A dual pathway of student motivation: Combining an implicit and explicit measure of student motivation

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Abstract

Abundant research in social psychology shows human behaviour is guided by beliefs through two pathways, a deliberate and automatic pathway. Research on student motivation has thus far focused mostly on the deliberate pathway and consequently almost exclusively relied on explicit measures (i.e. self-reports of motivation) to assess student motivation and subsequently predict student behaviour and achievement. The purpose of this study was to examine whether student motivation is associated with students' behavioural engagement and school grades through dual pathways by assessing motivation with a newly developed implicit measure and an explicit measure. Participants were 139 students in year 3 of secondary education (58% female, M = 14.8 years). Motivation was assessed with an implicit association test (IAT) as well as an explicit measure (self-report). Behavioural engagement was assessed by teacher ratings, and school grades were reported by students. The explicit and implicit measures of student motivation were not significantly correlated, suggesting that both measures tap into different aspects of student motivation. Furthermore, structural equation analyses revealed that students' explicit and implicit motivation were positively associated with school grades. Neither motivation measure was associated with teacher ratings of behavioural engagement. This study contributes to existing research by showing that an implicit measure of student motivation can predict unique variation in school grades in addition to an explicit measure. As such, the current study provides initial support for a dual pathway model of student motivation.

Keywords: Motivation; Engagement; Implicit measure; Dual pathway model

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1. Introduction

There is widespread consensus among researchers and educators that motivation to learn is a powerful factor contributing to engagement and achievement. Self-determination theory (SDT) (Deci & Ryan, 1985; Ryan & Deci, 2000a) states that intrinsic motivation facilitates higher levels of engagement and achievement, whereas extrinsic types of motivation can lead to maladaptive learning behaviours and outcomes. Previous research has empirically supported these claims and found positive reciprocal associations between intrinsic motivation and engagement and achievement (see for example Green et al., 2012; Guay, Ratelle, Liem, & Litalien, 2010; Korpershoek, 2016; Michou,Vansteenkiste, Mouratidis, & Lens, 2014; Taylor et al., 2014; Walker, Greene, & Mansell, 2006). Even though motivation has been found to facilitate achievement and vice versa, most studies only found weak or modest associations between motivation-related constructs on the hand, and behavioural engagement and achievement on the other hand (for reviews, see for example Cerasoli, Nicklin, & Ford, 2014; Richardson, Abraham, & Bond, 2012) instead of the powerful relationships that are often assumed. These modest findings may be due to the specific focus of previous studies on deliberate motivational processes. Yet, abundant research in social psychology shows that most human behaviour is not only predicted by conscious, deliberate processes. That is, in situations where people do not have an opportunity to deliberate, their beliefs operate in a more reactive or automatic way. When the automatic pathway is followed, beliefs are automatically activated and guide behaviour without conscious awareness or deliberation. Hence, it is believed that human behaviour can be predicted by two pathways, a deliberate and an automatic pathway (e.g., Chaiken & Trope, 1999; Gawronski & Bodenhausen, 2006; 2011). This may also apply to students' motivation for school. In everyday classroom situations, students may not always deliberately choose their actions or plan their strategies. Students' motivation will probably often impact their behaviours in more automatic or reactive ways. By assessing motivation with an implicit as well as an explicit measure, this study aims to examine whether student motivation predicts behavioural engagement and school grades through dual pathways.

1.1 Student motivation

SDT (Deci & Ryan, 1985; Ryan & Deci, 2000b) provides an integrative framework of student motivation. Students who are intrinsically motivated engage in an activity because the activity in itself evokes interest or pleasure or because they identify with reasons for performing an activity. Extrinsic motivation comes from external pushes, reinforcement, or internal pressures that cause feelings of obligation or guilt. Extrinsic motivation comes in various forms that vary in their degree of relative autonomy. Extrinsic motivation is fully external when students feel controlled by others or by contextual pressures to engage in an activity they would not otherwise want to engage in (i.e., external regulation). Alternatively, students can also pressure themselves to engage in an activity out of guilt, shame, or concerns about what others might think of them (i.e., introjected regulation). This type of regulation involves a higher level of autonomy compared to external regulation. In case of identified regulation, autonomy is even higher. For example when students are motivated for an activity because they consider it useful for their future careers or they recognize the importance of the skills they might develop through that activity. External and introjected regulation are associated with undesirable behaviours such as unwillingness or passive compliance. These two types of regulation have also been referred to as controlled motivation, whereas identified regulation and intrinsic motivation are referred to as autonomous motivation and are associated with more beneficial outcomes, such as greater behavioural engagement (e.g., Ryan & Deci, 2000a, 2000b; Vansteenkiste, Lens, & Deci, 2006, Vansteenkiste et al., 2009). In this study, behavioural engagement is defined as students' effort, attention, and persistence with regard to their schoolwork (e.g., Skinner, Furrer, Marchand, & Kindermann., 2008).

Previous research supports the assumption that autonomous motivation is positively associated with behavioural engagement and achievement, although these associations are in general not very strong. Recent meta-analyses (Cerasoli et al., 2014; Richardson et al., 2012) found small to medium correlations of $r = .17$

and $r = .21$ between intrinsic motivation and academic achievement in school settings. A positive relationship between autonomous motivation and behavioural engagement has also been found in previous research. Autonomous or intrinsic motivation has for example been associated with higher-quality learning (Grolnick & Ryan, 1987; Vansteenkiste, Simons, et al., 2004), the use of effective learning strategies (Michou et al., 2014), and class participation (Green et al., 2012). However, most studies on the relationship between motivation and behavioural engagement have used self-reports to assess both constructs, which may lead to common-method bias (e.g., Podsakoff, MacKenzie, Lee, & Podsakoff 2003). That is, correlations based on similar methods may overestimate the actual strength of the association. Previous research has indeed found much stronger associations of self-reported motivation with self-reported behavioural engagement compared to studies that included different measures, such as students' self-reported motivation and teacher ratings of behavioural engagement (e.g., Skinner & Belmont, 1993; Skinner, Chi, et al., 2012). This shows that previous studies may have overestimated the associations between self-reported motivation and behavioural engagement. Hence, it can be concluded from prior research that self-reports of motivation can only explain students' behavioural engagement or achievement to a limited extent.

