University of Groningen

The development of academic procrastination in first-year secondary education students

Ziegler, Niklas; Opdenakker, Marie-Christine

Published in:
Learning and Individual Differences

DOI:
[10.1016/j.lindif.2018.04.009](https://doi.org/10.1016/j.lindif.2018.04.009)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Ziegler, N., & Opdenakker, M-C. (2018). The development of academic procrastination in first-year secondary education students: The link with metacognitive self-regulation, self-efficacy, and effort regulation. *Learning and Individual Differences*, 64, 71-82. <https://doi.org/10.1016/j.lindif.2018.04.009>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

The development of academic procrastination in first-year secondary education students: The link with metacognitive self-regulation, self-efficacy, and effort regulation

Niklas Ziegler*, Marie-Christine Opdenakker

Groningen Institute for Educational Research (GION), University of Groningen, Grote Rozenstraat 3, 9712 TG Groningen, The Netherlands

ARTICLE INFO

Keywords:

Procrastination
Metacognitive self-regulation
Self-efficacy
Effort regulation
Secondary education

ABSTRACT

Academic procrastination has been widely recognized as a problematic but common phenomenon in education. A growing body of literature construes procrastination as a situational, dynamic construct. Yet, little is known about its development in young secondary education students. The current study aims to elucidate this issue while exploring the relation with metacognitive self-regulation, self-efficacy, and effort regulation. Hierarchical growth curve modeling of the development of students' procrastination (566 students, 20 Mathematics/English grade-1 secondary education classes) revealed positive linear trajectories at class level but showed greater variability at student level. All mentioned predictors were negatively associated with procrastination and declined over time, with effort regulation revealing the strongest association. Interaction effects with time revealed a stable procrastination - effort regulation association, whereas the association with metacognitive self-regulation and self-efficacy diminished over time. The findings support the view on academic procrastination as a dynamic construct and highlight the importance of early intervention.

1. Introduction

Procrastination has been acknowledged as a widespread phenomenon that interferes with academic tasks and daily activities (Klassen, Krawchuk, & Rajani, 2008). Although some types of dilatory behaviour can be seen as purposeful, academic procrastination typifies an irrational and often harmful kind of delay that is, among other things, negatively associated with academic performance, student health, and emotional well-being (e.g. Grunschel, Patrzek, & Fries, 2013; Jackson, Weiss, Lundquist, & Hooper, 2003; Kim & Seo, 2015; Klingsieck, 2013; Minnaert & Janssen, 1997; Tice & Baumeister, 1997). In a study by Ferrari, Díaz-Morales, O'Callaghan, Diaz, and Argumedo (2007) around 15% of the general population self-identified as chronic procrastinators. Within the population of college students, academic procrastination has been even described as an endemic phenomenon (Steel, 2007), with prevalence rates frequently reported between 50% to 70% and occasionally even higher (Janssen, 2015).

Academic procrastination can be defined as a form of self-regulatory failure, where one “voluntarily delay[s] an intended course of action despite expecting to be worse off for the delay” (Steel, 2007, p. 66). In line with this, Silver and Sabini (1981) stress the difference between simply “putting things off” and irrationally and needlessly delaying a

task despite its given priority. Only the latter would be classified as procrastination. Relatedly, Andreou (2007) describes the stable but intransitive nature of preferences that can engender procrastination by making counterproductive decisions. For instance, although students see the beneficial outcomes of a long-term goal generally as preferable, e.g. achieving high grades on a final exam, they might postpone studying for the exam in favour of a more pleasurable and tangible option in the moment of decision making. Whereas a singular decision to defer the study time presumably has little consequences for the achievement of the long-term goal, repeated postponement will have insidious effects. This example stresses the role of time and illustrates the cumulative nature of procrastination that ultimately leads to “a self-defeating behaviour pattern marked by short-term benefits and long-term costs” (Tice & Baumeister, 1997, p. 454).

While traditional research on procrastination often regarded the phenomenon as persistent character trait that remains stable across contexts and time (e.g. Lay, 1997; Schouwenburg & Lay, 1995; Van Eerde, 2000) a growing body of literature focuses on the dynamic nature of procrastination, suggesting a change over time that depends on contextual and task-related factors (Blunt & Pychyl, 2000; Moon & Illingworth, 2005; Sénécal, Lavoie, & Koestner, 1997; Wäschle, Allgaier, Lachner, Fink, & Nückles, 2014; Wolters, 2003). For instance,

* Corresponding author at: Leiden University Graduate School of Teaching (ICLON), Leiden University, Kolffpad 1, 2333 AL Leiden, The Netherlands.
E-mail addresses: n.ziegler@iclon.leidenuniv.nl (N. Ziegler), m.c.j.l.opdenakker@rug.nl (M.-C. Opdenakker).

Moon and Illingworth (2005) discovered a curvilinear trend in college students' level of procrastination during the course of a semester. Dilatory behaviour increased over time but dropped off during the end of the semester. Interestingly, opposed to the idea of trait procrastination, all observed students followed this trajectory, regardless of their initial level of dilatory behaviour.

Compared to the replete body of literature on academic procrastination in college students, surprisingly few studies have focused on secondary education. This is especially surprising when one considers that once maladaptive behaviour has been implemented and consolidated, it tends to persist and perpetuate itself so that it becomes difficult to change subsequently (Katz, Eilott, & Nevo, 2014; Kunnen & van Geert, 2012; Onatsu-Arvilommi, Nurmi, & Aunola, 2002). In their recent meta-analysis, Kim and Seo (2015) come to the conclusion that secondary school students are especially susceptible to procrastination which corroborates earlier findings revealing that young people are inclined to procrastinate to a greater extent than older people (Steel, 2007; Van Eerde, 2003). However, Janssen (2015) argues that the relation between age and academic procrastination is still poorly understood, with various contradictory findings and gaps in the peer-reviewed literature. Additionally, findings referring to the population of college students may not apply to the population of students in secondary education as procrastination appears to manifest itself differently in middle-school-aged children than among college-aged students (Rawlins, 1995). This could be especially true when referring to the youngest group of secondary education students; a group barely recognized in the literature about procrastination. In various countries with tracked educational systems, such as Germany or the Netherlands, this group does not only experience a transition from primary to secondary school with all its related environmental and personal changes, it also faces the onset of puberty. Approaching academic procrastination as a dynamic construct that undergoes situational change has to our knowledge not yet been linked to this group. However, negative trajectories of motivation, motivational beliefs, and self-regulation, variables closely related to procrastination, were discovered in first-year secondary education students. The decrease in these constructs was found to be the most intense after the transition from primary to secondary education (Anderman & Maehr, 1994; Peetsma & Van der Veen, 2013; Van der Veen & Peetsma, 2009; Van der Werf, Opdenakker, & Kuyper, 2008). The strong decline in these constructs might manifest itself in form of a persistent incline in procrastination. Consequently, procrastination in young secondary education students might follow a distinct pattern that differs from those found for older student populations. In addition, contrary to upper school or college, lower grades in secondary school seldom satisfy the needs of young adolescents for autonomy, independence, and self-determination (Anderman & Maehr, 1994), which could further exacerbate the tendency to procrastinate.

A profound understanding of the developmental pattern of procrastination is not only of utter importance for the advancement of our knowledge about procrastination as a theoretical construct but also provides educators with necessary insights to tailor interventions and instructional techniques that help to decrease the prevalence and weaken the impact of procrastination in secondary education students (Janssen, 2015). Diminishing the tendency to procrastinate at an early age will ultimately lead to beneficial long-term effects. The present study aims to contribute to the scarce body of knowledge on academic procrastination in secondary education students, while also approaching procrastination as a dynamic construct that is subject to change.

In the following section, we briefly elaborate on academic procrastination as time-varying construct in relation to metacognitive and motivational variables that have the potential to function as effective remedy for procrastination in younger students. Providing this theoretical background will naturally lead to number of research questions (presented in 1.2) that form the basis for the current study. The study takes place in the Netherlands and focuses on first-year secondary education students after their transition to secondary school.

1.1. Academic procrastination as a multi-faceted construct

Academic procrastination is no independent phenomenon without relations to other variables. In fact, various authors have acknowledged its complex entanglement with affective, behavioural, cognitive, and environmental constructs (e.g., Chow, 2011; Janssen, 2015; Rakes & Dunn, 2010; Solomon & Rothblum, 1984; Steel, 2007). Due to this complexity, an all-encompassing theory has not been established yet, leaving unsettled questions regarding procrastination (Janssen, 2015). Additionally, variability in the measures of procrastination and unaccounted variables might conceal the relation with other constructs, leading to contradictory findings in the literature (Kim & Seo, 2015).

For a number of important variables, especially elements related to self-regulated learning behaviour and self-efficacy, however, the relation with procrastination is widely consistent across different studies (Klassen et al., 2008; Steel, 2007; Wolters, 2003). As strong predictors these variables could function as key factors in the understanding of procrastination. In the following section, we give a brief introduction of these constructs and their relation to procrastination.

