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The role of self-study time in freshmen's achievement

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Abstract

Although invested study time is expected to relate to exam performance, research findings have been mixed. Therefore, the current study examined a) the role of self-study time above and beyond relevant student characteristics, affective-motivational processes (i.e., academic self-efficacy, learning goal orientation, and action-state orientation) and the cognitive learning activities deployed while studying the course (i.e., deep, stepwise, and concrete processing), and b) whether the effect of self-study time on course grade is moderated by these affective-motivational and cognitive learning activities and/or by student characteristics. 93 freshmen following a Macro-Economics course and 70 freshmen enrolling in Financial Accounting 2 participated. For Macro-Economics, self-study time predicted course grade above and beyond relevant student characteristics, the degree of class attendance, and course-specific affective-motivational and cognitive learning activities. No interaction effects were obtained. For Financial Accounting 2, students only benefited from more self-study time when they made few exercises.

Keywords: study time, cognitive learning activities, volition, motivation, academic performance, higher education

The role of self-study time in freshmen's achievement

Study results depend on many interrelated, interacting factors, including student characteristics, learning activities, and the teaching context (Biggs, 2001). The main focus of the current study is on learning activities[1] as predictors of academic performance. Although educational researchers have been primarily interested in the relation between qualitative aspects of students' learning activities and academic performance (e.g., deep/surface approaches to learning; Entwistle & McCune, 2004), quantitative aspects (such as effort and study time) have been examined as well. The interest in time investment dates back to Carroll (1963) who hypothesizes that '*the degree of learning, other things being equal, is a simple function of the amount of time during which the pupil engages actively in learning*' (p. 732). Consistently with this argument, evidence has been found that time-on-task (often observed in the classroom; e.g., Hattie, 2009) and study time investment (as reported by students themselves; e.g., Credé & Kuncel, 2008) affect academic performance.

The link between study time and academic performance has been under debate, however. Although, intuitively, more study time is expected to result in higher performance, research results have been inconsistent (Stinebrickner & Stinebrickner, 2004). In some cases, study time has been shown to predict academic performance beyond a myriad of intellective (e.g., high school GPA, SAT scores) and non-intellective student characteristics (e.g., gender, health; Brint & Cantwell, 2010; Diseth, Pallesen, Brunborg, & Larsen, 2010; George et al. 2008). In other cases, however, no significant association was obtained (e.g., Diseth, 2007; Gortner & Zulauf, 2000; Guillaume & Khachikian, 2011; Kember, Jamieson, Pomfret, & Wong, 1995).

One of the primary reasons for these inconsistent results may be that time investment in itself does not increase academic performance (cf. Hattie, 2009). It is the type of learning activities deployed while studying that matters. This assertion has two implications: 1) it

argues against the idea that there is an independent effect of study time on academic performance after taking into account the type of learning activities deployed; and 2) it implies that the effect of study time on academic performance may differ depending on these learning activities. To address the first implication, we examine whether study time affects academic performance after taking into account qualitative aspects of learning activities and relevant student characteristics (e.g., an intelligence test score). In line with research into students' approaches to learning (e.g., Entwistle & McCune, 2004), qualitative aspects of learning activities entail both cognitive and affective-motivational processing of course content (see further). To address the second implication, the present study looks for interplays between study time and qualitative aspects of learning activities in the prediction of academic performance.

We focus on self-study time rather than class attendance, because it is far more under the control of students. Whereas classes are scheduled (and, at our faculty, freshmen are inclined to follow classes because they often consist of workshops), students need to plan and monitor their self-study time on their own. Class attendance is, however, incorporated as a control variable in our model because of its demonstrated importance to exam performance (e.g., Credé, Roch, & Kieszczynka, 2010).

The Role of Self-Study Time Above and Beyond Other Important Factors

Our first research goal was to specify the role of student's self-study time in exam performance after accounting for relevant student characteristics and qualitative aspects of the learning activities deployed.

