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# Self-regulation (locomotion and assessment), well-being (subjective and psychological), and exercise behavior (frequency and intensity) in relation to high school pupils' academic achievement

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**Background:** Self-regulation is the procedure implemented by an individual striving to reach a goal and consists of two inter-related strategies: assessment and locomotion. Moreover, both subjective and psychological well-being along exercise behavior might also play a role on adolescents academic achievement.

**Method:** Participants were 160 Swedish high school pupils (111 boys and 49 girls) with an age mean of 17.74 (sd = 1.29). We used the Assessment and Locomotion Scales to measure self-regulation; Ryff's Psychological Well-Being Scales short version, the Temporal Satisfaction with Life Scale, and the Positive Affect and Negative Affect Schedule to measure well-being and the Archer Ratio to measure exercise behavior. Academic achievement was operationalized through pupils' the mean value of final grades in Swedish, Mathematics, English, and Physical Education.

**Results:** Academic achievement was positively associated to assessment, subjective well-being, and frequent/intensive exercise behaviour. Assessment was, however, negatively related to subjective well-being. Locomotion on the other hand was positively associated to subjective and psychological well-being and also to exercise behaviour.

**Conclusions:** Here we propose a dual (in)direct approach to increase pupils' academic achievement and well-being—locomotion being related to frequently exercising and well-being, in turn, increasing academic achievement; while assessment being directly related to higher academic achievement.

**Self-regulation (Locomotion and Assessment), Well-Being (Subjective and  
Psychological), and exercise behavior (Frequency and Intensity) in Relation to High  
School Pupils' Academic Achievement**

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From a social perspective, education exerts a strong influence on both the individual and the society since it lifts the national standard of living (Kessler et al., 1995). On a personal level, education endowers personal control (i.e., one aspect of an individual's psychological well-being), a healthy lifestyle, greater income, employment, interpersonal relations, and social support (Mirowsky & Ross, 2002). It is then important that individuals who work with any form of education, for example, teachers and other personnel in the educational system have knowledge of the different factors that affect students' grades. The present study investigates if self-regulation, well-being, and exercise behavior exert essential roles in influencing academic achievement among Swedish high school pupils.

### ***Well-being***

Modern research suggests two definitions of well-being; subjective well-being and psychological well-being (Garcia, Nima & Kjell, 2014; Diener, 1984; Ryff, 1995). Subjective well-being, or happiness, consists of a cognitive and an affective component (Schimmack, 2007). The cognitive component consists of individuals' degree of life satisfaction and the affective component of individuals' experiences of positive and negative feelings (Diener, 1984). Thus, a happy adolescent is satisfied with her/his life and experiences greater levels of positive emotions than negative emotions (Garcia, 2011). Psychological well-being is a multi-faceted concept which cannot be measured by any single variable but rather an assembly of factors that are related to greater or lesser extent. Ryff (1989) has, indeed, proposed a multidimensional model composed of six different factors that when measured together would provide an index of an individual's psychological well-being: self-acceptance, positive relationships with others, autonomy, environmental mastery, purpose in life and personal growth (Ryff, 1989; 1995). According to this notion of well-being, the most central part of well-being is a person's sense of self-acceptance, which is an attribute of mental health but also a characteristic of self-actualization, optimal functioning and maturity because it refers to

a person's ability to accept the good and bad sides of their personality, which might help adolescents to adapt to their environment (Garcia, 2011).

### ***Self-regulation***

Self-regulation is the procedure implemented by an individual who is striving to reach a goal. The individual must identify first the desired outcome, then choose how to operate to reach the desired goal. Thereafter, he/she needs to assess and decide between available approaches to reach the goal and then to take action and stay committed to the chosen strategies until the goal is reached (Kruglanski et al., 2000). Self-regulation has been suggested (Kruglanski et al., 2000) to have two constructs: (1) assessment which refers to the initial part of the self-regulation process when the individual assess, compare and appraise possible goals and procedures needed to attain these goals; and (2) locomotion, referring to the action-based part of self-regulation when the individual takes action and adheres to a step-by-step approach until the goal is reached.