1.1.1. Procrastination and metacognitive self-regulation

Self-regulation has been described as the source of purposeful actions and the heart of causal processes. Some of its essential components are the self-monitoring of one's behaviour and evaluation of its effects (Bandura, 1991). A subcomponent of self-regulation is metacognitive self-regulation (Bakravec Vukman & Licardo, 2010). Through the application of metacognitive strategies successful self-regulation enables people to control their behaviour, monitor their actions and adjust their performance where necessary in order to reach set goals (Singer & Bashir, 1999; Zimmerman, 1989). Applying the concepts of metacognitive self-regulation to students means that self-regulated learners are capable of choosing an appropriate learning strategy, evaluate their progress, and, where required, adjust their behaviour or change their learning strategy accordingly. Metacognitive self-regulation has been identified as an important predictor of academic achievement (Bakravec Vukman & Licardo, 2010; Zimmerman & Kitsantas, 2014).

Related to this matter, Tice and Baumeister (1997) describe procrastination as a hallmark of poor self-regulation and according to Steel (2007), procrastination is tantamount to the quintessential form of self-regulatory failure. Unsurprisingly, a copious number of studies support the idea of self-regulatory failure as a cause of procrastination (e.g., Balkis & Duru, 2015; Sims, 2014; Tan et al., 2008; Tuckman, 2005; Van Eerde, 2000; Wolters, 2003). According to Janssen (2015), negative correlations between procrastination and self-regulation can be explained by the large amount of mental energy that self-regulation requires. An inept choice of a learning strategy or the selection of inappropriate goals forces students to revise their decision. If this has to be done continuously due to a repeated pattern of maladaptive choices self-regulatory failure will ultimately lead to procrastination (Janssen, 2015).

1.1.2. Procrastination and self-efficacy

Self-efficacy describes the beliefs of a person about his or her capabilities to execute behaviour that will lead to success in a task (Bandura, 1994). Students with confidence in their own abilities are more inclined to engage in difficult tasks and show higher effort, whereas students that exhibit low levels of self-efficacy will try to evade such tasks by setting only easily attainable goals (Wäschle et al., 2014). Self-efficacy has been identified as an important predictor of academic achievement and school engagement (Martin, Way, Bobis, & Anderson, 2014; Multon, Brown, & Lent, 1991; Richardson, Abraham, & Bond, 2012; Robbins et al., 2004). Additionally, in their recent study Wäschle et al. (2014) corroborated findings of earlier research conducted by Caprara et al. (2008). Both studies confirm the idea of reciprocity between perceived goal achievement and self-efficacy, leading to a

virtuous circle that shows that high self-efficacy beliefs positively affect perceived goal achievement and vice versa. Moreover, the study by Wäschle et al. revealed that the relation between perceived goal achievement and procrastination works in a similar but contrary manner, creating a negative feedback loop that results in a “vicious circle of procrastination” (Wäschle et al., 2014, p.105). In various studies, procrastination shows a direct, strong inverse relation with self-efficacy (Chow, 2011; Seo, 2008; Steel, 2007). Similar to procrastination, self-efficacy should be seen as a context-dependent construct rather than a stable personality trait (Denzine & Brown, 2015; Klassen et al., 2008).

1.1.3. Procrastination and effort regulation

Effort regulation (sometimes referred to as effort management, self-control, or will power) can be defined as a resource management strategy that refers to the ability to show effort even when tasks are perceived as very challenging, tiresome or uninteresting (Pintrich, Smith, Garcia, & McKeachie, 1991). Students with high effort regulation will exhibit persistence when working on a task, whereas students with low effort regulation are more likely to quit before finishing their work (Pintrich, 2004; Richardson et al., 2012). As pointed out by Pintrich and Zusho (2002) and Onoda (2014), the aspect of volition that defines effort regulation forms a crucial element for the use of metacognitive strategies. In line with this, Sungur (2007) concludes that metacognitive strategy use alone will barely contribute to students' learning and performance if students are incapable of withstanding distractions or lack persistence when facing problems and difficulties. Consequently, effort regulation can be seen as an essential prerequisite for the execution of metacognitive self-regulated learning behaviour.

Even though the relation of effort regulation with academic procrastination has been barely investigated yet, its connections with self-efficacy, motivational, and metacognitive constructs (Komarraju & Nadler, 2013; Strunk & Steele, 2011; Sungur, 2007) give strong indications for the claim that effort regulation is inversely related to academic procrastination. One of the few studies that investigated the direct relation between procrastination and effort regulation was conducted by Rakes and Dunn (2010). Their analysis revealed a negative association between effort regulation and academic procrastination in online graduate students. However, these results cannot be simply translated into the context of the traditional classroom instruction without caution. Online education provides a highly autonomous environment in comparison to the traditional classroom context. In order to succeed a high degree of self-regulation is indispensable, whereas in the traditional classroom context a lack of such abilities might be compensated through the guidance of the instructor (Artino & Stephens, 2009). Overall, effort regulation appears to be a promising construct to explain academic procrastination; however, more investigation is required.

1.1.4. Procrastination, demographic factors and task characteristics

Metacognitive self-regulation, self-efficacy, and effort regulation can be unquestionably regarded as important and promising elements when aiming to understand academic procrastination. They are not only applicable to a wide range of groups, but also, in contrast to stable personality traits, these constructs are quite malleable in nature (Bandura, 1997; Gist & Mitchell, 1992; Wolters, Pintrich, & Karabenick, 2005). Focusing on their enhancement could alleviate students' tendency to procrastinate.

Next to these three constructs, a variety of demographic factors has to be addressed. In their epidemiological study, Steel and Ferrari (2013) surveyed 16,413 English-speaking adults. They concluded that procrastination occurs in virtually all groups, with procrastinators being able to come from any background. However, certain characteristics are more likely to be related to procrastination. As mentioned earlier, age appears to play an important role when investigating procrastination. This was no exception in the study of Steel & Ferrari. Younger

participants engaged more in procrastination than did older participants. It is important to mention that participants younger than 16 years were excluded from their study, which leaves the question whether their results are applicable to the population of younger students.

Another characteristic of interest is gender. The results by Steel and Ferrari (2013) support earlier findings about gender differences in procrastinators. In general, males were more likely found to be procrastinators than were females (Gröpel & Steel, 2008; Steel, 2007). According to Steel & Ferrari, this might be due to different levels of self-control and impulsiveness between men and women.

A third important characteristic is education. In a study by Dietz, Hofer, and Fries (2007) low-grade secondary school students in different educational tracks differed significantly in their reported level of procrastination. Students in lower school tracks engaged to a stronger degree in dilatory behaviour than students in the highest track. This tendency appears to persist even after graduation. Higher levels of education were found to be associated with lower levels of dilatory behaviour, even after controlling for age (Ferrari, Özer, & Demir, 2009; Steel & Ferrari, 2013). Additionally, Steel & Ferrari found evidence that procrastination mediates the relation between sex and education.

Finally, the task aspects must be considered when studying procrastination. Opposed to the idea of procrastination as a stable personality trait, research has not only identified dynamic aspects but also the dependence on domain-specific task characteristics. Tasks which are perceived as interesting, relevant, and require students to use a variety of different skills engender less dilatory behaviour (Ackerman & Gross, 2005). Low levels of task enjoyment, on the other hand, cause the converse effect (Sims, 2014). Moreover, task preferences, such as the preference for a certain school subject, might be influenced by students' gender (Kessels, 2005). This way, gender moderates the relation between academic procrastination and task preference. In line with this, Owens and Newbegin (2000) found gender variations in students' tendency to procrastinate for the subjects maths and English.

1.2. The present study

The present study adds to the body of literature on academic procrastination in several ways. As the predominant part of the literature often excludes the population of secondary education students, inferences about this group based on earlier studies can only be made with caution. This is especially true when referring to the youngest group of secondary education students. Therefore, the present study aims to shed light on the development of academic procrastination in first-year secondary education students. Moreover, metacognitive self-regulation, self-efficacy, and effort regulation, as well as important demographic aspects are included in the study in order to investigate their relation with academic procrastination in young students. In addition, we investigate the task-specific nature of procrastination by including the subjects English as a foreign language (EFL) and math into the measurements. Both subjects require distinct learning profiles and form essential elements in the curriculum of each school. Based on earlier findings about academic procrastination and its related variables, the present study focuses on a variety of research questions.

1. How does procrastination develop during the first year of secondary education?

We hypothesise that procrastination will increase over the course of the year, mainly due to an expected decrease in the independent variables metacognitive self-regulation, self-efficacy, and effort regulation. Although procrastination in college students was found to follow a curvilinear trend (Moon & Illingworth, 2005), the present study differs from earlier studies due to its research population and the linked circumstances. Opposed to the academic semester, which typically leads up to examinations for most courses during a temporarily limited

period at the end of the semester, secondary education follows a different pattern. Without a distinct period assigned for examinations, procrastination may follow a linear, rather than a curvilinear trend in secondary education students.

- 2.a. To what degree is procrastination related to gender, students' prior educational attainment, and school subject?
- 2.b. To what degree is procrastination related to metacognitive self-regulation, self-efficacy, and effort regulation on average during the first year of secondary education?
- 2.c. Does gender moderate the relation between school subject and procrastination?

Guided by previous research, we expect girls to engage in less di-latory behaviour than boys. Students' educational attainment at the beginning of the year is assumed to be negatively associated with procrastination. We predict a negative association between procrastination and metacognitive self-regulation, self-efficacy, and effort regulations. Furthermore, we expect a continuous decline in these three constructs during the course of the year. Students' task-preference is expected to manifest in different relations between the school subjects and procrastination. In addition, these differences should vary depending on students' gender.