Qualitative aspects of learning activities. The type of learning activities that students undertake is expected to determine to an important extent the learning results they achieve (Biggs, 2001; Vermunt, 2005). Because this is the predominant view in the literature, we were

challenged to investigate the role of self-study time above and beyond that of the cognitive and affective-motivational learning activities deployed.

Consistently with Vermunt (1992, 2005), the type of *cognitive processing* is described by three dimensions: deep, stepwise and concrete processing. The strategies relating course content, structuring, and critical processing were included as indicators of deep cognitive processing, whereas the cognitive strategies analysing and memorising were included as indicators of stepwise cognitive processing. In addition, we have incorporated the extent to which students made exercises, which is one of the indicators of concrete processing (Vermunt & Vermetten, 2004). Overall, deep and concrete processing are expected to relate positively to exam performance, whereas stepwise cognitive processing may be negatively related to achievement outcomes (Vermunt, 2005). The relationship between these strategies and exam performance has, however, been shown to vary according to major, course, and type of exam questions (Vermunt, 1992, 2005). Therefore, the effect of self-study time on exam performance was evaluated after taking into account all three cognitive strategies.

Regarding *affective-motivational processing*, dimensions of motivation and volition are considered. Whereas motivational processes set the stage for action through the commitment to explicit goals and intentions, volition guides the translation of goals and intentions into actions (Corno & Kanfer, 1993). Two motivational dimensions are included: academic self-efficacy and learning goal orientation. Academic self-efficacy refers to students' beliefs in their ability to master coursework (Zimmerman, Bandura, & Martinez-Pons, 1992) and, thus, concerns students' expectancies for success (Eccles & Wigfield, 2002). Student's academic self-efficacy has been found repeatedly to be one of the most important psychosocial predictors of academic performance in higher education (Credé & Kuncel, 2008; Richardson, Abraham, & Bond, 2012; Robbins et al., 2004). Learning goal orientation refers to the extent to which students desire to learn new skills, master new tasks, or understand new

things when studying a course (Dweck, 1999). This construct points to reasons for engaging in a task and is inherently linked to task value (Eccles & Wigfield, 2002). This construct has also been linked to university students' academic performance (e.g., Phan, 2010).

Regarding affective-motivational factors, a second aspect that was included is volition. Volition refers to students' ability to maintain the effort needed to achieve their goals, even in the face of adversity (Wolters, 1998). Kuhl's construct of action-state orientation describes how individuals deal with difficulties, such as negative affective-motivational processes. Action-oriented individuals are able to protect current goals (e.g., studying) from competing action tendencies by allocating attention, inhibiting irrelevant cognitions, and controlling emotions (Kuhl, 1994). State-oriented individuals have persistent, ruminative thoughts about alternative goals and affective states which reduce the cognitive resources available for goal striving (Diefendorff, Hall, Lord, & Strean, 2000). Two major dimensions of action-state orientation can be distinguished. The first dimension is: disengagement at the action-oriented pole versus preoccupation with failure at the state-oriented pole. Disengagement means: being able to detach from irrelevant cognitions that may interfere with completing the task. Preoccupation means: suffering from persevering thoughts about unpleasant events, such as failure (Kuhl, 1994). The second dimension is: taking initiative versus hesitating. It refers to the ease or difficulty of initiating goal-directed action. Action-oriented individuals easily start working on the task, without external pressure, even when it is boring or aversive (Diefendorff, 2004; Diefendorff et al., 2000). State-oriented individuals procrastinate and delay initiating action. These volitional constructs have been introduced in the higher education literature in the last decades (e.g., Volet, 1997; Diefendorff, 2004). In general, student's scoring higher on the action-oriented pole (i.e., disengagement and taking initiative) are expected to obtain better grades. Taking initiative and disengagement have indeed been shown to contribute to university students' exam performance, after also including cognitive

ability, goal orientation and self-efficacy in the model (Diefendorff, 2004). More easily taking initiative to study was related to a higher exam performance. However, the less students disengage (i.e., the more they are preoccupied with failure), the better their grades. Similar findings were obtained by Perry, Hladkyj, Pekrun, and Pelletier (2001). Both Kuhl (1994) and Diefendorff (2004) argue that for long-term goals (such as preparing for an exam) in which planning and persistence are important, preoccupation when facing failure/difficulties while studying the course may not be detrimental (and may even be positive) as long as one is able to postpone ruminative thoughts whenever one intends to focus on an important activity. In these situations '*ruminating about the possibility of failure may result in more cautious and deliberative goal-directed behavior'* (Diefendorff, 2004, p. 379). Based on these findings, we hypothesized that the capacity to easily start working (i.e., less procrastination and delaying action) is positively associated with students' academic performance, as is a higher preoccupation with failure (i.e., less disengagement).