1.2 A dual pathway model

The associative-propositional evaluation (APE) model (Gawronski, 2006; 2007; 2011) is a dual pathway model that describes how beliefs guide human behaviours. According to the APE-model, beliefs can be activated upon encountering a relevant stimulus, leading to an automatic reaction. Alternatively, in other instances, a deliberate propositional process may follow the activation of the belief in which a person consciously reflects on the validity of a belief before acting upon it. Especially within the domain of prejudice, the APE-model has been studied and supported by empirical evidence (Gawronski, Peters, Brochu, & Strack, 2008, or for an overview see Gawronski & Bodenhausen, 2011). This dual pathway may also apply to student motivation. That is, students' motivational beliefs may also guide student behaviour either automatically or in more deliberate ways. Students may hold different types of motivational beliefs, ranging from controlled to more autonomous. According to the dual pathway model, these beliefs can be activated automatically or they can be deliberated upon. In school, students encounter numerous moments on a daily basis during which motivational beliefs (e.g., 'I do not enjoy this type of task') may be activated and they can either engage in their schoolwork or not. Oftentimes they will not have the opportunity nor the willingness to deliberate and think about what behaviours they will express. Consequently, automatic processes will often guide students' behavioural engagement or performance. Take for example a student who mostly endorses controlled motivational beliefs ("I only do my schoolwork, because I have to."). Many situations in school may automatically activate this belief, and as a result, he/she often may not fully engage in adaptive learning behaviours or perform to the best of his/her abilities. However, when this student has the opportunity to deliberate, he/she may also endorse more autonomous reasons for engaging in schoolwork. Hence, when there is opportunity to deliberate, a second pathway may be followed and this student may realize the importance of doing her schoolwork and put in more effort after all.

1.3 Measurement of student motivation

In educational science, explicit self-reports are typically used to measure student motivation (e.g., Zimmerman, 2006). Self-reported motivation or 'explicit motivation' only captures those aspect of students' beliefs about their motivation that they are willing to report, that they can reflect upon, and that they are able to describe accurately. Hence, the value of such introspectively derived explicit measurements may be limited due to a variety of factors, including social desirability (Lepper, Corpus, & Iyengar, 2005), or limited awareness, opportunity, or ability to translate mental beliefs into a self-report (Nosek, Hawkins, & Frazier, 2011; Rudman, 2011). To circumvent such problems, reaction-time measures, commonly referred to as 'implicit measures', have become increasingly popular in other domains of social psychology over the last decades (Fazio & Olson, 2003). Implicit measures aim to capture beliefs that automatically guide behaviour.

Many implicit measures are reaction time measures which are administered on a computer and assess associations stored in memory (Greenwald McGhee, & Schwartz, 1998). By unobtrusively assessing the strength of these associations (for example the extent to which a person associates a certain attitude object with 'positive' or 'negative'), more or less automatically activated beliefs are assessed (Nosek et al., 2011). Thereby these measures aim to capture associations in memory that, when activated, can automatically cause affective or behavioural responses (Greenwald et al.,1998; Nosek et al., 2011; Rudman, 2011; Sherman, Gawronski & Trope, 2014). Implicit measures, have indeed been shown to be much less susceptible to social desirability and self-presentation bias than explicit measures (e.g., Steffens, 2004). In a variety of domains, implicit measures are found to add to the prediction of variations in human behaviour that are not accounted for by self-report measures (for an overview, see for example Greenwald, Poehlman, Uhlmann, & Banaji, 2009). Implicit measures may also be a suitable instrument to assess motivation. Because these measures assess associations stored in memory, they could also assess, for example, the extent to which students associate themselves with enjoyment of schoolwork. As such, they may provide an alternative to self-reports for assessing students' motivational beliefs.

One of the most widely used implicit measures is the Implicit Association Test (IAT) of Greenwald et al. (1998). The IAT assesses the association between various concepts by asking participants to repeatedly pair two concepts. The more strongly the participant associates two concepts, the faster the participant will respond when this particular pair of concepts is presented. The IAT is often used to assess people's attitudes, for example participants' positive versus negative attitudes toward ethnic minority versus majority people (e.g., McConnell & Leibold, 2001; Van den Bergh, Denessen, Hornstra, Voeten, & Holland, 2010) or political preferences (e.g., Galdi, Arcuri, & Gawronski, 2008). In addition to these attitude-IAT's, identity-IAT's have been developed to assess how participants associate themselves with a certain target concept. Gray et al. (2011) for example found that participants who associated themselves more strongly with alcohol, engaged in more drinking behaviours. The predictive validity of the IAT has been demonstrated for various domains (Greenwald, et al., 2009), including ethnic prejudice (Connell & Leibold, 2001), voting behaviour (Galdi, et al., 2008), substance use (Rooke, Hine, & Thorsteinsson, 2008), and consumer behaviours (Friese, Wänke, & Plessner, 2006).

In addition, there have been a few studies that examined motivation in an implicit manner. For example, several studies demonstrated that activating motivational beliefs or goals can affect subsequent behaviour or performance. That is, Bargh, Gollwitzer, Lee-Chai, Barndollar, and Trötschel (2001) have shown that when a goal to perform well (versus a goal to cooperate with others) was activated, respondents' performance on an intellectual task increased. Furthermore, in a study by Levesque and Pelletier (2003), respondents were primed with words representing intrinsic motivation, extrinsic motivation, or neither. Respondents who were primed with intrinsic motivation enjoyed a puzzle task more and performed better than respondents in the control condition. Respondents primed with extrinsic motivation enjoyed the task less and performed less well. In addition, Burton, Lydon, D'Alessandro, & Koestner (2006) found that priming students with intrinsic motivational words, led to greater well-being. Moreover, an (implicit) lexical decision test predicted subsequent course performance six weeks later. Finally, in a set of two laboratory experiments, Keatley, Clarke, and Hagger (2013) used an identity-IAT to assess undergraduate students' motivation and examined whether their implicit autonomous motivation predicted the duration respondents worked on an unsolvable task. Students' implicit motivation predicted task persistence beyond the prediction by explicit measures. Although the studies described here only included undergraduate students – thereby limiting the scope of these findings – these studies show the potential role of implicit motivation in predicting behavioural or performance outcomes.

1.4 Relations between implicitly and explicitly measured beliefs

Previous research in other domains found weak correlations between explicit and implicit measures (e.g., Nosek et al., 2011; Rudman, 2011). These weak correlations could indicate low concurrent validity of both measures, but could also suggest that both type of measures tap into different aspects of one's beliefs.