3. To what degree is the change in procrastination related to the change in metacognitive self-regulation, self-efficacy, and effort regulation during the course of the year?

The final research question concerns the interaction between metacognitive self-regulation, self-efficacy, and effort regulation with time and the relation of this interaction with the change of procrastination. We expect attenuation of the relation between metacognitive self-regulation, self-efficacy, and effort regulation with procrastination over time. This hypothesis is based on the earlier mentioned hypothesis of oppositional change between the independent variables and procrastination, and based on the assumption that once students have consolidated their (maladaptive) learning approaches, they will maintain these approaches, as a result of which they persist and become increasingly difficult to change subsequently (Katz et al., 2014; Onatsu-Arvilommi et al., 2002).

2. Method

2.1. Participants and procedure

The research concerns an observational study relating to the population of first-year students in regular secondary education in the Netherlands. A stratified sample of twenty classes was drawn from three different secondary schools that participated in the study. All three schools were located in a provincial city area in the northern part of the Netherlands (province of Groningen): Two were located in a medium-sized city (about 200,000 inhabitants) and one in a village (about 2460 inhabitants). The schools were representative of typical public schools for middle socio-economic status. The class sizes ranged from 21 to 31

students (mean = 28.3, sd = 2.98) and < 1% of the students were non-native Dutch. As variability in learning environment was considered to be influential, half of the included classes were EFL classes, whereas the other half were math classes. As the educational system in the Netherlands is highly tracked, the study design included classes of all school tracks of the regular secondary Dutch education system. In addition, eight of the twenty classes were so called transition classes ('brugklas') that combined several track levels. The pre-vocational track ('vmbo') forms the lowest level which takes 4 years and grants access to senior vocational courses upon finishing secondary school. The track of higher general continued education ('havo') requires 5 years and allows to access universities of applied sciences. Finally, the highest track, pre-university secondary education ('vwo'-gymnasium/atheneum), requires 6 years and grants access to all forms of tertiary education, including research universities. The sample was drawn on class level and contained 566 first year secondary education students. Marginally more boys than girls participated in the study (55% boys, 45% girls). In the Dutch educational system, the transition from primary to secondary school takes place after grade six where most children have reached the age of 12 years (mean age = 12.19, sd = 0.55). Researcher-school agreement regarding voluntary participation for conducting the survey at a regular interval was arranged. Written informed consent from parents and teachers was collected subsequently. The study was in accordance with human subject guidelines and approval for the surveys was granted by the ICO Dutch interuniversity research school for educational sciences and the University of Groningen (430016).

2.2. Variables and instrumentation

The study includes two types of variables: time-varying variables that were measured repeatedly and time-invariant variables that do not change over time. Time-varying variables included in the study were measured five times during the school year. Starting point for the first measurement was the first week of the new school year in September. Consecutive measures were assessed six, 16, 28 and 40 weeks after the initial measurement occasion. Procrastination, metacognitive self-regulation, self-efficacy, and effort regulation were considered to be time-varying. Measurements were obtained by having the students fill in questionnaires at every measurement occasion. The composite scores for each time-varying variable are based on a combination of items on a five-point Likert scale. All items were coded in the same way from 1 = "disagree" to 5 = "completely agree". To estimate the reliability of the different constructs, Cronbach's α was calculated for each set of items and each measurement occasion based on the drawn sample (Nunnally & Bernstein, 1994). Information on the scales and the average reliability of the scale scores across time is given in Table 1. Variables that were expected to differ notably on the basis of task characteristics were measured for the subjects EFL and math independently. In case a student did not participate in one measurement occasion, the student was indicated as missing for this occasion. Consequently, all children were measured on the same dates. Attainment scores and student background characteristics were obtained prior to the study.

Table 1

Scales, example items, number of items, and average reliability of the scales scores in this study (per scale minimum score = 1, maximum score = 5).

Scale	Origin	Example item	Number of items	Cronbach's α
Procrastination	VaSOV (Depreeuw & Lens, 1998)	I start studying later than I had intended to	5	.80
Metacognitive self-regulation	MSLQ (Peetsma & Van der Veen, 2009; Pintrich et al., 1991)	When I am reading I stop once in a while and go over what I have read	7	.71
Self-efficacy	PALS (Midgley et al., 2000)	I'm certain I can figure out how to do the most difficult class work for this subject	6	.90
Effort regulation	MSLQ (Pintrich et al., 1991)	I work hard in this class even if I don't like what we are doing	4	.70

Fig. 1. General development of the time-varying variables over time including 95%-CIs.

2.2.1. Gender and educational attainment

Gender and the attainment scores of each student were included into the study. For this purpose, we utilized the results of the Dutch primary school leavers' attainment test which is a standardized test developed by the Dutch National Institute for Measurement in Education (CITO). Students complete the test in their final year of primary education and the results are used as an indicator of students' aptitude in order to choose an appropriate secondary school and school track. For this study, the CITO scores of every student were obtained which are based on Dutch language, mathematics and study skill items. This variable is used to account for differences in educational attainment between the students at the start of secondary education.

2.2.2. Time-varying variables

Procrastination referred to the postponement of school related tasks. This means for example that students do not start to study when they originally intended to do so. The score on this scale is based on five items on a five-point Likert scale. The items derive from the procrastination sub-scale of the "VaSOV", a larger instrument concerning study management abilities, which has been constructed and validated for the Dutch-speaking population (Depreeuw & Lens, 1998). The chosen items were slightly adjusted to make a distinction between the subjects EFL and math possible.

Metacognitive self-regulation referred to the use of metacognition to regulate the study behaviour of the student (for example, does the student consider different strategies to choose from before starting a task?). The score on this scale is based on seven items on a five-point Likert scale. The items used to measure self-regulation derive from the "Motivated Strategies for Learning Questionnaire"-MSLQ (Pintrich et al., 1991). For this study, an adjusted version of the items was used which has been adapted to the Dutch-speaking population (Peetsma & Van der Veen, 2009). For self-regulation, a distinction between EFL and math was made for the second till fifth measurement occasion. The first measurement occasion served as general measure of metacognitive self-regulation.

Self-efficacy referred to the extent in which students have confidence in their own abilities to succeed in school related tasks. A high score on this variable means that a student possesses high confidence when it comes to school related tasks and believes to be able to succeed in more difficult tasks as well. The score on this scale is based on six items on a five-point Likert scale which origin from the "Patterns of Adaptive Learning Scales" – PALS (Midgley et al., 2000). The distinction between self-efficacy for EFL and math was made for the second till fifth measurement occasion. The first measurement occasion served as general measure of self-efficacy.

Effort regulation referred to the ability to control one's own workflow with regard to school related tasks. Low scores indicate for example that a student often stops with the work (for instance out of boredom) although the task has not been completed. The score on this scale is based on four items on a five-point Likert scale. The items derive from the MSLQ (Pintrich et al., 1991) and were adjusted for this study to make a distinction between the subjects EFL and math possible. This was necessary because the subject matter may affect student effort regulation in different ways, depending on personal preferences.

2.3. Analytic strategy

To investigate to what degree metacognitive self-regulation, self-efficacy, and effort-regulation are related to procrastination, the statistical analysis was conducted in different parts. Preliminary to the main analysis a univariate, descriptive analysis was conducted. The standard deviation, mean scores, and bivariate correlations between each measurement occasion were calculated for all four time-varying variables (Table A, appendix). Fig. 1 visualizes the observed development for all four variables over the course of the school year.

Due to the nested structure of the longitudinal data a three-level hierarchical growth curve model (Singer & Willett, 2003; Snijders & Bosker, 2012) was applied using the statistical software MLwiN 2.35 (Rasbash, Steele, Browne, & Goldstein, 2015), with measurement occasions (level 1) nested within students (level 2) nested within classes (level 3). Benefits of this design are its flexibility when handling unbalanced data and its ability to estimate missing data through ML-estimation under the assumption that the data is missing at random. Through this approach, all available information can be used without discarding incomplete data (Curran, Obeidat, & Losardo, 2010; De Leeuw & Meijer, 2008; Singer & Willett, 2003). To assure that the assumption of missing at random holds, a missing data analysis was conducted on class level as well as on student level prior to the main analysis (see '3.1. missing data analysis'). For this purpose, the statistical software environment R 3.2.3 was used (R Core Team, 2016).

For the modeling procedure, an unconditional model was built to estimate the distribution of total variance between levels (Model 0; Table 2). Subsequently, the development of procrastination over time was modelled by the comparison of a fixed (Model 1) and random slope model (Model 2) for a linear effect of time. Additionally, a quadratic effect of time with random slopes was introduced in order to investigate the existence of non-linear growth trajectories of procrastination (Model 3). The relevance of the random effects of time/time² was tested by the means of comparison models (not included). For this purpose, the variance of the linear/quadratic effect was constrained to zero for

Table 2
Unconditional model of procrastination.

	Model 0	
	Coefficient	SE
Fixed effects		
Intercept	2.291***	0.041
Random effects		
Level 3 variance (class)		
Var. Intercept	0.017	0.011
Level 2 variance (student)		
Var. Intercept	0.347	0.028
Level 1 variance (occasion)		
Var. Intercept	0.461	0.015
– 2 * loglikelihood (IGLS deviance)	5668.564	

* $p < .05$; ** $p < .01$; *** $p < .001$.

level 3 and 2 separately and the comparison models were compared to Model 2 and 3 by the means of a χ^2 -test on the decrease in $-2 * \text{loglikelihood}$ based on iterative generalized least squares (IGLS)

Table 3
Multilevel growth curve models for the prediction of procrastination over time.