Relevant student characteristics. Primarily intellective, educational student characteristics were selected (i.e., an indicator of students' prior knowledge of mathematics and their intelligence test score at university-entry) because of their substantive predictive value for students' academic performance (e.g., Credé & Kuncel, 2008; Dochy, Segers, & Buehl, 1999). Gender was also included because it has been shown repeatedly that women perform better academically than men (e.g., Bruinsma & Jansen 2009).

The Possible Moderating Role of Qualitative Aspects of Learning Activities

Qualitative aspects of learning activities. Because the effect of different *cognitive strategies* (deep, stepwise and concrete processing) on exam performance has been shown to vary depending on the course (Vermunt, 1992), it is difficult to predict beforehand which cognitive processing strategy may play a moderating role. Therefore, our examination of

interplays between cognitive processing strategies and exam performance remains exploratory.

Regarding interaction effects between self-study time and *affective-motivational variables*, we expect self-study time to relate positively to academic performance in as far as students are not hindered by a maladaptive internal affective-motivational climate (Boekaerts, 1996). According to Boekaerts (1993), negative affective-motivational processes reduce ones readiness to take action (in this case: to study), because dealing with them requires extra processing capacity and directs attention away from learning. As such, more self-study time is expected to foster students' achievement only if it is not spent on dealing with negative emotions and cognitions. Although Boekaerts' work mainly concerns students in primary education and high school, we expect this hypothesis also to hold in the first year of higher education. Freshmen are faced with a variety of new situations, which may be accompanied by uncertainty.

Boekaerts' work was inspired –amongst others – by Kuhl's action control theory (1994). Therefore, our main interest was in the interaction between self-study time and action-state orientation. For taking initiative, self-study time is expected to be positively related to academic performance if students easily take initiative to start studying (and do not procrastinate). For disengagement versus preoccupation with failure, based on Boekaerts work, our prediction would be that for students showing more disengagement (and thus less preoccupation with failure), self-study time results in better performance. However, given the findings and suggestions of Diefendorff (2004) and other researchers that preoccupation with failure could be beneficial, our analyses will also be exploratory in this regard. In line with the theorizing of Boekaerts (1996), self-study time is also expected to be related to academic performance if students have a high course-related self-efficacy and a high learning goal orientation.

Relevant student characteristics. Besides interplays between self-study time and qualitative aspects of learning activities, interaction effects with student characteristics are explored because these factors may also condition the effect of self-study time on academic performance. Some support for interaction effects between study time and intellective factors has been found. Kuh and colleagues, for example, reported an interaction between pre-college academic performance and study time: A positive relation between study time and performance was obtained, but this relation was less pronounced for students scoring low on a standardized school achievement measure (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008). Schuman, Walsh, Olson, and Etheridge (1985) reported a slight, albeit non-significant, trend pointing in the same direction. In line with these findings, it is expected in the current study that there is a positive relation between self-study time and academic performance, but that this association is lower for students with a low intelligence test score or few prior domain knowledge. No prior hypothesis is formulated with respect to possible interaction effects between self-study time and gender.