That is, implicit measures aim to assess beliefs that are activated without deliberation. These may be automatically activated beliefs which the respondent may not even consider to be valid (e.g., an association between 'black man' and 'criminal). Yet, this association can still affect one's behaviour, for example stepping back when one encounters a black person (Gawronski & Bodenhausen, 2011). Explicit measures on the other hand assess beliefs that one has deliberated upon. After deliberation, one may express a belief (e.g., 'Negative evaluations of black people are wrong') that may be inconsistent with the automatically activated belief. This explicitly assessed belief may also be predictive of one's behaviour (talking in a friendly manner to a black person). Hence, implicitly and explicitly assessed beliefs are not necessarily consistent with one another. Moreover, implicitly and explicitly assessed beliefs are found to be predictive of different types of behaviour. Namely, self-report measures are typically more predictive of planned and strategic behaviours (i.e. deliberate pathway), whereas reaction-time measures are more predictive of non-verbal and immediate behaviours (i.e., automatic pathway) (Sherman et al., 2014).

1.5 This study

The present study aims to examine whether a dual pathway model can also be applied to motivation of students in secondary education to predict students' behavioural engagement and school grades. At this age, motivation of many students starts to develop unfavourable (e.g. Opdenakker, Maulana, & Den Brok, 2012). Previous studies on implicit motivation (Bargh et al., 2001; Burton et al., 2006; Keatley et al., 2013; Levesque & Pelletier, 2003) have exclusively focused on undergraduate students. The results of these studies may not be generalizable to high school students, for whom – contrary to undergraduate students who chose their course of study – school is compulsory. As such, it is important to examine whether the findings of these previous studies can be extended to other educational contexts. Moreover, to our knowledge, prior studies have only assessed how implicit affects participants' behaviour or performance during tasks performed in a laboratory setting. The present study includes more ecologically valid outcome measures, and is among the first to examine whether an implicit measure of student motivation is associated with students' actual behaviours in class and their school grades.

This study adds to research on student motivation by assessing whether an innovative and new instrument to assess student motivation can be used as an alternative to explicit motivation measures –which have been shown to have limited predictive validity. Moreover, if this implicit measure of motivation is indeed associated with students' behavioural engagement and school grades, targeting maladaptive motivational associations may be a fruitful approach for motivational interventions, for example by priming associations that are considered adaptive for learning.

In the present study, students' motivational beliefs will be assessed implicitly, by means of a reaction-time measure, and explicitly, by self-report. For the sake of readability, we use the terms 'implicit motivation' and 'explicit motivation', although students' motivational beliefs are not necessarily implicit or explicit in nature. To be precise, the term 'implicit' and 'explicit' refer to the way the beliefs were measured and the pathways through which they are assumed to affect behaviour. The present study examined to what extent students' motivation predicts behavioural engagement and school grades, thereby aligning with the APE model that assumes that beliefs guide subsequent behaviours (Gawronski, 2006) and with prior studies which found causal effects of motivation on subsequent achievement (e.g., Green et al., 2012; Guay et al., 2010). However, we do not assume that these relationships are unidirectional. Previous research has shown reciprocal relationships between motivation and achievement (Taylor et al., 2014). As such, we assume that associations between motivation and engagement/school grades are indicative of reciprocal relationships between these constructs. The following hypotheses were addressed in this study:

Hypothesis 1: Implicit and explicit motivation are positively, but weakly correlated.

As previous research mostly found weak correlations between explicit and implicit measures (e.g., Nosek et al., 2011; Rudman, 2011), a positive, but weak association is expected between both measures of motivation.

Hypothesis 2. Implicit motivation uniquely predicts teacher ratings of students' behavioural engagement and school grades in addition to explicit motivation.

Previous research (e.g. Sherman et al., 2014) indicated that explicit beliefs tend to be more predictive of planned and strategic behaviours and implicit beliefs more predictive of non-verbal and immediate behaviours. As behavioural engagement and school grades both comprise and result from a complex variety of planned and immediate behaviours, it is expected that implicit and explicit motivation are both predictive of behavioural engagement and school grades. Therefore we expect that explicit and implicit motivation both explain unique variations in behavioural engagement and school grades.

2. Methods

2.1 Respondents

A sample of 139 students (59 male, 80 female) from six classes from two different schools participated. They attended year 3 (grade 9) of general secondary education. This track is attended by approximately 23% of secondary school students in the Netherlands. It can be positioned between pre-vocational education and pre-university education (attended by approximately 56% and 20% of the secondary school population, respectively) (Ministry of Education, Culture, and Science, 2014). The mean age of the students was 14.8 years (SD = 0.67). The majority of students had a Dutch or western background (95.7%).

2.2 Instruments

2.2.1 Explicit motivation

The self-regulation questionnaire academic (SRQ-A) (Ryan & Connell, 1989) was administered to assess students' explicit motivation for school. This measure is rooted in SDT. It assesses the extent to which students' school-related behaviours are autonomously regulated. It consists of four subscales with 32 items in total that are answered on a four-point scale ranging from not true at all (1) to very true (4). The items were preceded by a question, for example 'Why do I work on my schoolwork?'. The four subscales are intrinsic regulation (e.g., 'Because I enjoy doing my schoolwork.'), identified regulation ('e.g., 'Because it's important to me to work on my classwork.') , introjected regulation ('Because I'll be ashamed of myself if it didn't get done.'), and external regulation ('Because I want the teacher to think I'm a good student.'). A confirmatory factor analyses revealed that a model with two factors, that is autonomous motivation (consisting of the items of the subscales intrinsic regulation and identified regulation) and controlled motivation (consisting of the items of the subscales introjected regulation and external regulation) fitted the data reasonably well (CFI= .89; RMSEA= .070; SRMR= .088) and outperformed alternative models. Internal consistencies, as indicated by Cronbach's alpha, were good: autonomous motivation, α= .84 and controlled motivation, α= .86.

2.2.2 Implicit motivation

An implicit association test (IAT) (Greenwald et al., 1998) was administered to assess the extent to which students associate autonomous versus controlled reasons for making schoolwork with their perception of themselves. The IAT measures the strength of associations by comparing reaction times to different pairings of concepts. Specifically, the IAT works as follows: the strength of automatic associations between a target category (e.g., autonomous or controlled reasons for schoolwork) and an identity category (e.g., 'me' or 'not me') is inferred from the relative speed with which one sorts stimulus words into these categories

correctly. To represent the target categories, we used the category labels 'Making schoolwork because I want to' and 'Making schoolwork because I have to' to represent autonomous and controlled motivation respectively. The corresponding words of both categories were terms that could be associated with autonomous motivation ("wanting", "fun", "voluntary", "interesting", "important") and words that could be associated with controlled motivation ("obligation", "boring", "control", "required", "pressure"). Identity-related words were used ("I", "myself", "self" or "they", "them", "their") that either belonged to the category 'me' or to 'not me'. It was expected that students with higher autonomous implicit motivation would associate themselves more strongly with 'making schoolwork because I want to' and find it easier to classify the stimulus words into the correct categories – hence, respond more quickly – when 'making schoolwork because I want to' and 'I' were presented on the same side. Prior to this study, a small pilot (*N*= 17 students) was conducted in which a large set of words were presented that respondents could classify as belonging to the two categories. Only words that were exclusively listed to belong to one of these categories and not to both were used in this IAT.