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		95%-CI	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE		
Fixed effects														
Intercept	2.124***	0.047	2.124***	0.040	2.106***	0.040	2.218***	0.059	2.292***	0.036	2.275***	0.040	2.197	2.352
Time	0.011***	0.001	0.011***	0.001	0.016**	0.005	0.011***	0.001	^a 0.002	0.001	0.002*	0.001	0.000	0.004
Time ²					0.000	0.000								
Subject							–0.096	0.074	–0.041	0.040	0.000	0.053	–0.105	0.105
Gender							–0.091	0.058	–0.008	0.041	0.033	0.057	–0.078	0.144
CITO							–0.001	0.007	0.000	0.004	0.001	0.004	–0.007	0.009
Metacognitive self-regulation									–0.047*	0.023	–0.097***	0.033	–0.161	–0.034
Self-efficacy									–0.081***	0.021	–0.146***	0.032	–0.208	–0.083
Effort regulation									–0.587***	0.022	–0.587***	0.030	–0.646	–0.529
Gender $\times$ subject											–0.087	0.080	–0.244	0.069
Time $\times$ self-reg.											^c 0.004*	0.001	0.001	0.006
Time $\times$ self-eff.											^d 0.004**	0.001	0.001	0.006
Time $\times$ eff. reg.											0.000	0.001	–0.003	0.003
Random effects														
Level 3 variance (class)														
Var. intercept	0.024	0.013	0.012	0.010	0.010	0.010	0.008	0.009	0.000	0.000	0.000	0.000	0.000	0.000
Var. slope (time)			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Var. slope (time) ²					0.000	0.000	0.000	0.000						
Cov. int. $\times$ time			0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cov. int. $\times$ (time) ²					0.000	0.000	0.000	0.000						
Cov. time $\times$ (time) ²					0.000	0.000								
Level 2 variance (student)														
Var. intercept	0.354	0.028	0.333	0.034	0.304	0.043	0.319	0.034	0.116	0.019	0.106	0.019	0.106	0.019
Var. slope (time)			0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Var. slope (time) ²					0.000	0.000								
Cov. int. $\times$ time			0.000	0.001	0.003	0.004	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001
Cov. int. $\times$ (time) ²					0.000	0.000								
Cov. time $\times$ (time) ²					0.000	0.000								
Level 1 variance (occasion)														
Var. intercept	0.430	0.014	0.391	0.015	0.381	0.034	0.401	0.016	0.324	0.014	0.324	0.014	0.324	0.014
Var. slope (time)					0.000	0.000								
Cov. int. $\times$ time					–0.002	0.002								
– 2 * Loglikelihood	5543.14***		5506.07***		5486.76*		^b 5349.65		^b 4352.23		4333.82**			
(IGLS deviance)														

* $p < .05$; ** $p < .01$; *** $p < .001$.

Note: due to space constraints only the first three rounded decimal places are reported.

^aBorderline significance: $\beta = 0.0018$, $SE = 0.001$, $p = .072$.^bNo comparison of deviance could be conducted between models 2, 4, and 5 due to variations in sample size.Model 6 was compared to Model 5. c. $\beta = 0.00351$, $SE = 0.00149$, $p = .018$, d. $\beta = 0.00354$, $SE = 0.00132$, $p = .0073$.

estimation (Hedeker, 2004; Snijders & Bosker, 2012). Time was coded uncentered so that the initial measurement occasion at the beginning of the school year served as point of comparison for the subsequent measurements. Next, gender, the school subject, and the CITO scores (Model 4), as well as the time-varying predictors (Model 5) were included stepwise into the model as fixed effects to assess their overall association with procrastination. Grand mean centering was applied to the time-varying predictors and CITO scores to allow a meaningful interpretation of the intercept. Moreover, every predictor was also entered on its own into the model to assess the individual association with procrastination without being corrected for other predictors. For the final model (Model 6) the interaction between the time-varying predictors and time was incorporated into the model to investigate possible changes in their relationship with procrastination across the school year. To answer the question whether the relation between the school subject and procrastination differs depending on students' gender, the final models also included the interaction between subject and gender. The values for all fixed and random coefficients, including their standard errors, of each model were checked at least up to the first two non-zero decimal places after the decimal point. Models 1 to 6 are reported

in Table 3. Due to space limitations only the first three rounded decimal places are included.

3. Results

3.1. Missing data analysis

Prior to the main analysis, an analysis of missing data was conducted. The vast majority of missing data can be attributed to the longitudinal nature of the study. Due to the tight time schedule missed occasions could not be caught up on a later date. Missing data were encountered for individual students as well as on class level. For seven of the 20 classes, measurements for the time-varying variables were missing completely for at least one measurement occasion. This was due to pragmatic reasons (e.g. miscommunication or timely unavailability of mentors). Missingness on class level was only encountered for the last three measurement occasions but never occurred during the first two measurement occasions. As mentioned above, a strength of ML growth curve modeling is its ability to estimate missing data through ML-estimation under the assumption that the data is missing at random. In order to confirm that classes that completely missed one or more of the later measurement occasions did not violate this assumption, a group comparison was conducted between classes that missed at least one occasion completely and classes that participated at all five occasions. To achieve this, all classes that were absent during at least one occasion were merged into one group whereas classes that were present during all occasions formed the second group. For the comparison of these two groups, the scores of the first measurement occasion were utilized which were available for all twenty classes. Results of the comparison showed no significant difference for the scores on procrastination or any of the independent variables. This indicates that classes which participated in all measurement occasions were representative for classes with missing occasions.

Additionally, for every single class, the number of missing students within the class was investigated per occasion. In eight of the 20 classes, > 15% of the students were absent during either the second or the fifth measurement occasion. As this kind of missing data might form a potential threat to the assumption of missing at random, the scores of the first measurement occasion were compared within each class between students with complete data and students with incomplete data. For this purpose, a series of Mann-Whitney *U* tests was used due to the small sample sizes of the within-class groups. For the vast majority of classes, the comparison did not yield any significant results. Only one EFL class and one math class on VMBO/HAVO level showed a significant difference in effort regulation between missing students and students that had completed the questionnaire at all measurement occasions. The group of students with missing values scored significantly higher on effort regulation than the group that participated in all five measurement occasions. This should be taken into account during the interpretation of the results; however, the impact is expected to be small as the violation only concerned the last measurement occasion and only two out of the 20 classes.

3.2. Observed development of procrastination, metacognitive self-regulation, self-efficacy, and effort regulation

Fig. 1 illustrates the development of the time-varying predictors over the 40 weeks. Inspection of the mean scores across the different measurement occasions (Table A) disclosed a monotonous decline in metacognitive self-regulation. Self-efficacy slightly increased during the first weeks. After the second measurement occasion, however, a negative trend became visible that sustained itself for the rest of the school year. Effort regulation showed the strongest decline between the first two measurement occasions and followed a less intense but steady decline during the remainder of the year. Procrastination increased

gradually during the course of the 40 weeks with a slight inhibition between the second and third measurement occasion. The strongest change over time was found for effort regulation (average decrease of 0.55 units over 40 weeks on a five-point Likert scale) followed by procrastination (an increase of 0.43 units). Metacognitive self-regulation (−0.19 units) and self-efficacy (−0.16 units) exhibited a less intensive change over time.

3.3. Differences and development of procrastination over time

3.3.1. Distribution of the variance in procrastination

Based on the unconditional model (Model 0; Table 2.) the distribution of variance in procrastination across the three levels (occasion, student, class) was estimated. A clear disparity in the attribution of variance became evident with most variance attributable to student and occasion level. Not more than a small proportion of the total variance was found on class level (2.06%) which implies only meagre differences between classes in their average level of procrastination. A substantial amount of the total variance was attributable to student level (42.06%) but the preponderant part was found on occasion level (55.88%). The average level of procrastination across all measurement occasions was found to be 2.291 (SE = 0.041).

3.3.2. Estimated development of procrastination over time

The extension of the unconditional model is shown in Table 3. Time was coded in line with the weeks of the five respective measurement occasions (see ‘2.2 Variables and instrumentation’). The main effect of time on procrastination was significant ($\beta = 0.011$, $p < .001$; Model 1).¹ This is in line with the monotone increase in procrastination during the course of the school year. A comparison between the estimated slope and the calculated slope based on the observed values (Table A) indicated high congruence between estimation and observation. A highly significant decrease in $-2 \times \text{loglikelihood}$ was found when comparing the unconditional model to Model 1 ($\chi^2 = 125.42$; $df = 1$; $p < .001$). Model 1 was expanded by including a random slope for time on level 2 and 3 (Model 2). The main effect of time remained significant. The decrease in deviance was highly significant as well ($\chi^2 = 37.07$; $df = 4$; $p < .001$) and the relevance of the random coefficients was confirmed after including separate comparison models in which the level 3/level 2 variance of time was constrained to zero. On both levels, excluding any of the random coefficients would have caused a significant increase in deviance and consequently reduced the total model fit. This indicates that the change of procrastination over time might differ within classes for students. It was therefore decided to retain the random coefficients of time. A subsequent construction of the confidence interval (see Hedeker, 2004, p.221) around the main effect of time on class level revealed that 95% of the classes are expected to have positive slopes in the range of 0.0025 and 0.019 which refers to the predicted increase in procrastination per week. On individual level the interval ranged from −0.011 to 0.033. That the interval includes negative slopes reflects the fact that the level of procrastination might decrease over time for some students, even though the average level per class is expected to increase.