Unlike Rubicon's model of action phases (Gollwitzer, 1990; Heckhausen, 2000), Kruglanski and colleagues (2000) and Higgins and colleagues (2003) have studied locomotion and assessment separately and conceptualized them in accordance to Lewin's distinction between setting a goal and striving for it (Lewin, Dembo, Festinger, & Sears, 1944). In other words, assessment and locomotion are two separate and individual personality orientations, both influencing self-regulation in order to help a person to achieve a goal (Higgins et al, 2003; Kruglanski et al, 2000). If a person is high in the assessment orientation, she/he tends to reflect and assess different possible pathways and goals. This type of person often evaluates her/his personality and behavior. Instead, individuals who are high in locomotion focus primarily on achieving goals and moving forward. These individuals reflect and evaluate goal achievement factors only briefly and get going with the action part of the task, or as accurately depicted by the Nike slogan: "they just do it" (Kruglanski et al., 2000).

While assessment has been found to be positively correlated with depression and anxiety and negatively correlated with self-confidence and optimism; Locomotion has been found to be correlated positively with self-confidence and optimism, and negatively with anxiety and depression (Kruglanski et al., 2000; Higgins et al., 2003). Pierro and colleagues (2013) obtained similar results showing positive correlations between locomotion and the individuals' sense of work-related satisfaction. Moreover, there is a positive relationship between locomotion and extrovert behavior (e.g, the ability to socialize with others, positive affectivity), motivation, type-A behavior, readiness for action, and vitality (Higgins et al., 1997; Kruglanski et al., 2000), and higher affective well-being (Giacomantonio, Manetti & Pierro, 2012). These findings, among adults, are in line with recent research conducted among high school pupils showing that adolescents with high levels of negative affect report being higher in assessment compared to adolescents with low levels of negative affect, while adolescents with high levels of positive affect report higher levels of locomotion compared to adolescents with low levels of positive affect (Jimmefors, Garcia, Rosenberg, Mousavi, Adriansson & Archer, 2014).

In sum, the tendency to constantly evaluate one self, which is typical for the assessment-oriented person, prompts to a sense of inadequacy, negative emotions, lower self-esteem and less optimism (Kruglanski et al, 2004; Jimmefors et al., 2014). Locomotion, on the other hand, implying activation, proactivity, and forward-striving, is linked with lesser reflection and more goal-oriented movement thereby providing more positive emotions, higher optimism and self-confidence (Kruglanski et al, 2004; Jimmefors et al., 2014). The locomotion construct does not only reminds of the “just do it” slogan, but is probably related to the individual's exercise behavior.

### ***Exercise behavior***

It has been known for some time that good exercise habits increases physical health and well-being (Silvestri, 1997; Lotan, Merrick & Carmeli, 2005ab). For instance, good exercise habits (i.e., frequently engaging in intensive physical training) during adolescence provide a more positive and healthy basis, which gives good prognosis for early prevention of many chronic diseases that originate in early childhood (Twisk, 2001; Archer & Garcia, 2014ab). Other studies have confirmed that adolescences who report higher physical activity, also report less stress and depression (e.g., Norris, Carroll & Cochrane, 1992). Moreover, physical exercise exerts effects at multiple physical and mental health levels with benefits in young people's (age 7-15) academic performance (Dwyer, Sallis, Blizzard, Lazarus & Dean, 2001). Thus, adolescents who have good exercise habits might be able to influence not only their well-being, but also their academic achievement.

### ***Factors influencing academic achievement***

Kruglanski and colleagues (2000) have tested how self-regulation influences academic achievement among 665 high school pupils and found that the individuals who were high in both assessment and locomotion had the highest score in their grade point average. To the best of our knowledge, no studies have been conducted using Swedish pupils in the context of self-regulation. Nevertheless, earlier pedagogical research has suggested a learning characteristic that is related to assessment, rather than to locomotion, as enhancing academic achievement—self-regulated learning (Corno & Mandinach, 1983; Corno & Rohrkemper, 1985; Pintrich & V. De Groot, 1990). Self-regulated learning as assessment is based on metacognition (i.e., thinking about one's thinking) and strategic action (i.e., goal-planning, goal-monitoring, self-evaluation, modification of one's thoughts and cognitions, as well as evaluating different ways to complete a goal), but also on the pupils' motivation to learn (Pintrich, 2004). In other words, self-regulated learning does not include the locomotion

construct, thus, suggesting only a positive relationship between the assessment orientation and academic achievement. Therefore, our first hypothesis was:

H1: Assessment is expected to be positively associated to the pupils' grade point average.