The IAT consisted of seven blocks (see Fig. 1). In the first practice block, respondents were shown a series of words that appeared in the middle of the screen that either represented autonomous or controlled motivation. Participants had to correctly classify these words in the categories 'Making schoolwork because I want to' on the left side of the screen by pressing the 'E' key on the laptop or in the category 'Making schoolwork because I have to' on the right side of the screen by pressing the 'I' key. In the second block, identity-related words were shown that needed to be classified as 'me' or 'not me' with the same keys. The third and fourth block were congruent test blocks and the aforementioned categories were combined. During these blocks, both motivation-related words and identity-related words were presented on the screen and needed to be classified in the correct categories with the 'E' and 'I' keys. These test blocks were followed by a practice block and two incongruent test blocks in which the motivation categories were switched to the other sides of the screen. Reaction times were measured for each response. The response latencies for the first two congruent test blocks were compared to the response latencies for the latter two incongruent test blocks. It was expected that a stronger association between two concepts paired together (e.g., 'autonomous motivation' and 'me') would result in shorter reaction times when compared to other pairs. Given the relatively small sample size, the order of blocks was not counterbalanced. The meta-analysis by Greenwald et al (2009) indicates that using a fixed order of blocks does not affect predictive validity. In general, IAT's are found to have good test-retest reliability, good convergent validity with other implicit measures (Cunningham, Preacher, & Banaji, 2001), and good predictive validity (e.g. Greenwald et al., 2009). The internal consistency of this IAT, calculated by the method described by Bosson, Swann, and Pennebaker (2000), was $\alpha= .74$ which indicates good reliability of the measure.

The scoring procedures recommended by Greenwald, Nosek and Banaji (2003) were used to calculate the standardized D-score. Trials greater than 10,000 milliseconds indicate that respondents may have been distracted and were deleted. Subjects who responded extremely fast (<300 milliseconds) on more than 10% of the trials were not included in the analyses (i.e., those who were simply hitting keys as fast as possible). In addition, the IAT scores of students with less than 60% correct responses were not included in subsequent analyses . Consequently, the scores of 19 students were excluded. Positive IAT scores indicated a higher level of autonomous motivation for schoolwork and negative IAT scores indicated a higher level of controlled motivation for schoolwork.

(a)

Making schoolwork
because I <u>want</u> to

Making schoolwork
because I <u>have</u> to

Boring

(b)

<u>Me</u>

<u>Not me</u>

Them

(c)

Making schoolwork
because I <u>want</u> to

Making schoolwork
because I <u>have</u> to

<u>Me</u>

<u>Not me</u>

<u>Myself</u>

(d)

Making schoolwork
because I <u>have</u> to

Making schoolwork
because I <u>want</u> to

Interesting

(e)

Making schoolwork
because I <u>want</u> to

Making schoolwork
because I <u>have</u> to

<u>Me</u>

<u>Not me</u>

Fun

Figure 1. Screen shots of the IAT during (a) practice block 1, (b) practice block 2, (c) test block 3-4, (d) practice block 5, and (e) test block 6-7.

2.2.3 Behavioural engagement.

Teachers (*N*= 6) rated the behavioural engagement, i.e. their effort, attention, and persistence, of each student. We used this method instead of students' self-reports, because explicit motivation was also measured by self-reports. Assessing both constructs by similar measures would likely result in an overestimation of the correlation between explicit motivation and behavioural engagement (i.e. 'common method bias', Podsakoff et al., 2003). We used the behavioural engagement scale of Skinner, Kindermann, and Furrer (2008) who based their measure on Wellborn (1991). A back-translation procedure was used to translate the items to Dutch. The scale consisted of five items per student to be answered on a four-point Likert scale ranging from totally not applicable to this student (1) to totally applicable to this student (4). An example item is "When this student doesn't do well, he/she works harder". The reliability of this scale was *α*= .92.

2.2.4 School grades

Students reported their average course grade for three core subjects in the curriculum, Dutch, English, and Mathematics. Self-reported grades are considered to reflect actual grades with reasonable accuracy, especially in academic domains (Kuncel, Credé, & Thomas, 2005). The average grade across these three core subjects was calculated for each student. The grades can range from 1 to 10, with 10 representing the highest grade.

2.3 Procedure

Passive parental consent was obtained prior to data collection. No parents objected to participation. During data collection, students were visited by a researcher in a computer room. They received a brief explanation by the researcher and a brief instruction on paper, after which they could turn on the computer. All instruments were administered online. They were first presented with the IAT, followed by the explicit motivation questionnaire, questions on demographics and their school grades. Simultaneously, their teachers filled out the ratings of behavioural engagement for each student.

2.4 Data-analyses

For explicit motivation and school grades, missing data were limited (2.2%-4.3% missing data). For implicit motivation and behavioural engagement, more data were missing (13.7% and -18.7% respectively). Missingness was due to students who were excluded because of high error rates on the IAT and because one teacher did not fill out the ratings of behavioural engagement. Because missingness could not be considered completely at random (MCAR), missing data were handled by using the Full Information Maximum Likelihood procedure (FIML) (Schafer & Graham, 2002).

To test the first hypothesis on the association between the implicit and explicit motivation measure, the correlation between both measures was calculated. Furthermore, to test the second hypothesis, which states that both implicit and explicit motivation predicted behavioural engagement and school grades, Structural Equation Analyses were performed in Mplus 7.4 (Muthén & Muthén, 1998-2017). The dependent variables (behavioural engagement and school grades) were estimated as latent factors based on the observed scores. In the analysis, we controlled for several factors associated with the outcome variables, i.e., gender, grade repetition, and minority background. These were entered as dummy variables in the analysis. Explicit (autonomous and controlled) and implicit motivation were added as observed predictors to the model. Given that we corrected for error in the implicit motivation, when calculating the IAT scores, measurement error was also taken into account for the explicit measure, by correcting for attenuation. The significance of the coefficients for the different predictor variables was tested using Wald tests (z tests). The set level of significance was 5%. Model fit was evaluated with Chi-square difference tests, the RMSEA, the CFI, and by
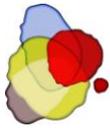
the Standardized Root Mean Square Residual (SRMR). A significant Chi-square difference indicates whether or not model fit significantly improved or worsened. An RMSEA below 0.05 indicates good fit of a model and scores between .05 and .08 indicate reasonable fit. Scores above .10 indicate poor fit. A CFI above 0.90 indicates good fit of a model. A SRMR value below .08 is generally considered a good fit (Hu & Bentler, 1999).