The present study

In sum, we assume that one of the reasons for inconsistent results in previous research with respect to the relation between ST and academic performance may be that study time investment in itself does not increase academic performance, it is the type of learning activities deployed while studying that matters. Therefore, the current study investigates a) whether self-study time remains a predictor of students' academic performance after taking into account qualitative aspects of learning activities and relevant student characteristics, and b) whether the effect of self-study time on academic performance depends on these qualitative aspects and student characteristics. Based on previous research (Masui, Broeckmans, Doumen, Groenen, & Molenberghs, 2012), two other possible reasons for a non-significant relation between study time and academic performance were ruled out, namely the way of

measuring study time and other key variables. More specifically, in previous research study time has been either estimated retrospectively across a large period of time (risk of arbitrary answers) or recorded continuously during one week (representativeness for the entire term?). In the current study, study time was permanently (and at least weekly) recorded across the entire term. In addition, Masui and colleagues (2012) reported that the relationship between study time and grades may be different from course to course. Therefore, and because the relation between cognitive processing and academic performance has also been shown to vary across courses, in the current study, key variables (study time, qualitative aspects of learning activities and academic performance) were measured at course level. Two courses were selected, Macro-Economics and Financial Accounting part 2^2. In the case of Macro-Economics, students are expected to understand complex theories and models and to be able to apply these to the current macro-economic reality. For Financial Accounting 2, students are expected to acquire insight in accounting rules and techniques, mainly by making book keeping exercises. Previous research showed that for the Macro-Economics course, study time was positively related to exam performance after taking into account several student characteristics, whereas for Financial Accounting 2, no significant association was obtained (Masui et al., 2012). The Macro-Economics course allows us to test the first hypothesis to the fullest extent (does the relation between study time and exam performance remain present after controlling for student characteristics and the qualitative aspects of learning activities?), whereas the Financial Accounting 2 course was included to be able to explore the interaction effects hypothesis also for a course without a significant study time - performance relation. Moreover, because Financial Accounting 2 was the second part of a course, students already received feedback (i.e., a course grade) for the first part. This allows us to examine the (interaction) effects of self-study time and qualitative aspects of learning activities on course grade after taking into account this previous result.

Method

Participants and Context

Participants were freshmen of the Faculty of Business Economics of Hasselt University, Belgium. In Belgium, for most degree programs, a high school diploma is sufficient to start university education. Students were, thus, unselected with respect to high school GPA. For Macro-Economics, the sample consisted of 93 (48 men, 45 women) out of 106 freshmen. Thirteen students with missing data on study time and/or grades (n = 7) or on the intelligence test administered (see below; n = 6) were omitted. For Financial Accounting 2, the sample consisted of 70 (45 men, 25 women) out of 98 freshmen. Twenty-eight students had missing data on study time and/or grades (n = 12) or on the intelligence test (n = 13) or other background variables (n = 3). Comparison of the participating students for Macro-Economics and Financial Accounting 2 by means of independent samples t-tests or chi-square tests revealed no systematic differences with respect to gender, age, and prior domain knowledge in mathematics. The students in the Macro-Economics sample, however, had significantly lower average scores on the intelligence test administered at university entry than the students in Financial Accounting 2 sample, $t(161) = -3.00$, $p < .01$.

Measures

Grades. Grades were the end of term marks for each course, as retrieved from the academic records.

Study time. The study time data were collected with the web-based tool RESET (REgistration of Study time Electronic Tool; for more information, see Masui et al., 2012). This instrument has been developed within the framework of quality control and is used to inform curriculum boards, teaching staff, and students on the study time invested per course. With this tool, each student recorded on a permanent basis (and at least once a week) the time in minutes spent on the different types of classes and self-study activities for a particular

course. Students' recording of study time was compulsory: It was a condition for obtaining credits for one of the first-year courses. Because Macro-Economics and Financial Accounting 2 had different credit point loads, the amount of study time per credit point was used in the analyses.

Student characteristics. Gender and prior domain knowledge in mathematics (number of hours of mathematics in the final years of high school)[3] were derived from administrative records. All freshmen had completed an intelligence test at university entry (AH56-L; Minnaert & Janssen, 1999). This test is an adaptation and a translation to Dutch of the group test for highly intelligent persons developed by Heim, Watts, and Simmonds (1982). It consists of a verbal, a numeric, and a graphic part (72 items in total). Subscores were added up to an overall score. The AH56-L has been reported to have an internal consistency coefficient of .78 (N = 592). Its predictive validity with respect to freshmen's overall academic performance has been established in several samples (R^2=.12 to.16; e.g., Masui, 2002; Minnaert & Janssen, 1999). In the current study, the internal consistency coefficients were .73 (Macro-Economics sample) and .69 (Financial Accounting 2 sample). For Financial Accounting 2, the obtained course grade for part 1, which was taught in the preceding trimester, was retrieved from students' academic records.