Subjective well-being has been proved to be positively related university students' final psychology grades (Borrello, 2005), Lebanese university students' grade point average (Ayyash-Abdo & Sánchez-Ruiz, 2012), and middle-school pupils' grades (Quinn & Duckworth, 2005; Huebner & Gilman, 2003). Furthermore, although some inferences can be drawn, there is a paucity of research on the relationship between psychological well-being and academic achievement. Nevertheless, high self-efficacy or a person's belief that she/he has the capacity to achieve a goal or a specific outcome (Bandura, 1977, 1982) is related to higher grades and better results on different tasks in school, seatwork, exams, quizzes, essays, reports and higher grades (Pintrich & V. De Groot, 1990). Self-efficacy is, indeed, positively related to psychological well-being (Ryff, 1989), which in turn is positively related to positive affect (Garcia, Archer, Moradi & Andersson-Arntén, 2012). With regard to self-regulation, well-being seem to be positively related to locomotion and negatively to assessment (Kruglanski et al, 2004; Jimmefors et al., 2014). Our second and third hypotheses were:

H2: Subjective and psychological well-being are expected to be positively associated to the pupils' grade point average.

H3: Locomotion is expected to be positively associated with pupils' subjective and psychological well-being, while assessment was expected to be negatively associated to both measures of well-being.

As earlier mentioned, physical exercise exerts a positive effect brain stimulation and enhances learning (Brink, 1995). Moreover, Archer and Garcia (2014a) reviewed research on this association and concluded that both the amount of time, frequency, and the intensity of exercise, are related to high school pupils academic achievement and both physical and



mental health. Even acute aerobic exercise interventions (12-minute long), seem to improve selective attention and reading comprehension among adolescents (Tine, 2014), at least among those coming from low-income households. In the Swedish context, schools schedule less physical education than ever before (Ericsson, 2005) despite the fact that children that participate in physical activity display better motor fitness, better academic performance and attitude toward schools compared to their sedentary peers (Myers, Strikmiller, Webber & Berenson, 1996). Finally, although the relationship between locomotion and exercise habits seem obvious no other study has investigated if high locomotion is associated to good exercise behavior (i.e., frequently engaging in intensive physical training). Our last two hypothesis were:

H4: Exercise behavior is expected to be positively related to pupils' grades and well-being.

H5: Locomotion is expected to be positively related to exercise behavior.

## **Method**

### ***Ethical Statement***

According to law (2003: 460, §2) concerning the ethical research involving humans we arrived to the conclusion that the design of the present study (e.g., all participants' data will not be used for commercial or other non-scientific purposes) required only informed consent from participants.

### ***Participants and Procedure***

Participants were 160 Swedish high school pupils (111 boys and 49 girls) with an age mean of 17.74 ( $ds = 1.29$ ). The pupils came from two different schools on the Swedish west coast. The first school had five hundred pupils and is situated in Gothenburg. The second school is located in a smaller city with eight hundred pupils. Due to the different geographic locations, the pupils' social backgrounds are varied. The principals were informed about the study and they confirmed the retrieving of the grades. The pupils were selected by the criteria of being

in their last year of high school, because of legal complications with pupils under this age (e.g., parent consent). The tests were completed online using a link that was sent by email to the respondents. The session took place during the students' original classes, and it took about forty minutes to complete the test. Pupils were briefly informed about the test (e.g., confidentiality, right to drop out at any time, etcetera). In the first school, everyone who participated received a cinema ticket, while in the second school the participants took part in a lottery for the remaining tickets. The pupils were asked to provide their social security number in order to match their answers with their final grades. The grades were provided by administrative personnel at the schools and were sent to the authors of this article in an Excel file.