3. Results

3.1 Descriptive statistics and correlations

In Table 1, descriptive statistics are reported. The implicit measure has a positive mean, suggesting that on average students implicitly endorse autonomous motivation over controlled motivation.

Table 1
Descriptive statistics

	N	M	SD	Min	Max
Explicit motivation – Autonomous	136	2.28	0.39	1.14	3.43
Explicit motivation – Controlled	136	2.24	0.39	1.06	3.11
Implicit motivation	120	0.26	0.48	-1.56	1.36
Behavioural engagement	113	2.72	0.76	1.00	4.00
School grades	133	6.42	0.80	4.30	10.00
Total	139				

With regard to the first hypothesis, weak correlations were expected between the implicit and explicit measures of motivation. The correlations reported in Table 2 show that implicit motivation was not significantly correlated with either autonomous or controlled explicit motivation ($r = .12$; $p = .191$; $r = .13$; $p = .172$, respectively). In addition, Table 2 shows that behavioural engagement and school grades were significantly positively correlated ($r = .20$; $p = .042$). None of the motivation measures were correlated with behavioural engagement (explicit – autonomous: $r = 0.17$; $p = .069$; explicit – controlled: $r = .03$; $p = .723$; implicit: $r = .28$; $p = .788$). With respect to school grades, it was found that both explicit measures were not significantly correlated with school grades (explicit – autonomous: $r = .10$; $p = .246$; explicit – controlled: $r = -.02$; $p = .831$). Implicit motivation was, however, positively associated with school grades ($r = .19$; $p = .037$).

Table 2
Correlations

	1.	2.	3.	4.	5.
1. Explicit motivation - Autonomous	1.00				
2. Explicit motivation - Controlled	.63**	1.00			
3. Implicit motivation	.12	.13	1.00		
4. Behavioural engagement	.17	.03	.03	1.00	
5. School grades	.10	-.02	.19*	.20*	1.00

* p<0.05; ** p<0.01; *** p<0.001

3.2 Prediction of behavioural engagement and school grades

The second hypothesis stated that both implicit and explicit motivation would predict behavioural engagement and school grades. Table 3 presents a summary of the structural equation model with the different measures of motivation (explicit motivation – autonomous, explicit motivation – controlled, and implicit motivation) as predictors of both behavioural engagement and school grades. Gender, grade repetition, and minority background were entered as control variables. To test whether the predictive value differed of implicit and explicit motivation differed, we constrained the associations between both types of motivation and the outcome measures to be equal for implicit and explicit motivation. Neither for behavioural engagement, nor for school grades, this worsened model fit ($\Delta\chi2$ (1) = .611, p = .805 and $\Delta\chi2$ (1) = .031, p = .860, respectively). Therefore, the final model indicated that the relations between motivation on the one hand and school grades and behavioural engagement on the other hand were equal for implicit motivation and explicit (autonomous) motivation. The final model with equality constrains fitted the data well: $\chi2(68)$ = 102.927, p = .004; CFI = .93; RMSEA = .065; SRMR = .093. Table 3 reports the final model. Note that even though the unstandardized coefficients were constrained to be equal, the standardized coefficients slightly differ for implicit and explicit motivation.

The results of the final model indicated that, after controlling for gender, grade repetition, and minority background, neither explicit, nor implicit motivation were significantly associated with behavioural engagement (explicit motivation – autonomous: β = .20, p = .227; explicit motivation – controlled: β = -.29, p = .307; implicit motivation: β = -.20, p = .227). Contrarily, school grades were positively predicted by explicit autonomous motivation as well as implicit motivation (both β = .26, p = .025). Explicit controlled motivation did not significantly predict students' school grades (β= -.22, p = .305). Hence, the hypothesized relation between both types of motivation and behavioural engagement could not be confirmed, but hypothesis 2 was confirmed for the association between implicit and explicit motivation and school grades. That is, both implicit and autonomous motivation were found to be positive predictors of school grades. The corresponding effect sizes (*ES* = .17 and *ES* = .24), which were based on the standardized coefficients, indicate small to medium effect sizes. When implicit motivation was not included as a predictor in the final model, the background characteristics and both aspects of explicit motivation explained 4.0% of the variance in school grades. This was raised to 9.7% after adding implicit motivation to the model, indicating that implicit motivation explained an additional 5.7% of the variance in school grades.

Table 3

Summary of Structural Equation Model for Variables predicting Behavioural Engagement and School Grades (N= 139)

	Behavioural engagement				School grades			
	Unstandardized (SE)		*Standardized (SE)*		*Unstandardized (SE)*		*Standardized (SE)*	
Gender (girl)	.09	(.17)	.05	(.10)	.02	(.14)	.01	(.12)
Grade repetition	-.93***	(.24)	-.42***	(.09)	-.19	(.16)	-.13	(.11)
Minority background	-.17	(.58)	-.03	(.11)	.41	(.38)	.12	(.12)
Explicit motivation - Autonomous	.20	(.17)	.09	(.07)	.26*	(.12)	.17*	(.08)
Explicit motivation - Controlled	-.29	(.29)	-.13	(.12)	-.22	(.21)	-.15	(.14)
Implicit motivation	.20	(.17)	.11	(.09)	.26*	(.21)	.23*	(.11)
R^2	.19				.10			