Next, the inclusion of time² (Model 3) yielded a significant decrease in deviance compared to Model 2 ($\chi^2 = 19.31$; $df = 9$; $p < .05$). The main effect of time² however, was not found to be significant with a magnitude approaching zero. Random coefficients for time² were included on level 3 and 2 but altogether appeared to be negligible. A second series of comparison models was therefore used which stepwise constrained the random coefficients related to time² to zero. The result of the comparison with Model 3 showed no significant increase in deviance when the variance of time² on level 3 or 2 was constrained to

¹ In line with the standard notation of MLwiN we use β to present the unstandardized coefficients.

zero. Consequently, no evidence was found for the assumption that procrastination follows a quadratic growth pattern. Model 3 was therefore discarded in favour of Model 2.²

3.4. Relations between procrastination and time-invariant and time-varying variables

3.4.1. Overall relation between procrastination and subject, gender, and educational attainment

Model 2 was expanded by including fixed effects for the three time-invariant predictors subject, gender, and the educational attainment (CITO scores). Due to the decrease in sample size after including the time-invariant variables (Model 4) and time-varying variables (Model 5), no direct comparison in terms of decrease in $-2 \times \log\text{likelihood}$ between Model 2 and Model 4, as well as between Model 4 and Model 5, could be conducted. A closer examination of the lost cases revealed that the assumption of missing at random in relation to procrastination holds. Furthermore, the smaller sample did not suffer from range restriction. The inclusion of subject, gender and CITO scores in Model 4 did not reveal any significant relation with procrastination when all three predictors were incorporated into the model as a group. The relation between gender and procrastination became significant once all remaining predictors (except for time) were excluded from the model ($\beta = -0.124$, $p < .05$; -0.24 to -0.01). However, this effect disappeared after the number of used cases for all individual models was equalized by including only cases without any missing data. As a result, the found effect for gender is likely to be attributable to the mere increase in sample size when compared to Model 4.

3.4.2. Overall relation between procrastination and metacognitive self-regulation, self-efficacy and effort regulation

Model 5 included the time-varying predictors metacognitive self-regulation, self-efficacy and effort regulation to assess their relation with procrastination. A preceding check for multicollinearity revealed no high correlations between the independent variables, with the highest correlation found to be .45 between the fourth measurement occasion for self-efficacy and effort regulation. The relations between the time-varying predictors in model 5 and procrastination concern the average relation between the constructs across the whole year. For all three time-varying predictors, a negative significant relation with procrastination became evident. Effort regulation revealed the strongest negative relation with procrastination ($\beta = -0.587$, $p < .001$; 95%-CI ranged from -0.63 to -0.54). Self-efficacy showed a less intense but still meaningful relation ($\beta = -0.081$, $p < .001$; -0.12 to -0.04). Metacognitive self-regulation appeared to have a weak, yet statistically significant relation ($\beta = -0.047$, $p < .05$; -0.09 to -0.002).

3.4.3. Gender: A moderator of the relation between school subject and procrastination?

For the final model (Model 6), we expanded Model 5 by incorporating the interaction terms between school subject and gender, and the interaction of the three time-varying predictors with time. The comparison with Model 5 revealed a significant decrease in deviance due to the inclusion of the interaction terms ($\chi^2 = 18.41$; $df = 4$; $p < .01$). The interaction between subject and gender revealed no significant effect, even when only the gender $\times$ subject interaction was added. Differences in the association between gender and procrastination were found to be independent of the school subject. However, comparable to the previous models, neither for gender nor for school subject a significant main effect was discovered.

² In a more explorative fashion, we also examined whether procrastination follows a cubic trajectory, as the slightly s-shaped development in Fig. 1 might suggest. The inclusion of an additional cubic term for time however did not yield any evidence to support this assumption.

3.5. Changes in the relation between procrastination and the time-varying predictors

Due to inclusion made in Model 6, the strength of the relation between the time-varying predictors and procrastination increased slightly for the main effects of metacognitive self-regulation ($\beta = -0.097$, $p < .01$; -0.16 to -0.03) and self-efficacy ($\beta = -0.146$, $p < .05$; -0.21 to -0.083). Compared to Model 5, the coefficients of the main effects of metacognitive self-regulation, self-efficacy, and effort regulation now represent the initial slopes of the linear relation with procrastination at week 1 due to the inclusion of the interaction effects with time. Positive, significant interaction effects with time were found for two variables (self-reg. $\times$ time: $\beta = 0.0035$, $p < .05$; 0.0006 to 0.0064 ; self-efficacy $\times$ time: $\beta = 0.0035$, $p < .01$; 0.0009 to 0.0061). These interactions indicate the change per week in the associations between metacognitive self-regulation and self-efficacy with procrastination. In contrast to the negative coefficients of the main effects, both interaction terms possess positive coefficients. Concretely, this signifies that the relation of metacognitive self-regulation and self-efficacy with procrastination is attenuated across time. For effort regulation, no significant interaction effect was found. Therefore, it appears that the association between effort regulation and procrastination remains constant over time.

4. Discussion

In the current study, we investigated the pattern of development in first-year secondary education students' academic procrastination after the transition from primary to secondary education. In addition, we explored whether the negative relation, as predicted by the literature, between procrastination, metacognitive self-regulation, self-efficacy, and effort regulation holds for this population. It was also investigated whether this relation changes over time or remains stable. Another point of attention were the relations between procrastination and prior educational attainment, gender and task characteristics as well as the question whether the tendency to procrastinate on different tasks interacts with students' gender. In order to answer these questions, we investigated a sample of 566 Dutch first-year secondary education students from twenty different classes for the course of 40 weeks. Due to differences in learning environment we distinguished between EFL and math classes.

Evidence for the dynamic nature of procrastination could be found in the unconditional model with over 55% of the total variance attributable to the occasion level. This was in line with the significant results for time as a predictor of procrastination. Unlike in the study by Moon and Illingworth (2005) the development of procrastination did not follow a curvilinear trend but a positive linear trend which confirms our expectation that procrastination in young secondary school children develops differently than in college students. However, it is not entirely clear yet whether these differences have their origin solely in the absence of a distinct examination phase, which is a common part of the curriculum in colleges at the end of each semester, or whether the positive linear trend would persist despite examinations at the end of the school year. In addition, it is assumable that the linear trend might actually turn into a quadratic trend when focusing on the trajectory of procrastination over multiple years in secondary school. For instance, quadratic trends over the course of secondary school have been found in students' development of achievement motivation, which is negatively associated with procrastination (Howell & Watson, 2007; Steel, 2007; Van der Werf et al., 2008).

Our results also revealed a difference in the development of procrastination on class and student level. While the model clearly predicted an increase in the average level of procrastination for all classes, the student level showed a more varying pattern in which some students might not change or even experience a decline in their level of procrastination. These findings connect to earlier results with regard to

differences between class and student level. In their study on the development of math engagement [Martin et al. \(2014\)](#) found a negative trend in engagement that generalized on class and school level but showed a far greater variability on student level. In addition, procrastination (called self-handicapping) as a form of maladaptive engagement was strongly influenced by self-efficacy.

Concerning the time-varying variables, metacognitive self-regulation, self-efficacy, and effort regulation the current study succeeded in confirming their importance as predictors of procrastination and, additionally, extended the knowledge about their role in the population of young secondary education students. While all three constructs were negatively related to procrastination, effort regulation appeared to have the strongest association. This is surprising due to the fact that the relation between effort regulation and procrastination is underrepresented in the literature about academic procrastination. The fact that self-efficacy and self-regulation are closely related to effort regulation (e.g. [Komarraju & Nadler, 2013](#); [Richardson et al., 2012](#); [Sungur, 2007](#)) suggests that part of their relation with procrastination might be explained through effort regulation. However, it became evident that every single one of the three factors remained significant even after controlling for the other two factors. In consequence, based on their malleable nature, student metacognitive self-regulation, self-efficacy, or effort regulation can be enhanced and therefore form a concrete source to mitigate academic procrastination in young students ([Bandura, 1997](#); [Gist & Mitchell, 1992](#); [Wolters et al., 2005](#)). On the other hand, the non-significance of our additional variables, gender, prior educational attainment, and subject forms first evidence for the universal occurrence of procrastination in all types of young students. This deviation from earlier findings that identified the “prototypical procrastinator” ([Steel & Ferrari, 2013, p.56](#)) supports the conjecture that researchers should approach the group of young students in secondary education as a distinct group rather than simply projecting findings about other populations on this group.