### **Measures**

*Self-regulation.* The Swedish version (Jimmefors et al., 2014) of the Regulatory Mode questionnaire (Kruglanski et al., 2000) was used to assess self-regulation orientations. The test consists of 30 items measured on a 6 point likert scale (from 1 = *strongly disagree* to 6= *strongly agree*) measuring assessment (e.g., "I spend a great deal of time taking inventory of my positive and negative characteristics", "I am a critical person") and locomotion ("I am a doer", "When I get started on something, I usually persevere until I finish it").

*Subjective Well-Being.* The Positive Affect and Negative Affect Schedule, PANAS (Watson, Clark, Tellegen, 1988) assesses the affective component of subjective well-being by requiring participants to indicate on 5-point liker scale to what extent (1= *very slightly*, 5 = *extremely*) they generally experienced 20 adjectives describing different affect states (10 positive affect and 10 negative affect) within the last few weeks. The positive affect scale includes adjectives such as strong, proud, and interested; and the negative affect scale includes adjectives such as afraid, ashamed, and nervous. The Temporal Satisfaction With Life Scale (Pavot, Diener & Suh, 1993) assess the cognitive component of subjective well-

being and comprises 15-items (7-point likert scale; 1=strongly disagree, 7=strongly agree) organized in three subscales assessing past (e.g., “If I had my past to live over, I would change nothing”), present (e.g., “I would change nothing about my current life”), and future life satisfaction (e.g., “There will be nothing that I will want to change about my future”). The Swedish versions of both instruments have been used in previous studies among adolescents (e.g., Garcia & Erlandsson, 2011; Nima, Archer & Garcia, 2012; Nima, Archer & Garcia, 2013; Schütz, Archer & Garcia, 2013; Garcia, Rosenberg & Siddiqui, 2011). In the present study we used the standardized scores (z-scores) of the temporal life satisfaction total score (i.e., the sum of the past, present, and future subscales) and the difference between participants’ positive affect and negative affect to create the subjective well-being score (i.e.,  $z_{\text{temporal life satisfaction}} + z_{\text{positive affect}} - z_{\text{negative affect}}$ ).

*Psychological well-being.* The Swedish version (Garcia & Siddiqui, 2009; Garcia, 2012) of Ryff’s short test (Clarke, Marshall, Ryff Wheaton, 2001) was used to operationalize psychological well-being. The test consists of 18 items with a 6 point likert scale (from 1 = *strongly disagree* to 6 = *strongly agree*) measuring the six dimensions of psychological well-being: autonomy (e.g., “I have confidence in my opinions, even if they are contrary to the general consensus”), environmental mastery (e.g., “In general, I feel I am in charge of the situation in which I live”), personal growth (e.g., “I think it is important to have new experiences that challenge how you think about yourself and the world”), positive relations with others (e.g., “People would describe me as a giving person, willing to share my time with others”), purpose in life (e.g., “Some people wander aimlessly through life, but I am not one of them”), and self-acceptance (e.g., “I like most aspects of my personality”). The Swedish version has showed low reliability for many of the subscales (e.g., Garcia & Siddiqui, 2009; Garcia, Jimmefors, Adriansson, Mousavi, Rosenberg & Archer, 2014), therefore the total score for psychological well-being was used in the present study.

*Exercise Behavior.* The background questionnaire included two items to measure frequency (“How often do you exercise?”; 1 = never, 5 = 5 times/week or more) and intensity (“Estimate the level of effort when you exercise”; 1 = non or very low, 10 = Very High) of exercise behavior (Garcia et al., 2012). The participants’ answers to both exercise-items were first standardized (i.e., transformed to *z-scores*) in order to summarize them into a composite measure for exercise behavior, that is, The Archer Ratio (Garcia & Archer, 2014). A principal components analysis, with oblimin rotation, suggested that a single primary factor accounted for at least 70.94% of the variance, thus supporting the calculation of The Archer Ratio.