Qualitative aspects of learning activities. Qualitative aspects of the learning activities deployed for the courses concerned were measured in week 6 or week 8 by means of a student questionnaire. Items assessing the type of cognitive learning processes were formulated by two experts in the field. Students were asked to indicate to what extent they had applied specific learning strategies in the previous 6/8 weeks during self-study tasks for *course x*. Students responded to the items on a 5-point scale ranging from 1 = *(almost) never* to 5 = *(almost) always*. The subscale Deep Processing consisted of 5 items measuring relating and structuring (e.g., When studying new course content for *course x*, (I) evaluate whether I

can connect this to what I already know) and two items assessing critical processing (e.g., During lectures or workshops of *course x* I think along with the lecturer). The subscale Stepwise Processing included two items measuring analysing (e.g., While studying *course x,* (I) use a quite analytical approach, i.e., I try to reconstruct the line of reasoning step by step) and two items measuring memorising (e.g., (I) take the time to memorise concepts and relations for *course x*). Concrete processing (i.e., making exercises) was assessed by means of two items (e.g., (I) prepare the workshops for *course x* by making the exercises given). Scores for Deep Processing, Stepwise Processing, and Making Exercises were calculated by counting the number of strategies that the student used often or (almost) always while studying the course.

The affective-motivational learning processes included were academic self-efficacy, learning goal orientation, and action-state orientation in relation to a particular course.

The 18-item **Academic Self-Efficacy** scale assessed students' self-evaluations of their ability and probability of success for *course x*. Students responded on a 6-point scale ranging from 1= *During the past 6/8 weeks, I was absolutely not certain whether I would be able to do this for (course x)* to 6 = *During the past 6/8 weeks, I was absolutely certain that I would be able to do this for (course x)*. A sample item is "… handle the workload of *course x*." This questionnaire was based on the work of Bandura (1982). Cronbach's alphas were high (α = .89 for Macro-Economics and α =.91 for Financial Accounting).

Learning Goal Orientation referred to the extent to which students desire to learn new skills or understand new things with respect to *course x*. The questionnaire was based on the work of Dweck (1999). A sample item is "The most important question I ask myself for *course x* is: What can I learn from it and what can I do with it?." Students responded on a 4-point scale ranging from 1= *totally not applies for me* to 4 = *totally applies for me*.

Cronbach's alphas were sufficient (α =.68 for Macro-Economics and α = .61 for Financial Accounting).

Action-State Orientation referred to the degree to which students differed in the ability to initiate and maintain study intentions with respect to *course x*. The questionnaire is a Dutch translation and adaptation (Masui, 2002) of the action control questionnaire for university students of Volet and Pears (Volet, 1997).

Disengaging vs. Being Preoccupied with Failure was measured by 10 items (α =.79 for Macro-Economics and α =.78 for Financial Accounting). A sample item is "When I am

concerned about my progress in *course x*, I start with something else and don't think about it anymore *(4)* / it takes me a long time before I can concentrate on something else *(1)*".

Taking Initiative vs. Hesitating was also a 10-item scale (α =.78 for Macro-Economics and α =.72 for Financial Accounting). A sample item is "When I have to complete an important assignment, I easily start working *(4)* / I often think too long about where to start *(1)*".

Data analyses for both samples

First, descriptive statistics and intercorrelations of all study variables were calculated. Next, hierarchical regression analyses were performed: In the first step, course grades were only predicted by student characteristics. In the second step, qualitative aspects of the learning activities deployed were added. In the third step, study time was added to the equation. These analyses were performed to examine the role of self-study time investment beyond the other factors in the equation. Finally, forward regression analyses were performed in order to determine which interaction effects between self-study time and all variables in the previous steps (qualitative aspects of learning activities and student characteristics) contributed significantly to the prediction of course grade. In this step, the interaction between self-study time and class attendance was also examined. All predictors were grand-mean centered.