Finally, the study gave new insights into the dynamics of the relation between the three time-varying variables and procrastination. As we approached all four variables as time-varying constructs a consequent step was to explore whether their relation should be approached in a similar manner rather than being seen as time-invariant. Indeed, our results yielded evidence for this assumption by finding a decrease in the relation of metacognitive self-regulation and self-efficacy with procrastination over time. In terms of procrastination as a self-regulatory failure, the changes in the strength of association can be construed as an indication that the use of maladaptive strategies is consolidated over time and, as a consequence, becomes less susceptible to change ([Katz et al., 2014](#)). In accordance with this, [Onatsu-Arvilommi et al. \(2002\)](#) found stable patterns for maladaptive achievement strategies that manifested in children as young as the age of 6 or 7 years old in their first year of primary education. Consequently, our results corroborate the need to identify students' tendency to engage in dilatory behaviour at an early stage and counteract where possible. Notably, our hypothesis did not hold for the interaction with effort regulation. The fact that its relation with procrastination remained stable and, in addition, overall was stronger than the relations between procrastination and metacognitive self-regulation or self-efficacy reveals the appropriateness of including this construct as a separate factor into our models. It also confirms the auspicious role of effort regulation as an antidote to procrastination.

4.1. Limitations and further directions

Despite these promising findings, our study knows different limitations that future research should consider addressing. The first limitation is linked to the reliance on self-report measures to obtain the scores for procrastination and the time-varying predictors. Although [Pintrich \(2004\)](#) points out that self-report measures, in fact, are able to capture the general propensity and aptitude to utilize self-regulatory

processes, shortcomings of self-report measures have been discussed as well ([Elliott, 2004](#); [Fulmer & Frijters, 2009](#); [Kim & Seo, 2015](#)). One point of attention is the potential risk of reactivity among respondents which could have been exacerbated by the longitudinal nature of our study, e.g. due to an increasing awareness of students concerning the measured constructs ([Heppner, Wampold, & Kivlighan, 2008](#)). In addition, the suitability of self-report procrastination scales to capture actual procrastination behaviour rather than students' self-assessment of their own procrastination remains subject of an on-going debate ([Moon & Illingworth, 2005](#); [Steel, Brothen, & Wambach, 2001](#)). However, concerning procrastination as a time-varying state, as was the case in the current study, recent findings by [Krause and Freund \(2014\)](#) clearly support the use of self-report scales as opposed to purely behavioural measures. Nevertheless, the reliance on multiple approaches (e.g. the addition of external observations) might strengthen the validity of our results. Next, attention should be paid to the possibility of confounding variables. The use of growth curve models in hierarchical linear modeling allowed us to rule out the possibility of any time-invariant, confounding variable. However, this technique cannot eliminate the possibility of unobserved time-varying confounds that might change contemporaneously with one of the measured time-varying predictors and furthermore determine procrastination ([Duckworth, Tsukayama, & May, 2010](#)). In consequence, the chosen design of the current study does not allow to claim causal relations between procrastination and the independent variables. Although [Duckworth et al. \(2010\)](#) argue that an experimental design would set the final step to ensure the exclusion even of time-varying confounds and therefore set the stage for truly proofing causality, it remains arguable whether an experimental design would be feasible or could yield ecologically valid results in the context of our study.

Future research should also consider the possibility to extend the focus of the current study and observe students for a longer period of time, for example during the course of their complete secondary education. As mentioned before, this could reveal a distinct trajectory for the development of procrastination when compared to the change during only the first year of secondary education. Such a design will also permit the distinction between within-year and between-year trajectories. In addition, following young students till the end of adolescence would also enable us understand how procrastination may be affected by the maturation of students and the underlying neurological changes which are crucial for the development of higher cognitive functions ([Yurgelun-Todd, 2007](#)).

4.2. Conclusion

The current study gave a deeper insight into the development of academic procrastination in first-year secondary education students and contributed to the scarce literature concerning the population of younger students. While the study provided evidence that procrastination is a dynamic construct that undergoes changes over time, it also stresses the importance of the time-varying predictors metacognitive self-regulation, self-efficacy, and effort regulation. An important implication of this study is that educators should observe and aim to tackle students' tendency to procrastinate from early on before consolidation occurs. The enhancement of metacognitive self-regulation, self-efficacy and especially effort regulation shows great promise for the reduction of dilatory behaviour. To achieve this, educators and school policy makers should, for instance, not only focus on the transfer of factual knowledge but also educate young students in the acquisition of metacognitive skills which would facilitate self-regulatory processes and enable the regulation of effort ([Dignath, Buettner, Langfeldt, & Goethe, 2008](#); [Schraw, Crippen, & Hartley, 2006](#)). In addition, customized school tasks that correspond to students' individual abilities and attainment level are more likely to stimulate self-efficacy ([Pajares, 2006](#)).

It became evident that procrastination in young secondary education students should be viewed as a universal construct, affecting all

types of students, independent of their gender or prior educational attainment. More generally, we hope that our study highlighted the need to focus future procrastination research on the group of youngest students in secondary education. Only after advancing our understanding of this group, we can finally thwart procrastination and prevent its detrimental effects from occurring.

Appendix A

Table A

Pearson correlation matrix including sample means (M) and standard deviations (SD) for each variable and measurement occasion.

Variable and measurement occasion	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	M	SD
1 Procr. T0	–																				2.09	0.83
2 Procr. T1	.33	–																			2.22	0.88
3 Procr. T2	.30	.42	–																		2.25	0.89
4 Procr. T3	.18	.53	.43	–																	2.37	0.92
5 Procr. T4	.30	.37	.41	.48	–																2.52	0.96
6 Self-reg. T0	–.24	–.04	–.08	–.01	–.17	–															3.23	0.59
7 Self-reg. T1	–.21	–.19	–.11	–.19	–.23	.29	–														3.19	0.70
8 Self-reg. T2	–.31	–.24	–.27	–.22	–.26	.23	.56	–													3.15	0.82
9 Self-reg. T3	–.29	–.29	–.28	–.27	–.27	.22	.56	.59	–												3.11	0.69
10 Self-reg. T4	–.09	–.17	–.15	–.19	–.20	.26	.50	.44	.51	–											3.04	0.73
11 Self-eff. T0	–.37	–.28	–.18	–.15	–.12	.28	.31	.28	.27	.28	–										3.91	0.59
12 Self-eff. T1	–.17	–.34	–.19	–.14	–.22	.03	.26	.12	.09	.16	.35	–									3.95	0.77
13 Self-eff. T2	–.16	–.18	–.30	–.12	–.19	–.03	.10	.06	.18	.07	.30	.46	–								3.92	0.83
14 Self-eff. T3	–.23	–.17	–.20	–.21	–.12	–.02	.19	.16	.20	.18	.28	.44	.48	–							3.83	0.91
15 Self-eff. T4	–.24	–.23	–.28	–.13	–.27	.10	.35	.24	.19	.24	.26	.47	.43	.39	–						3.75	0.89
16 Eff. reg. T0	–.54	–.16	–.14	–.09	–.18	.26	.25	.34	.28	.15	.39	.09	.13	.15	.12	–					4.13	0.67
17 Eff. reg. T1	–.38	–.63	–.38	–.43	–.33	.13	.28	.22	.24	.17	.26	.43	.21	.27	.26	.22	–				3.89	0.77
18 Eff. reg. T2	–.33	–.35	–.73	–.36	–.39	.10	.20	.33	.41	.19	.19	.24	.39	.25	.27	.25	.45	–			3.85	0.85
19 Eff. reg. T3	–.43	–.37	–.38	–.53	–.44	–.02	.27	.32	.42	.24	.25	.23	.21	.39	.20	.26	.48	.48	–		3.72	0.80
20 Eff. reg. T4	–.33	–.39	–.41	–.40	–.67	.13	.27	.30	.35	.33	.19	.33	.30	.33	.45	.21	.43	.47	.56	–	3.58	0.82

Note. Numbers in italic represent correlations that were non-significant at a significance level of $p < .05$.