*Academic achievement.* This variable was operationalized through pupils’ final grades in Swedish, Mathematics, English, and Physical education. The courses take place during either one or two semesters and the grading scale ranges from A = *pass with distinction* to F = *fail*. The grades were transformed to “points” accordingly to The Swedish National Agency for Education: A = 20, B = 17.5, C = 15, D = 12.5, E = 10, F = 0, - = -10 (<http://www.studera.nu/download/18.4149f55713bbd91756380003453/gymnasietgy2011.pdf>) . A grade point average was then computed by simply summarizing the points for each subject and the divided by the number of subjects (i.e., four).

### ***Statistical treatment***

For the statistical analyses, a Pearson correlation analysis was conducted to identify the expected correlations between self-regulation (locomotion and assessment), well-being (subjective and psychological well-being), exercise behavior (The Archer Ratio), and academic achievement (grade point average). A multiple regression analysis was also conducted in order to investigate this further. See Table 1 for *Cronbach’s alphas*. ) As recommended by Ferguson (2009), we focused on correlations equal or larger than .2 as a minimum effect size presenting a "practically" significant effect for social science data.

## Results

As expected (H1), academic achievement was positively related to assessment ( $r = .25, p < .01$ ). The results also showed that academic achievement was positively related to both subjective well-being ( $r = .31, p < .01$ ) and psychological well-being ( $r = .22, p < .01$ ), that is Hypothesis 2 (H2). Also as expected (H3), locomotion was positively related to subjective well-being ( $r = .48, p < .01$ ) and psychological well-being ( $r = .58, p < .01$ ), while assessment on the other hand was negatively related to subjective well-being ( $r = .23, p < .01$ ). Although we expected both measures of well-being to be related to the Archer Ratio (H4), only subjective well-being was positively related to exercise behavior ( $r = .24, p < .01$ ). Nevertheless, the Archer ratio was positively related to academic achievement ( $r = .23, p < .01$ ). Finally, as expected (H5), locomotion was positively associated to the Archer ratio ( $r = .20, p < .05$ ). For more details, see table 1. Further regression analysis showed that assessment ( $\beta = .21, p < .008$ ) and subjective well-being ( $\beta = .31, p < .03$ ) had an significant effect on grade point average. Hence, suggesting that, when controlling for all variables in the study, the main predictors of higher final grades were assessment and subjective well-being.

TABLES 1 and 2 SHOULD BE HERE

## Discussion

The purpose of this study was to investigate how high school pupils' self-regulated orientation, well-being and exercise habits are related to academic achievement. Assessment was positively correlated with grade point average, while locomotion was weakly associated (below .20 which is the minimum effect size presenting a "practically" significant effect for social science data). This result was expected because of assessment's similarity to self-regulated learning—assessment involves strategic thinking, assessing different goals and pathways to achieve these goals (Kruglanski et al, 2000), while self-regulated learning

emphasizes assessing one's own cognitions and thinking and also elaboration and constant renewal and development of one's learning strategies (Pintrich, 2004). Indeed, previous research has shown that self-regulated learning (i.e., pupils who have developed cognitive strategies in order to plan, monitor and modify their cognitive functions) predicts higher grades in school (Pintrich & V. De Groot, 1990; Corno & Mandinach, 1983; Corno & Rohrkemper, 1985). Other studies show that locomotion orientation is positively related to type-A behavior expressed by impatience, competitiveness and a 'winner-mentality' (Perry et al, 1990), thus, it is plausible to suggest that high levels of locomotion might interfere with pupils ability to study and perform well in typical school work. Perhaps explaining the weak correlation between locomotion and grade point average in the present study.