Significant interaction effects were investigated further using simple slope analysis by means of ModGraph (Jose, 2008). By inspecting these interaction effects, we address the second research question, that is, whether qualitative aspects of learning activities (and student characteristics) play a moderating role in the relation between self-study time and academic performance.

Results

Macro-Economics

Descriptive Statistics and Intercorrelations

The bivariate correlations among the study variables are presented in Table 1. The following study variables were related to course grade. Prior knowledge in mathematics, the intelligence test score and the amount of self-study time had moderate to high associations with course grade (Cohen, 1988). The more prior knowledge in mathematics, the higher the score on the intelligence test or the more self-study time invested, the higher the students' course grade for Macro-Economics. With respect to qualitative aspects of learning activities, self-efficacy, disengaging and making exercises were low to moderately related to course grade. The higher students' self-efficacy for Macro-economics, the fewer they disengaged (i.e., the more students were being preoccupied with failure) or the more they indicated to have made exercises while studying Macro-Economics, the higher their course grade.

Regarding the correlation between the predictor variables, the following pattern emerged. The student background variables gender, prior knowledge in mathematics and intelligence test score were largely unrelated to the affective-motivational and cognitive processing factors. A notable exception is the moderate to high association between gender and making exercises: Women made more exercises while studying Macro-Economics than men. Whereas significant, positive associations were found among most qualitative aspects of learning activities, disengaging seems to be a fairly independent indicator which is hardly

related to the other affective-motivational variables nor to cognitive processing strategies. All affective-motivational and cognitive processing factors, except stepwise processing, related to self-study time. In contrast, these factors were unrelated to the numbers of hours spent in class, which was not even related to course grade.

-- Insert Table 1 about here --

Primary analyses

Results of the hierarchical regression analyses for Macro-Economics are presented in Table 2 (left side). The blocks representing student characteristics, qualitative aspects of learning activities, and study time each contributed significantly to the prediction of course grade. Better course grades were obtained by students who had more prior knowledge in mathematics and a higher intelligence test score. Above and beyond student characteristics, affective-motivational factors predicted course grade. The higher students' self-efficacy regarding Macro-Economics and the less students disengage (i.e., the more they are preoccupied with failure), the higher their course grade. Finally, above and beyond all other factors in the model the amount of self-study time invested related positively to course grade for Macro-economics, hereby supporting the hypotheses that self-study time has an independent effect on exam performance. The effect of self-study time was not moderated by the other study variables included.

-- Insert Table 2 about here --

Financial Accounting 2

Descriptive Statistics and Intercorrelations

The bivariate correlations for Financial Accounting 2 are presented in Table 3. The following study variables were related to course grade. Prior knowledge in mathematics, the intelligence test score, and the previous result for Financial Accounting 1, had moderate to high associations with course grade. The more prior knowledge in mathematics, the higher the

score on the intelligence test or the better the previous result for the course, the higher the students' course grade for Financial Accounting 2. With respect to qualitative aspects of learning activities, self-efficacy, learning goal orientation, taking initiative and making exercises were moderately to highly related to course grade. The higher students' self-efficacy for Financial Accounting 2, the higher their learning goal orientation for the course, the more students took initiative to start studying the course, or the more they indicated to have made exercises while studying, the higher their course grade. Applying deep processing strategies while studying the course tended to be positively related to course grade. Both time spent in class and in self-study were moderately related to course grade. The more time students invested in attending classes and self-study for Financial Accounting 2, the higher their course grade.