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

4. Discussion

The aim of this study was to examine whether motivation is associated with students' behavioural engagement and school grades through a dual pathway model. Previous research focused almost exclusively on the deliberate pathway by measuring motivation with self-reports that require respondents to be consciously aware of their motivational beliefs and to be able to accurately reflect on those beliefs. By developing and employing an implicit measure of student motivation, we were able to assess students' implicit motivational beliefs. In line with our expectations we found that the explicit and implicit measure of student motivation both added to the prediction of students' school grades. This suggests that automatic, non-deliberate motivational processes and deliberate motivational processes play a role in predicting secondary students' school grades. Neither motivation measure was associated with teacher ratings of behavioural engagement. By showing that an implicit measure of student motivation adds to the prediction of students' school grades, this study contributes to existing research. To our knowledge, this study was the first study examining how implicit motivation is related to actual student outcomes in the classroom, and the first to examine this with secondary school students. As such, the present study has shown that in actual school settings, motivation is associated with students' school grades through different pathways. In addition, this study also provides further support for basic assumptions of SDT (e.g., Deci & Ryan, 2000a), as we found that (implicit) autonomous motivation is more beneficial for school grades as compared to controlled motivation. This shows that these basic assumptions of SDT can be extended to implicit processes as well. Together, the results are a first step toward supporting the existence of a dual pathway model of student motivation. The outcomes show that automatically activated motivational beliefs may impact students' school grades through an implicit pathway, although effect sizes can be considered to be modest. These results are in line with previous studies in many other domains of human functioning in which it was shown that peoples' implicit beliefs can explain unique variations in behaviour, beyond what is explained by self-reports (Greenwald et al. 2009).

The results also indicated that the implicit and explicit measure of motivation were not significantly correlated even though we aimed for a high degree of conceptual correspondence. This aligns with prior research on relations between implicit and explicit measures (e.g., Hoffmann, Gawronski, Gschwendner, Le, Schmitt, 2005; Nosek et al., 2011). Low correspondence between both types of measures can indicate independence of the constructs that are measured by both types of measures or can be caused by several other factors, including, method-related characteristics, bias in explicit self-reports, or limited awareness, opportunity, or ability to translate mental beliefs into a self-report (Hoffmann et al., 2005). Further research is needed to examine whether both measures assess independent belief systems regarding students' motivation for school which could be differentially predictive of different types of student outcomes or, alternatively, whether explicit measures are more strongly affected by the aforementioned methodological limitations.

Neither explicit nor implicit motivation was significantly associated with behavioural engagement, contrary to previous studies (Green et al., 2012; Guay et al., 2010; Korpershoek, 2016; Michou et al., 2014; Taylor et al., 2014; Walker, et al., 2006). Previous studies typically used self-reports to assess both explicit motivation and behavioural engagement and found more substantial correlations between explicit motivation and behavioural engagement. Studies that did not use similar measures, but included teacher ratings of behavioural engagement instead, as we did in our study, found weaker, but nevertheless significant relations between explicit motivation and behavioural engagement (e.g., Skinner & Belmont, 1993; Skinner, Chi, et al., 2012). The absence of a significant relation between motivation and behavioural engagement in our study may be accounted for by a lack of power. That is, there may be weak relationships which could only be detected with a larger sample size.

In addition, it is important to note that the effect sizes for the association between both types of motivation and school grades were only small to medium. One factor that could account for the modest effect sizes may be the level of specificity at which students' motivation was assessed in this study. That is, the focus of the present study was on students' general motivational dispositions regarding their school work.

As such, this study was able to demonstrate that students' implicit motivational dispositions are associated with their school grades. Yet in future studies, it may also be of interest to study students' implicit and explicit motivational processes at a more specific level, focusing on domain-specific, task-specific, or situation-specific motivation. Given that implicit beliefs can be activated and effect behaviour within a specific situation (e.g. Bargh et al, 2001), a more specific approach may potentially yield more substantial effect sizes. In addition, given the modest effect sizes, it is important to take into consideration that there was still a substantial degree of variance in school grades that could not be accounted for by either their implicit or explicit motivation, and is caused by other factors beyond the scope of the present study.

4.1 Limitations

Some limitations of this study need to be acknowledged. First of all, because of the cross-sectional nature of this study, we cannot draw any conclusions on causal directions. Based on previous research (e.g., Taylor et al., 2014), we assume that students' motivation, both implicit and explicit, are reciprocally associated with school grades. That is to say, higher school grades will likely also increase students' implicit and explicit motivation for their schoolwork. Second, our sample was relatively small given that small effects were to be expected. As such, our study may not have sufficient power to reveal weak relationships. This study can be considered to be a first step in examining whether a dual process model applies student motivation. However, we recommend follow-up studies with larger samples, as well as longitudinal designs in order to find further support for the proposed model. Third, IAT measures have some limitations and/or disadvantages. Although IAT's can measure implicit associations, these associations do not necessarily have to be implicit because the participant can be aware of their associations (Fazio & Olson, 2003). In addition to that, some participants might be able to discover what associations are being measured during the test. Even though they might be aware of this, chances of manipulation of the test are small (De Houwer, 2002). Another possible limitation of the IAT is that it only measures relative preference for the two concepts (Brunel, Greenwald & Washington, 2004). Even though someone can have a stronger association with autonomous motivation compared to controlled motivation, this does not say anything about the absolute strength of their motivation. Fourth, our sample was restricted to students in general secondary education. As such, the variation in student motivation and both outcome measures may have been larger if students from other tracks would have been involved, which could also have increased the strength of the relationships between motivation and the outcomes variables. Finally, the implicit and explicit motivation measures were administered in a computer room during regular classroom hours. If feasible, individual administration would be preferable to ensure that students can fill out the IAT and questionnaires quietly without any disruptions.

4.2 Conclusions and future research

This study is among the first to show that implicit motivation can predict students' school grades. To better understand how implicit motivation affects school grades, more in-depth research is needed on the psychological processes and behaviours that are evoked by implicit motivation. In addition, research on explicit motivation suggested that a wide range of individual, background, and contextual characteristics affects explicit student motivation (e.g., Goodenow, 1993, Hornstra, Van der Veen, &Peetsma, 2016; Hornstra, Van der Veen, Peetsma, & Volman, 2015a; 2015b; Shernoff & Schmidt, 2007; Vansteenkiste et al., 2012; Stroet et al., 2013). More research is also needed on individual and contextual antecedents of students' implicit motivation, to gain a better understanding of how educators can facilitate optimal student functioning. To summarize, the current study provided initial support for a dual pathway model of student motivation and showed that an implicit measure of student motivation can predict unique variation in school grades in addition to an explicit measure. Consequently, future research on student motivation would benefit from incorporating both explicit and implicit measures of student motivation.

Keypoints

- We hypothesized a dual-pathway model of student motivation and examined if motivation guides behaviour through a deliberate and an automatic pathway.
- Motivation of 139 high school students was assessed with an explicit measure (self-reports) and a newly developed implicit measure (IAT).
- Implicit motivation and explicit motivation both predicted students' school grades.
- Neither explicit nor implicit motivation predicted teacher reports of students' behavioural engagement.
- Motivation can affect student achievement through an implicit automatic pathway and a deliberate pathway.

