in science). The bullying is more frequent in schools with a negative school climate (*Malm & Löfgren, 2006*), which indicates the congruency of our findings. Longitudinal studies suggest that being exposed to bullying has both short-term and long-term consequences. The most common short-term consequences include anxiety, depression, insecurity, reduced school performance, loneliness, and sadness, which may in extreme cases lead to suicide (*Huesmann, 1994*). The combination of all these consequences of bullying then leads to lower literacy achievement as reflected in our data and in PISA 2015 data.

A sense of school belonging, motivation for having good grades (extrinsic motivation) and the amount of future goals, interestingly, resulted as negative predictors in our model. The regression coefficient of a sense of school belonging -7.04 in the model for explaining variance in reading literacy scores represents 8 percent of the overall standard deviation in the reading scores, the coefficient -4.75 in the model for scientific literacy represents 5 percent of the overall standard deviation in these scores while this predictor is not significant in the model for mathematical literacy. The more students feel connected to school and feel as a part of the school the lower, on average, is their achievement in literacy domains. This is in contradiction with the data presented in the Table 2 indicating that the more students feel related to their teachers in the school, the higher is their achievement in literacy domains. These results and discrepancies are in need of additional analyses.

While having future goals and motivation for having good grades are not significant predictors in the model for reading literacy, they are significant in the models for mathematical and scientific literacy, indicating a drop of approximately 6 and 7 percent of overall standard deviation in scores associated with a one standard deviation increase in the values of the predictors. As far as extrinsic motivation is concerned the results are in line with the theory indicating that intrinsic motivation is the one significantly linked to higher academic achievement (*Ryan & Deci, 2009*). There are three indicators in the PISA 2015 database for which our

results can be compared for the population of students in the analysis. In the PISA 2015 background questionnaire, students were asked about their overall school-related and general achievement motivation. While international comparisons show that Slovenian students generally indicate low levels of this motivation, the relation of this indicator to achievement in literacy domains is shown to be positive and significant. A one standard deviation increase in this indicator is associated with 15 score-point increase in reading literacy, 19 score-point increase in mathematic literacy and 20 score-point difference in science literacy. When comparing the findings from both data sets, there is an indication that motivation in PISA is measured more on the general level that comprise also of the elements of intrinsic motivation.

A final observation relates to the socio-economic and cultural status: while this predictor significantly added to the proportion of variance explained by each model as well as being shown to be the strongest predictor in all of the models, preliminary analyses of the models with all but this predictor showed that the coefficients for the other predictors were not substantially affected by the addition of this predictor. This indicates relative independence of the wellbeing predictors of achievement in literacy domains from the socio-economic and cultural status.

Conclusions

Our results first of all through all four models indicate the interconnectiveness of wellbeing and literacy. There are several interpretations of our findings about this relationship possible. The first group of interpretations focuses on the changes within individuals that lead to a better quality of learning and knowledge. For instance, as indicated in the research (Aronson, 2002), higher learning outcomes are typical of students who are more confident about their learning skills, who make more effort and persist longer in doing more difficult tasks. The relationship is partly evident also in our data, e.g. our results confirmed a positive relationship between academic self-concept and achievement, but not persistence and engagement. Therefore some further analyses would be needed here. Another set of characteristics related to higher academic achievements are higher educational goals, more self-disciplined and motivated behaviour and a better ability to cope with stress (Duckworth and Seligman, 2005). In our data, future goals were negatively associated to achievement, however we have to point out that the goals were not specifically educational but more on a general level. Our data also revealed a positive relationship between empathy and achievement and a negative relationship of achievement with prosocial behaviour, sadness and worries.

The second set of interpretations look for associations based on characteristics of the environment (Hawkins, Smith and Catalano 2004; Blum and Libbey, 2004). They list various characteristics of the environment, such as the norms of peers and adults, which encourage high expectations and support for learning success; good interpersonal relationships among students or between students and teachers, which encourage greater classroom and school loyalty; the promotion of collaborative learning; ensuring a safe and well organised learning environment that promotes positive behaviour. In our data, a positive school climate and a lower exposure to bullying have been linked to higher achievement. As far as connectedness is concerned, the findings are contradictory with having positive relationships with teachers leading to higher achievement in literacy domains and having a positive relationship with significant adults in the neighbourhood leading to lower achievement in literacy domains. The best combinations are changes both at the level of individuals and at the school level, which lead to immediate and long-term positive consequences (Catalano, Berglund, Ryan, Lonczak and Hawkins, 2002).

The majority of our findings are in line with our expectations and research literature, but not all, which raises additional research questions. The study is not without limitations stemming from the sample selection (not being fully representative for a whole population of Slovenian 15-year-olds) as well as from the robust measure selection (only a few items per construct). The study is a good starting point for additional more in-depth analysis, for instance on the interplay between empathy, pro-social behaviour and achievement in literacy domains since our results show contradictions in these areas. The complexity and intertwines of the two concepts in question are well reflected in our study. We would like to conclude our debate with a reminder of the principle of equity of education policies, which encompasses the promotion of the individuals' overall development and the development of education policies, and practices that make it possible for each individual to achieve their optimum levels of development (both cognitive and non-cognitive). Here we would like to stress also our finding of relative independence of the wellbeing predictors of achievement in literacy domains from the socio-economic and cultural status. And, as we have seen from our results, there is a strong indication on the intertwined nature of wellbeing and literacy achievement therefore both need to be in focus when planning the educational policies.

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