Regarding the correlation between the predictor variables, the following pattern emerged. The student background variables gender, prior knowledge in mathematics and intelligence test score were largely unrelated to the affective-motivational and cognitive processing factors. Gender related only to deep processing and making exercises: women applied more deep processing and made more exercises while studying Financial Accounting 2 than men. Another notable exception was the positive association between prior knowledge in mathematics and making exercises while studying the course. The previous result for the course in the preceding trimester related, however, positively to self-efficacy, learning goal orientation, taking initiative, and making exercises in the current term. Whereas significant, positive associations were found among most qualitative aspects of learning activities, disengaging again seems to be a fairly independent indicator which is only slightly related to the other affective-motivational variables and not related to cognitive processing strategies. For Financial Accounting 2, disengaging only tended to relate negatively to learning goal orientation and related positively to taking initiative and academic self-efficacy. All affective-

motivational and cognitive processing factors, except self-efficacy and stepwise processing, related to self-study time. In contrast, only taking initiative and making exercises related to the number of hours spent in class.

-- Insert Table 3 about here --

Primary analyses

Results of the hierarchical regression analyses for Financial Accounting 2 are presented in Table 2 (right side). The blocks representing student characteristics and the quality of learning activities each contributed significantly to the prediction of course grade for Financial Accounting 2. Better course grades were obtained by students who had more prior knowledge in mathematics and a higher previous result for the course in the preceding trimester. Above and beyond student characteristics, some of the affective-motivational factors and cognitive processing strategies predicted course grade. The higher students' self-efficacy regarding Financial Accounting 2 and the less students disengaged (i.e., the more they were preoccupied with failure), the higher their course grade. Moreover, higher course grades were obtained by students who applied less stepwise processing strategies while studying the course. Although the study time variables did not have a significant effect on course grade after taking into account student characteristics and qualitative aspects of learning activities, self-study time tended to be positively related to course grade. This effect was qualified by a significant interaction between self-study time and making exercises (Figure 1). Only for students who made few exercises while studying Financial Accounting 2, more self-study time was positively related to course grade.

-- Insert Figure 1 about here --

Discussion

Research findings regarding the relation between study time and academic performance have been inconsistent. The primary aim of the current study was to further clarify the role of self-

study time in academic performance by examining a) whether the relation between self-study time and grades remains present after taking into account not only relevant student characteristics but also cognitive and affective-motivational processes and b) whether this relation is moderated by qualitative aspects of the learning activities deployed while studying (and/or by student characteristics). Two courses at our university were selected to address these questions, namely Macro-Economics and Financial Accounting 2.

For Macro-Economics, self-study time had an independent effect on exam performance above and beyond student characteristics and qualitative aspects of learning activities. These findings are consistent with previous research on this course that controlled only for relevant student characteristics and used a composite of self-study time and class attendance (Masui et al., 2012). For Financial Accounting 2, findings were also in line with previous research that did not find a relation between study time and exam performance (Masui et al., 2012). In the current study, study time also did not contribute uniquely to the prediction of courses grade, with the exception of a small, marginally significant effect of self-study time. In general, our findings suggest that, at least for some courses (such as Macro-Economics at our university) investing self-study time is beneficial for freshmen's exam performance. Given that students' study time has been shown to have declined substantially since the 1960s (Babcock & Marks, 2011), it is of vital importance to inform students about this.

Regarding the predictive value of qualitative aspects of learning activities, particularly academic self-efficacy and the dimension disengagement vs. preoccupation with failure of action-state orientation are of note. These affective-motivational factors proved their importance after taking into account student characteristics, other affective-motivational factors, and cognitive processing strategies. As expected, a higher confidence in the ability to succeed for a course resulted in higher course grades. Consistent with the work of Diefendorff

(2004) and Perry and colleagues (2001) we found that the less students disengage (i.e., the more they are preoccupied with failure), the better their grades. This finding suggests that Diefendorff's assertion that ruminating about the possibility of failure may result in more cautious and deliberative goal-directed behaviour indeed may apply to the context of freshmen preparing for exams.

For Financial Accounting 2, more stepwise processing predicted lower grades. Particularly with respect to cognitive processing, student counsellors may play an important role in improving students' performance by making students aware of the importance of selecting an adequate strategy while studying a course. Moreover, students' performance may be enhanced by increasing the degree to which course assignments are directive with respect to the type of learning activity that students are expected to engage in (cf. Masui et al. 2012).