Moreover, grade point average correlated positively with subjective well-being and psychological well-being. For similar results regarding emotional well-being see Batenburg-Eddes and Jolles' study (2013). High subjective well-being is, indeed, defined by high levels of positive affect, low levels of negative affect, and high satisfaction with life (Schimmack, 2007). Psychological well-being on the other hand, consists of several constructs, such as self-acceptance, autonomy, tolerance towards others, goal-directed behavior, and self-efficacy (i.e., agentic or self-directed behavior). Agency, for instance, is part of a mature character (Cloninger, 2004) whereby mature individuals with positive self-attitude are more likely to achieve higher grades and happiness (Kjell, Nima, Sikström, Archer & Garcia, 2013). While assessment was positively correlated with grade point average, it was negatively correlated with subjective well-being. Possibly, high achieving pupils experience pressures, from parent and significant others, towards achievement that might lower affective status and subjective well-being. Also, ruminating about one's performance and choices might lead to unhappiness (Nima et al., 2012, 2013). Suggesting that, while assessment is good for high grades, it might be harmful for pupils' own happiness. In contrast, locomotion was positively related to both

subjective and psychological well-being. This is important because it implies that seeing self-regulation as a dual construct (e.g., Kruglanski et al., 2000) suggests that schools need to promote self-regulating learning for good grades and locomotion for well-being, which in turn might also lead to higher grades.

Along this line, exercise behavior was positively associated to locomotion, subjective well-being and higher grades. Earlier research suggests that physical education increases academic achievement (e.g., Carlson et. al., 2008) and that pupils who enjoy physical exercise and sports outside school might also achieve a higher level of physical fitness, which correlates with higher grades (e.g., Johnson, 2008). In other words, exercise interventions may offer an important factor for pupils striving for better grades within several domains, affective, cognitive, health, and with additional effects on the learning process, if not the grade-level. Recent studies (e.g., Tine, 2014) show that even acute aerobic exercise interventions (12-minute long) might improve learning. Together with our results, we suggest that exercise might increase grades because it increases well-being.

### ***Implications and conclusions***

Swedish pupil's grades are lower than ever (Skolverket, 2009) and the Swedish education system is facing a huge problem that needs to be addressed urgently. According to the report by the Programme for International Student Assessment (Skolverket, 2012) no other country has fallen so far behind concerning grades between the years 2009-2012 compared to the other 32 OECD countries. For example, Natural Science scoring have dropped from 495 to 485 points, the international average is 501 points. Only six other countries have fewer points (Skolverket, 2012). At the same time, researchers are concerned with decay in physical education hours among Swedish high school pupils (Sveriges Radio, 2013). Self-regulated learning emphasizes assessment orientation, which according to this and earlier studies, predicts higher grades. Locomotion, on the other hand is related to well-being and also to

exercise behavior, both being positively related to academic achievement. Our findings suggest a dual (in)direct approach to increase pupils' academic achievement and well-being— locomotion being related to frequently exercising (and probably even higher grades in Physical Education as a subject per se) and higher well-being, in turn, increasing academic achievement; while assessment being directly related to higher academic achievement (see Figure 1).

FIGURE 1 SHOULD BE HERE

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Table 1. Correlations among Locomotion, Assessment, Subjective Well-Being, Psychological Well-Being, Archer Ratio and Grade Point Average.

	1	2	3	4	5	6
(1) Locomotion	-					
(2) Assessment	.09	-				
(3) Subjective Well-Being	.48***	-.23**	-			
(4) Psychological Well-Being	.59***	-.15	.77***	-		
(5) The Archer Ratio	.20*	.11	.24**	.14	-	
(6) Grade Point Average	.17**	.25**	.31***	.22**	.23**	-
Mean and Sd.	3.81± .66	3.76±.71	-0.01±.1.79	4.19±.64	10.47±2.82	14.51±2.57
Cronbach's $\alpha$	.74	.75	-	.79	-	.75

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .



Table 2. The regression analysis that shows the influences of Locomotion, Assessment, Subjective Well-Being, Psychological Well-Being and Archer Ratio on Grade Point Average.

Predictor Variable	Outcome Variable	<i>Unst. B</i>	<i>Unst. SE</i>	<i>Stand. <math>\beta</math></i>	<i>t</i>
Locomotion	Grade Point Average	-.28	.37	-.08	-.75
Assessment		.72	.32	.21	2.24*
Subjective Well-Being		.41	.18	.32	2.25*
Psychological Well-Being		.21	.54	.06	.38
The Archer Ratio		.10	.08	.11	1.95

Note: \*  $p < .05$ . Adj.  $R^2 = .11$ ,  $F = 3.76$ ,  $p < .001$ .