References

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A., Barndollar, K., & Trötschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology, 81,* 1014–1027. doi:10.1037/0022-3514.81.6.1014

Bosson, J. K., Swann, W. B., & Pennebaker, J. W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited? *Journal of Personality and Social Psychology, 79,* 631–643. doi:10.1037/0022-3514.79.4.631

Brunel, F. F., Tietje, B. C., & Greenwald, A. G. (2004) Is the implicit association test a valid and valuable measue of implicit consumer social cognition? *Journal of Consumer Psychology, 4*, 385-404. doi:10.1207/s15327663jcp1404_8

Burton, K. D., Lydon, J. E., D'Alessandro, D. U., & Koestner, R. (2006). The differential effects of intrinsic and identified motivation on well-being and performance: Prospective, experimental, and implicit approaches to self-determination theory. *Journal of Personality and Social Psychology, 91,* 750–762. doi:10.1037/0022-3514.91.4.750

Cerasoli, C. P., Nicklin, J. M., & Ford, M. T. (2014). Intrinsic motivation and extrinsic incentives jointly predict performance: A 40-year meta-analysis. *Psychological Bulletin, 140*, 980–1008. doi:10.1037/a0035661

Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology.* New York: Guilford Press.

Cunningham, W. A., Preacher, K. J., & Banaji, M. R. (2001). Implicit Attitude Measures: Consistency, Stability, and Convergent Validity. *Psychological Science, 12*, 163–170. doi:10.1111/1467-9280.00328

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour.* New York: Plenum

De Houwer, J. (2002) The implicit association test as a tool for studying dysfunctional associations in psychopathology: strengths and limitations. *Journal of Behavior Therapy and Experimental Psyciatry, 33,* 115-133. doi:10.1016/S0005-7916(02)00024-1

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology, 54,* 297–327. doi:10.1146/annurev.psych.54.101601.145225

Friese, M., Wänke, M., & Plessner, H. (2006). Implicit consumer preferences and their influence on product choice. *Psychology and Marketing, 23,* 727–740. doi:10.1002/mar.20126

Froiland, J. M., & Worrell, F. C. (2016). Intrinsic motivation, learning goals, engagement, and achievement

in a diverse high school. *Psychology in the Schools, 53,* 321–336. doi:10.1002/pits.21901

Galdi, S., Arcuri, L., & Gawronski, B. (2008). Automatic Mental Associations Predict Future Choices of Undecided Decision-Makers. *Science, 321,* 1100–1102. doi:10.1126/science.1160769

Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin, 132,* 692–731. doi:10.1037/0033-2909.132.5.692

Gawronski, B., & Bodenhausen, G. V. (2007). Unraveling the processes underlying evaluation: Attitudes from the perspective of the APE model. *Social Cognition, 25,* 687–717. doi:10.1521/soco.2007.25.5.687

Gawronski, B., & Bodenhausen, G. V. (2011). The Associative–Propositional Evaluation Model. *Advances in Experimental Social Psychology, 44,* 59–127. doi:10.1016/b978-0-12-385522-0.00002-0

Gawronski, B., Peters, K. R., Brochu, P. M., & Strack, F. (2008). Understanding the relations between different forms of racialp: A cognitive consistency perspective. *Personality and Social Psychology Bulletin, 34,* 648–665. doi:10.1177/0146167207313729

Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *The Journal of Early Adolescence, 13*, 21–43. doi:10.1177/0272431693013001002

Green, J., Liem, G. A. D., Martin, A. J., Colmar, S., Marsh, H. W., & McInerney, D. (2012). Academic motivation, self-concept, engagement, and performance in high school: Key processes from a longitudinal perspective. *Journal of Adolescence, 35,* 1111–1122. doi:10.1016/j.adolescence.2012.02.016

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74,* 1464–1480. doi:10.1037/0022-3514.74.6.1464

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85,* 197–216. doi:10.1037/0022-3514.85.2.197

Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology, 97,* 17–41. doi:10.1037/a0015575

Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52,* 890-898. doi:10.1037/0022-3514.52.5.890

Guay, F., Chanal, J., Ratelle, C. F., Marsh, H. W., Larose, S., & Boivin, M. (2010). Intrinsic, identified, and controlled types of motivation for school subjects in young elementary school children. *British Journal of Educational Psychology, 80,* 711–735. doi:10.1348/000709910x499084

Guay, F., Ratelle, C. F., Roy, A., & Litalien, D. (2010). Academic self-concept, autonomous academic motivation, and academic achievement: Mediating and additive effects. *Learning and Individual Differences, 20,* 644–653. doi:10.1016/j.lindif.2010.08.001

Guthrie, J. T., Klauda, S. L., & Ho, A. N. (2013). Modeling the Relationships Among Reading Instruction, Motivation, Engagement, and Achievement for Adolescents. *Reading Research Quarterly, 48,* 9–26. doi:10.1002/rrq.035

Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A Meta-Analysis on the Correlation Between the Implicit Association Test and Explicit Self-Report Measures. *Personality and Social Psychology Bulletin, 31,* 1369–1385. doi:10.1177/0146167205275613

Hornstra, L., van der Veen, I., & Peetsma, T. (2016). Domain-specificity of motivation: A longitudinal study

in upper primary school. *Learning and Individual Differences, 51,* 167–178. doi:10.1016/j.lindif.2016.08.012

Hornstra, L., van der Veen, I., Peetsma, T., & Volman, M. (2015a). Innovative learning and developments in motivation and achievement in upper primary school. *Educational Psychology, 35(5),* 598–633. doi:10.1080/01443410.2014.922164

Hornstra, L., van der Veen, I., Peetsma, T., & Volman, M. (2015b). Does classroom composition make a difference: effects on developments in motivation, sense of classroom belonging, and achievement in upper primary school. *School Effectiveness and School Improvement, 26),* 125–152. doi:10.1080/09243453.2014.887024

Keatley, D., Clarke, D. D., & Hagger, M. S. (2012). Investigating the predictive validity of implicit and explicit measures of motivation in problem-solving behavioural tasks. *British Journal of Social Psychology, 52,* 510–524. doi:10.1111/j.2044-8309.2012.02107.x

Korpershoek, H. (2016). Relationships among motivation, commitment, cognitive capacities, and achievement in secondary education. *Frontline Learning Research, 4,* 28-43. doi :10.14786/flr.v4i3.182

Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology,* 97, 184–196. doi:10.1037/0022-0663.97.2.184

Levesque, C., & Pelletier, L. G. (2003). On the Investigation of Primed and Chronic Autonomous and Heteronomous Motivational Orientations. *Personality and Social Psychology Bulletin, 29*, 1570–1584. doi:10.1177/0146167203256877

McConnell, A. R., & Leibold, J. M. (2001). Relations among the implicit association test, discriminatory behaviour, and explicit measures of racial attitudes. *Journal of Experimental Social Psychology, 37,* 435–442. doi:10.1006/jesp.2000.1470

Michou, A., Vansteenkiste, M., Mouratidis, A., & Lens, W. (2014). Enriching the hierarchical model of achievement motivation: Autonomous and controlling reasons underlying achievement goals. *British Journal of Educational Psychology, 84,* 650–666. doi:10.1111/bjep.12055

Ministry of Education Culture, and Science (2014*). Kerncijfers 2009-2013: Onderwijs, Cultuur, en Wetenschap* [Core figures 2009-2013: Education, culture and science]. The Hague: Ministry of Education, Culture and Science

Muthén, L. K., Muthén, B. (1998-2017). *Mplus user's guide* (7th ed.). Los Angeles, CA: Author.

Kuncel, N. R., Crede, M., & Thomas, L. L. (2005). The Validity of Self-Reported Grade Point Averages, Class Ranks, and Test Scores: A Meta-Analysis and Review of the Literature. *Review of Educational Research, 75,* 63–82. doi:10.3102/00346543075001063

Nosek, B. A., Hawkins, C. B., & Frazier, R. S. (2011). Implicit social cognition: From measures to mechanisms. *Trends in Cognitive Sciences, 15,* 152–159. doi:10.1016/j.tics.2011.01.005

Opdenakker, M.-C., Maulana, R., & den Brok, P. (2012). Teacher–student interpersonal relationships and academic motivation within one school year: Developmental changes and linkage. *School Effectiveness and School Improvement, 23,* 95–119. doi:10.1080/09243453.2011.619198

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioural research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88,* 879–903. doi:10.1037/0021-9010.88.5.879

Reeve, J., & Tseng, C.-M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology, 36,* 257–267. doi:10.1016/j.cedpsych.2011.05.002

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic
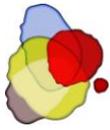
performance: a systematic review and meta-analysis. *Psychological Bulletin, 138,* 353-387. doi: 10.1037/a0026838

Rooke, S. E., Hine, D. W., & Thorsteinsson, E. B. (2008). Implicit cognition and substance use: A meta-analysis. *Addictive Behaviours, 33,* 1314–1328. doi:10.1016/j.addbeh.2008.06.009

Rudman, L. A. (2011). *Implicit measures for social and personality psychology.* London: Sage. doi:10.4135/9781473914797

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57,* 749–761. doi:10.1037/0022-3514.57.5.749

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology, 25,* 54–67. doi:10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68–78. doi:10.1037/0003-066x.55.1.68

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7,* 147–177. doi:10.1037/1082-989x.7.2.147

Sherman, J. W., Gawronski, B., & Trope, Y. (Eds.). (2014). *Dual-process theories of the social mind.* New York: Guilford Publications.

Shernoff, D. J., & Schmidt, J. A. (2007). Further Evidence of an Engagement–Achievement Paradox Among U.S. High School Students. *Journal of Youth and Adolescence, 37,* 564–580. doi:10.1007/s10964-007-9241-z

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behaviour and student engagement across the school year. *Journal of Educational Psychology, 85,* 571–581. doi:10.1037/0022-0663.85.4.571

Skinner, E. A., Chi, U., & The Learning-Gardens Educational As. (2012). Intrinsic Motivation and Engagement as "Active Ingredients" in Garden-Based Education: Examining Models and Measures Derived From Self-Determination Theory. *The Journal of Environmental Education, 43,* 16–36. doi:10.1080/00958964.2011.596856

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2008). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioural and emotional participation in academic activities in the classroom. *Educational and Psychological Measurement, 69,* 493-525. doi: 10.1177/0013164408323233

Steffens, M. C. (2004). Is the Implicit Association Test Immune to Faking? *Experimental Psychology, 51,* 165–179. doi:10.1027/1618-3169.51.3.165

Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review, 9,* 65–87. doi:10.1016/j.edurev.2012.11.003

Taylor, G., Jungert, T., Mageau, G. A., Schattke, K., Dedic, H., Rosenfield, S., & Koestner, R. (2014). A self-determination theory approach to predicting school achievement over time: the unique role of intrinsic motivation. *Contemporary Educational Psychology, 39,* 342–358. doi:10.1016/j.cedpsych.2014.08.002

Van den Bergh, L., Denessen, E., Hornstra, L., Voeten, M., & Holland, R. W. (2010). The Implicit Prejudiced Attitudes of Teachers: Relations to Teacher Expectations and the Ethnic Achievement Gap. *American Educational Research Journal, 47,* 497–527. doi:10.3102/0002831209353594

Vansteenkiste, M., Lens, W., & Deci, E. L. (2006). Intrinsic versus extrinsic goal contents in self-

determination theory: Another look at the quality of academic motivation. *Educational Psychologist, 41,* 19–31. doi:10.1207/s15326985ep4101_4

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology, 101,* 671–688. doi:10.1037/a0015083

Vansteenkiste, M., Sierens, E., Goossens, L., Soenens, B., Dochy, F., Mouratidis, A., Aelterman, N., Haerens, L., & Beyers, W. (2012). Identifying configurations of perceived teacher autonomy support and structure: Associations with self-regulated learning, motivation and problem behaviour. *Learning and Instruction, 22(6),* 431–439. doi:10.1016/j.learninstruc.2012.04.002

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating Learning, Performance, and Persistence: The Synergistic Effects of Intrinsic Goal Contents and Autonomy-Supportive Contexts. *Journal of Personality and Social Psychology, 87,* 246–260. doi:10.1037/0022-3514.87.2.246

Walker, C. O., Greene, B. A., & Mansell, R. A. (2006). Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and Individual Differences, 16,* 1–12. doi:10.1016/j.lindif.2005.06.004

Wellborn, J.G. (1991). Engaged and disaffected action: The conceptualization and measurement of motivation in the academic domain. *Unpublished doctoral dissertation,* University of Rochester, New York.

Zimmerman, B. J. (2008). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal, 45,* 166–183. doi:10.3102/0002831207312909