References

- Ackerman, D. S., & Gross, B. L. (2005). My instructor made me do it: Task characteristics of procrastination. *Journal of Marketing Education*, 27(1), 5–13. <http://dx.doi.org/10.1177/0273475304273842>.
- Anderman, E., & Maehr, M. L. (1994). Motivation and schooling in the middle grades. *Review of Educational Research*, 64(2), 287–309. <http://dx.doi.org/10.3102/00346543064002287>.
- Andreou, C. (2007). Understanding procrastination. *Journal for the Theory of Social Behaviour*, 37(2), 183–193. <http://dx.doi.org/10.1111/j.1468-5914.2007.00331.x>.
- Artino, A. R., & Stephens, J. M. (2009). Academic motivation and self-regulation: A comparative analysis of undergraduate and graduate students learning online. *The Internet and Higher Education*, 12(3–4), 146–151. <http://dx.doi.org/10.1016/j.iheduc.2009.02.001>.
- Bakravecic Vukman, K., & Licardo, M. (2010). How cognitive, metacognitive, motivational and emotional self-regulation influence school performance in adolescence and early adulthood. *Educational Studies*, 36(3), 259–268. <http://dx.doi.org/10.1080/03055690903180376>.
- Balkis, M., & Duru, E. (2015). Procrastination, self-regulation failure, academic life satisfaction, and affective well-being: Underregulation or misregulation form. *European Journal of Psychology of Education*. <http://dx.doi.org/10.1007/s10212-015-0266-5>.
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, 50(2), 248–287. [http://dx.doi.org/10.1016/0749-5978\(91\)90022-L](http://dx.doi.org/10.1016/0749-5978(91)90022-L).
- Bandura, A. (1994). Self-efficacy. In S. Ramachandran (Vol. Ed.), *Encyclopedia of human behavior*. Vol. 4. *Encyclopedia of human behavior* (pp. 71–81). New York: Academic Press. <http://dx.doi.org/10.1002/9780470479216.corpsy0836>.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman & Company.
- Blunt, A. K., & Pychyl, T. A. (2000). Task aversiveness and procrastination: A multi-dimensional approach to task aversiveness across stages of personal projects. *Personality and Individual Differences*, 28(1), 153–167. [http://dx.doi.org/10.1016/S0191-8869\(99\)00091-4](http://dx.doi.org/10.1016/S0191-8869(99)00091-4).
- Caprara, G. V., Fida, R., Vecchione, M., Del Bove, G., Vecchio, G. M., Barbaranelli, C., & Bandura, A. (2008). Longitudinal analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. *Journal of Educational Psychology*, 100(3), 525–534. <http://dx.doi.org/10.1037/0022-0663.100.3.525>.
- Chow, H. P. H. (2011). Procrastination among undergraduate students: Effects of emotional intelligence, school life, self-evaluation, and self-efficacy. *Alberta Journal of Educational Research*, 57(2), 234–240.
- Curran, P. J., Obeidat, K., & Losardo, D. (2010). Twelve frequently asked questions about growth curve modeling. *Journal of Cognition and Development*, 11(2), 121–136. <http://dx.doi.org/10.1080/15248371003699969>.
- De Leeuw, J., & Meijer, E. (2008). Handbook of multilevel analysis. In J. de Leeuw, & E. Meijer (Eds.). *Handbook of multilevel analysis*. New York, NY: Springer New York. <http://dx.doi.org/10.1007/978-0-387-73186-5>.
- Denzine, G., & Brown, R. (2015). Motivation to learn and achievement. In R. Papa (Ed.). *Media rich instruction* (pp. 19–33). Cham: Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-00152-4_2.
- Depreuw, E., & Lens, W. (1998). Vragenlijst aangaande studie-organisatie-vaardigheden—VaSOV [study management skills: A questionnaire]. *Unpublished manuscript, center for research in motivation and time perspective*. Belgium: Catholic University Leuven.
- Dietz, F., Hofer, M., & Fries, S. (2007). Individual values, learning routines and academic procrastination. *The British Journal of Educational Psychology*, 77, 893–906. <http://dx.doi.org/10.1348/000709906X169076>.
- Dignath, C., Buettner, G., Langfeldt, H., & Goethe, J. W. (2008). How can primary school students learn self-regulated learning strategies most effectively? *Educational Research Review*, 3(2), 101–129. <http://dx.doi.org/10.1016/j.edurev.2008.02.003>.
- Duckworth, A. L., Tsukayama, E., & May, H. (2010). Establishing causality using longitudinal hierarchical linear modeling: An illustration predicting achievement from self-control. *Social Psychological and Personality Science*, 1(4), 311–317. <http://dx.doi.org/10.1177/1948550609359707>.
- Elliott, J. (2004). Multimethod approaches in educational research. *International Journal of Disability, Development and Education*, 51(2), 135–149. <http://dx.doi.org/10.1080/10349120410001687364>.
- Ferrari, J. R., Díaz-Morales, J. F., O'Callaghan, J., Diaz, K., & Argumedo, D. (2007).