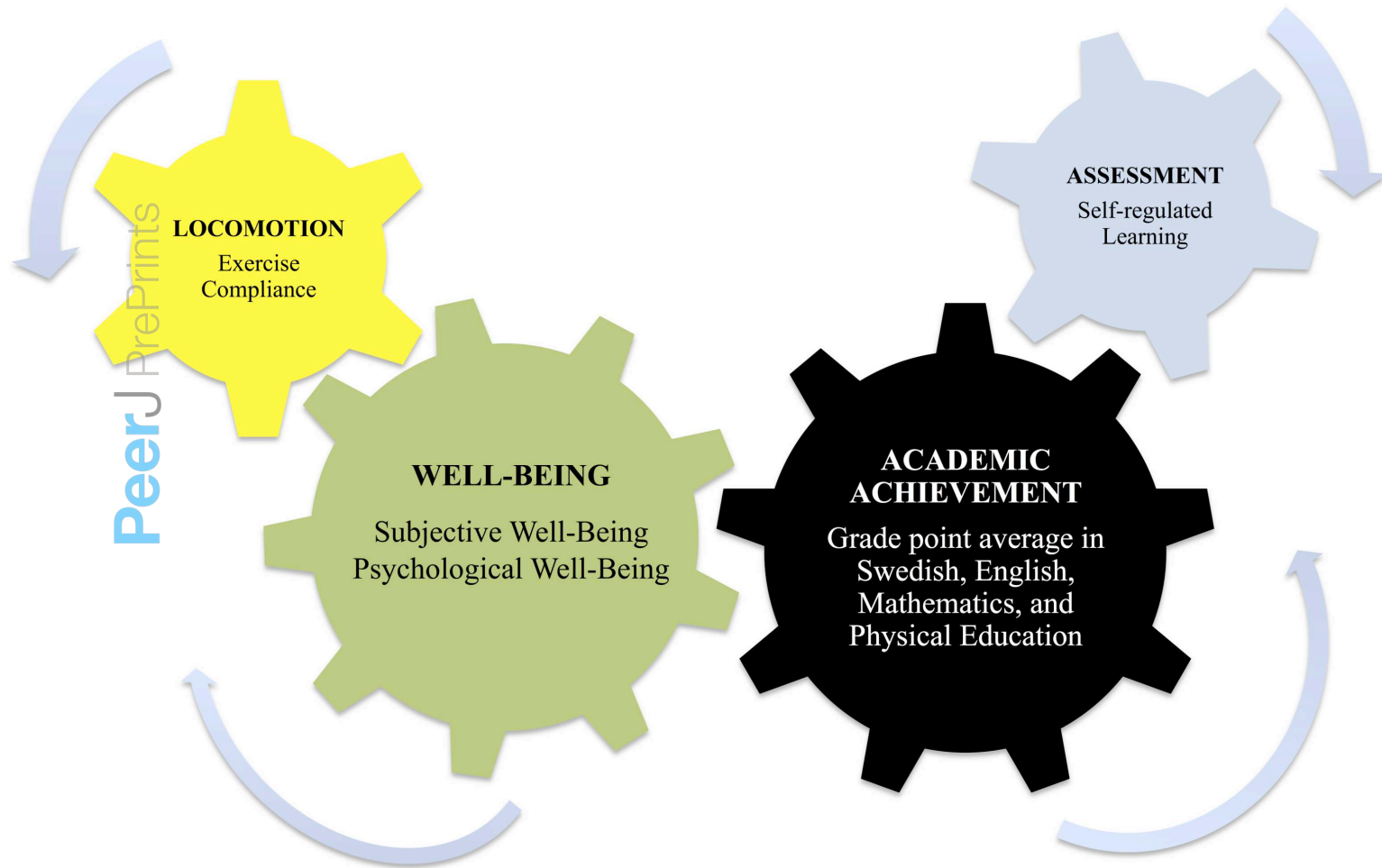


Figure 1. A dual focus approach simultaneously influencing well-being and academic achievement.