For Financial Accounting 2, a significant interaction effect between self-study time and concrete processing was obtained. The direction of this effect was surprising. Whereas for students who moderately to highly applied the strategy 'making exercises', the amount of self-study time did not matter (because they were applying the adequate cognitive strategy), for students who made few exercises more invested self-study time increased students' academic performance to a similar level as the moderate to high group. Self-study time, thus, seemed to buffer the effect of making few exercises while studying Financial Accounting 2. This interpretation is, however, only post hoc and needs to be addressed in further research.

Overall, given that a variety of interaction effects were expected, support for our second, moderation hypothesis was fairly modest: For Macro-Economics there was no evidence of moderation of the relation between self-study time and exam performance by any of the variables considered; for Financial Accounting, only an interaction effect with one cognitive learning activity was obtained, but not with affective-motivational variables nor

with student characteristics. Hence, no support was obtained for our hypothesis, which was based on the work of Boekaerts (1996), that maladaptive internal states may diminish the effect of self-study time on exam performance. Further research in this area, considering other potential affective-motivational moderators, is needed, however. It is plausible that some of the affective-motivational factors considered in this study (e.g., academic self-efficacy and learning goal orientation) are antecedents of self-study time, pointing to a potential intervening role of self-study time in the relation between affective-motivational factors and exam performance (see, for example, Fenollar, Román, & Cuestas, 2007). Investigating the mediational role of study time between these factors and academic performance is one of the points of interest of our research group, but falls outside the scope of this paper.

As expected, the role of self-study time and cognitive processing varied from one course to the other. It may be suspected, therefore, that features of the learning environment, such as the specific teaching approach and the mode of assessment play a role. These features are linked to the subject of a course: does it concern a more theoretical, model-based course (such as Macro-Economics) or a more practical, application-oriented course (such as Financial Accounting 2)? Furthermore, the fact that Financial Accounting 2 is the second part of a course may also have contributed to these differential results. Whereas the students of Macro-Economics did not yet receive feedback in terms of exam performance, students enrolling in the second part of the Financial Accounting course did. As a result, these students already have had an indication whether or not they invested enough self-study time, selected an adequate cognitive processing strategy, etc., which, in turn, may affect the study time and qualitative aspects of learning activities for the second part of the course. The effect of intermediate exams and other possible differences between courses should be explored further in future research.

In conclusion, at least for some courses, investing self-study time remains important for exam performance, even after taking into account affective-motivational and cognitive learning activities, class attendance, and student characteristics such as intelligence test score. Students should be made aware of the importance of investing ST. We found few support for our hypothesis that the effect of self-study time on academic performance depended on cognitive and affective-motivational processing. Further research in this area is needed, however. Which other factors may moderate the relation between self-study time and academic performance? Future research may also examine which course characteristics (such as the specific teaching approach and the mode of assessment) may explain differences between course-specific results regarding the effect of study time and cognitive processing strategies on academic performance. For Financial Accounting 2, making exercises seems to be an adequate cognitive strategy, whereas stepwise cognitive processing is not. Although these findings are in need of replication, they indicate that students' performance may be enhanced by increasing the degree to which course assignments are directive with respect to the type of learning activity that students are expected to engage in.

Footnote

[1] According to Vermunt (1992), learning activities consist of cognitive, regulative and affective-motivational learning activities.

[2] Financial Accounting 2 was the second part of the course Financial Accounting, with a separate exam.

[3] At our university, the number of hours of mathematics is considered to be a reliable indicator of the amount of prior knowledge in mathematics. For example, students are assigned to tutorial groups based on the number of hours of mathematics in the final years of high school. Moreover, the number of hours of mathematics has been found to be a reliable predictor of academic performance at our university.

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Figure Captions

Figure 1. The interaction between self-study time and making exercises in the prediction of course grade for Financial Accounting 2. Dotted lines represent non-significant slopes; solid lines represent significant slopes. Slopes were -.01 (ns, high on making exercises), .07 (ns, medium on making exercises), and .16** (low on making exercises). *$p < .05$, ** $p < .01$.