- Frequent behavioral delay tendencies by adults: International prevalence rates of chronic procrastination. *Journal of Cross-Cultural Psychology*, 38(4), 458–464. <http://dx.doi.org/10.1177/0022022107302314>.
- Ferrari, J. R., Özer, B. U., & Demir, A. (2009). Chronic procrastination among Turkish adults: Exploring decisional, avoidant, and arousal styles. *The Journal of Social Psychology*, 149(3), 402–408. <http://dx.doi.org/10.3200/SOCP.149.3.402-408>.
- Fulmer, S. M., & Frijters, J. C. (2009). A review of self-report and alternative approaches in the measurement of student motivation. *Educational Psychology Review*, 21(3), 219–246. <http://dx.doi.org/10.1007/s10648-009-9107-x>.
- Gist, M. E., & Mitchell, T. B. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review*, 17(2), 183–211. <http://dx.doi.org/10.5465/AMR.1992.4279530>.
- Gröpel, P., & Steel, P. (2008). A mega-trial investigation of goal setting, interest enhancement, and energy on procrastination. *Personality and Individual Differences*, 45(5), 406–411. <http://dx.doi.org/10.1016/j.paid.2008.05.015>.
- Grunschel, C., Patrzek, J., & Fries, S. (2013). Exploring different types of academic delayers: A latent profile analysis. *Learning and Individual Differences*, 23, 225–233. <http://dx.doi.org/10.1016/j.lindif.2012.09.014>.
- Hedeker, D. (2004). An introduction to growth modeling. In D. Kaplan (Ed.), *The Sage handbook of quantitative methodology for the social sciences* (pp. 215–234). London: Sage Publications.
- Heppner, P. P., Wampold, B. E., & Kivlighan, D. M. (2008). *Research design in counseling* (3rd ed.). Thomson <http://dx.doi.org/10.1177/0011000003254630>.
- Howell, A. J., & Watson, D. C. (2007). Procrastination: Associations with achievement goal orientation and learning strategies. *Personality and Individual Differences*, 43(1), 167–178. <http://dx.doi.org/10.1016/j.paid.2006.11.017>.
- Jackson, T., Weiss, K. E., Lundquist, J. J., & Hooper, D. (2003). The impact of hope, procrastination, and social activity on academic performance of midwestern college students. *Education*, 124(2), 310–320.
- Janssen, J. (2015). *Academic procrastination: Prevalence among high school and undergraduate student and relationship to academic achievement (doctoral dissertation)*. Georgia State University. (Retrieved from) http://scholarworks.gsu.edu/epse_diss/103/.
- Katz, I., Eilat, K., & Nevo, N. (2014). "I'll do it later": Type of motivation, self-efficacy and homework procrastination. *Motivation and Emotion*, 38(1), 111–119. <http://dx.doi.org/10.1007/s11031-013-9366-1>.
- Kessels, U. (2005). Fitting into the stereotype: How gender-stereotyped perceptions of prototypic peers relate to liking for school subjects. *European Journal of Psychology of Education*, 20(3), 309–323. <http://dx.doi.org/10.1007/BF03173559>.
- Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences*, 82, 26–33. <http://dx.doi.org/10.1016/j.paid.2015.02.038>.
- Klassen, R. M., Krawchuk, L. L., & Rajani, S. (2008). Academic procrastination of undergraduates: Low self-efficacy to self-regulate predicts higher levels of procrastination. *Contemporary Educational Psychology*, 33(4), 915–931. <http://dx.doi.org/10.1016/j.cedpsych.2007.07.001>.
- Klingsieck, K. B. (2013). Procrastination: When good things don't come to those who wait. *European Psychologist*, 18(1), 24–34. <http://dx.doi.org/10.1027/1016-9040/a000138>.
- Komarraju, M., & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter? *Learning and Individual Differences*, 25, 67–72. <http://dx.doi.org/10.1016/j.lindif.2013.01.005>.
- Krause, K., & Freund, A. M. (2014). Delay or procrastination - A comparison of self-report and behavioral measures of procrastination and their impact on affective well-being. *Personality and Individual Differences*, 63, 75–80. <http://dx.doi.org/10.1016/j.paid.2014.01.050>.
- Kunnen, E. S., & van Geert, P. (2012). General characteristics of a dynamic systems approach. In E. S. Kunnen (Ed.), *A dynamic systems approach to adolescent development* (pp. 15–34). London: Psychology Press. <http://dx.doi.org/10.4324/9780203147641>.
- Lay, C. H. (1997). Explaining lower-order traits through higher-order factors: The case of trait procrastination, conscientiousness, and the specificity dilemma. *European Journal of Personality*, 11(4), 267–278. [http://dx.doi.org/10.1002/\(SICI\)1099-0984\(199711\)11:4<267::AID-PER281>3.0.CO;2-P](http://dx.doi.org/10.1002/(SICI)1099-0984(199711)11:4<267::AID-PER281>3.0.CO;2-P).
- Martin, A. J., Way, J., Bobis, J., & Anderson, J. (2014). Exploring the ups and downs of mathematics engagement in the middle years of school. *Journal of Early Adolescence*, 35(2), 199–244. <http://dx.doi.org/10.1177/0272431614529365>.
- Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., Freeman, K. E., & Urdan, T. C. (2000). *Manual for the patterns of adaptive learning scales (PALS)*. Ann Arbor: University of Michigan.
- Minnaert, A. E. M. G., & Janssen, P. J. (1997). Bias in the assessment of regulation activities in studying at the level of higher education. *European Journal of Psychological Assessment*, 13(2), 99–108. <http://dx.doi.org/10.1027/1015-5759.13.2.99>.
- Moon, S. M., & Illingworth, A. J. (2005). Exploring the dynamic nature of procrastination: A latent growth curve analysis of academic procrastination. *Personality and Individual Differences*, 38(2), 297–309. <http://dx.doi.org/10.1016/j.paid.2004.04.009>.
- Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38(1), 30–38. <http://dx.doi.org/10.1037/0022-0167.38.1.30>.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill.
- Onatsu-Arviolommi, T., Nurmi, J. E., & Aunola, K. (2002). The development of achievement strategies and academic skills during the first year of primary school. *Learning and Instruction*, 12(5), 509–527. [http://dx.doi.org/10.1016/S0959-4752\(01\)00029-9](http://dx.doi.org/10.1016/S0959-4752(01)00029-9).
- Onoda, S. (2014). Examining the relationships between self-efficacy, effort regulation strategy use, and English vocabulary skills. *Studies in Self-Access Learning Journal*, 5(4), 357–371. (Retrieved from) <http://sisaljournal.org/archives/dec14/onoda%0AThis>.
- Owens, A. M., & Newbegin, I. (2000). Academic procrastination of adolescents in English and mathematics: Gender and personality variations. *Journal of Social Behavior and Personality*, 15(5), 111–124.
- Pajares, F. (2006). Self-efficacy during childhood and adolescence: Implications for teachers and parents. In F. Pajares, & T. C. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 339–367). Greenwich, CT: Information Age.
- Peetsma, T., & Van der Veen, I. (2009). Influencing students' motivation for school: The case of first-year students from different ethnic backgrounds in the Netherlands in the lowest level of secondary school. In M. Wosnitza, S. A. Karabenick, A. Efklides, & P. Nenninger (Eds.), *Contemporary motivation research: From global to local perspectives* (pp. 299–320). Cambridge: Hogrefe Publishing.
- Peetsma, T., & Van der Veen, I. (2013). Influencing young adolescents' motivation in the lowest level of secondary education. *Educational Review*, 67(1), 97–120. <http://dx.doi.org/10.1080/00131911.2013.830593>.
- Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational Psychology Review*, 16(4), 385–407.
- Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ)*. University of Michigan.
- Pintrich, P. R., & Zusho, A. (2002). The development of academic self-regulation: The role of cognitive and motivational factors. In A. Wigfield, & J. S. Eccles (Eds.), *Development of achievement motivation* (pp. 249–284).
- R Core Team (2016). R: A language and environment for statistical computing (Vienna, Austria). Retrieved from <https://www.r-project.org/>.
- Rakes, G. C., & Dunn, K. E. (2010). The impact of online graduate students' motivation and self-regulation on academic procrastination. *Journal of Interactive Online Learning*, 9(1), 78–93.
- Rasbash, J., Steele, F., Browne, W. J., & Goldstein, H. (2015). *A user's guide to MLwiN, v.2.33*. UK: Centre for Multilevel Modelling, University of Bristol.
- Rawlins, D. R. (1995). A study of academic procrastination in middle-school-aged children. *Dissertation Abstracts International*, 56, 1708.
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138(2), 353–387. <http://dx.doi.org/10.1037/a0026838>.
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, 130(2), 261–288. <http://dx.doi.org/10.1037/0033-2909.130.2.261>.
- Schouwenburg, H. C., & Lay, C. H. (1995). Trait procrastination and the big-five factors of personality. *Personality and Individual Differences*, 18(4), 481–490. [http://dx.doi.org/10.1016/0191-8869\(94\)00176-S](http://dx.doi.org/10.1016/0191-8869(94)00176-S).
- Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, 36(1–2), 111–139. <http://dx.doi.org/10.1007/s11165-005-3917-8>.
- Senécal, C., Lavoie, K., & Koestner, R. (1997). Trait and situational factors in procrastination: An interactional model. *Journal of Social Behavior and Personality*, 12(4), 889–903.
- Seo, E. H. (2008). Self-efficacy as a mediator in the relationship between self-oriented perfectionism and academic procrastination. *Social Behavior and Personality: An International Journal*, 36(6), 753–764. <http://dx.doi.org/10.2224/sbp.2008.36.6.753>.
- Silver, M., & Sabini, J. (1981). Procrastinating. *Journal for the Theory of Social Behaviour*, 11(2), 207–221. <http://dx.doi.org/10.1111/j.1468-5914.1981.tb00033.x>.
- Sims, C. M. (2014). *Self-regulation coaching to alleviate student procrastination: Addressing the likeability of studying behaviours*. 9(2). International Coaching Psychology Review 147–164.
- Singer, B. D., & Bashir, A. S. (1999). What are executive functions and self-regulation and what do they have to do with language-learning disorders? *Language, Speech, and Hearing Services in Schools*, 30(3), 265–273. <http://dx.doi.org/10.1044/0161-1461.3003.265>.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis*. Oxford University Press <http://dx.doi.org/10.1093/acprof:oso/9780195152968.001.0001>.
- Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed.). London: Sage Publisher.
- Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of Counseling Psychology*, 31(4), 503–509. <http://dx.doi.org/10.1037/0022-0167.31.4.503>.
- Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin*, 133(1), 65–94. <http://dx.doi.org/10.1037/0033-2909.133.1.65>.
- Steel, P., Brothen, T., & Wambach, C. (2001). Procrastination and personality, performance, and mood. *Personality and Individual Differences*, 30(1), 95–106. [http://dx.doi.org/10.1016/S0191-8869\(00\)00013-1](http://dx.doi.org/10.1016/S0191-8869(00)00013-1).
- Steel, P., & Ferrari, J. R. (2013). Sex, education and procrastination: An epidemiological study of procrastinators' characteristics from a global sample. *European Journal of Personality*, 27(1), 51–58. <http://dx.doi.org/10.1002/per.1851>.
- Strunk, K. K., & Steele, M. R. (2011). Relative contributions of self-efficacy, self-regulation, and self-handicapping in predicting student procrastination. *Psychological Reports*, 109(3), 983–989. <http://dx.doi.org/10.2466/07.09.20.PR0.109.6.983-989>.
- Sungur, S. (2007). Modeling the relationships among students' motivational beliefs, metacognitive strategy use, and effort regulation. *Scandinavian Journal of Educational Research*, 51(3), 315–326. <http://dx.doi.org/10.1080/00313830701356166>.
- Tan, C. X., Ang, R. P., Klassen, R. M., Yeo, L. S., Wong, I. Y. F., Huan, V. S., & Chong, W. H. (2008). Correlates of academic procrastination and students' grade goals. *Current Psychology*, 27(2), 135–144. <http://dx.doi.org/10.1007/s12144-008-9028-8>.

- Tice, D. M., & Baumeister, R. F. (1997). Longitudinal study of procrastination, performance, stress, and health: The costs and benefits of dawdling. *Psychological Science*, 8(6), 454–458. <http://dx.doi.org/10.1111/j.1467-9280.1997.tb00460.x>.
- Tuckman, B. W. (2005). Relations of academic procrastination, rationalization, and performance in a web course with deadlines. *Psychological Reports*, 96, 1015–1021. <http://dx.doi.org/10.2466/pr0.96.3c.1015-1021>.
- Van der Veen, I., & Peetsma, T. (2009). The development in self-regulated learning behaviour of first-year students in the lowest level of secondary school in the Netherlands. *Learning and Individual Differences*, 19(1), 34–46. <http://dx.doi.org/10.1016/j.lindif.2008.03.001>.
- Van der Werf, G., Opendakker, M.-C., & Kuyper, H. (2008). Testing a dynamic model of student and school effectiveness with a multivariate multilevel latent growth curve approach. *School Effectiveness and School Improvement*, 19(4), 447–462. <http://dx.doi.org/10.1080/09243450802535216>.
- Van Eerde, W. (2000). Procrastination: Self-regulation in initiating aversive goals. *Applied Psychology: An International Review*, 49(3), 372–389. <http://dx.doi.org/10.1111/1464-0597.00021>.
- Van Eerde, W. (2003). A meta-analytically derived nomological network of procrastination. *Personality and Individual Differences*, 35(6), 1401–1418. [http://dx.doi.org/10.1016/S0191-8869\(02\)00358-6](http://dx.doi.org/10.1016/S0191-8869(02)00358-6).
- Wäschle, K., Allgaier, A., Lachner, A., Fink, S., & Nückles, M. (2014). Procrastination and self-efficacy: Tracing vicious and virtuous circles in self-regulated learning. *Learning and Instruction*, 29, 103–114. <http://dx.doi.org/10.1016/j.learninstruc.2013.09.005>.
- Wolters, C. A. (2003). Understanding procrastination from a self-regulated learning perspective. *Journal of Educational Psychology*, 95(1), 179–187. <http://dx.doi.org/10.1037/0022-0663.95.1.179>.
- Wolters, C. A., Pintrich, P. R., & Karabenick, S. A. (2005). Assessing academic self-regulated learning. In K. A. Moore, & L. H. Lippman (Eds.). *What do children need to flourish?* (pp. 251–270). US: Springer. http://dx.doi.org/10.1007/0-387-23823-9_16.
- Yurgelun-Todd, D. (2007). Emotional and cognitive changes during adolescence. *Current Opinion in Neurobiology*, 17(2), 251–257. <http://dx.doi.org/10.1016/j.conb.2007.03.009>.
- Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, 81(3), 329–339. <http://dx.doi.org/10.1037/0022-0663.81.3.329>.
- Zimmerman, B. J., & Kitsantas, A. (2014). Comparing students' self-discipline and self-regulation measures and their prediction of academic achievement. *Contemporary Educational Psychology*, 39(2), 145–155. <http://dx.doi.org/10.1016/j.cedpsych.2014.03.004>.