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ABSTRACT

The role of learning strategies in gaining academic success has been widely investigated for campus-based college students. Within distance education (DE) students, however, research on this relationship is limited, while this group of learners is growing. The present study was designed to investigate the relationship between learning strategies and academic performance in DE students. Participants were 758 students (age 19–71 years) at a distance education university in the Netherlands. An online questionnaire was used to determine learning strategies and exam grades were obtained from the university exam database to determine academic performance. Mixed model analyses showed that management of time and effort, as well as complex cognitive strategy-use were positive predictors of academic performance, whereas contact with others was a negative predictor of academic performance. Explanations for these results as well as their implications are discussed.

1. Introduction

Students use different kinds of learning strategies to reach the same goal: gaining academic success. Which learning strategies are most beneficial and which strategies are detrimental to academic success has been widely investigated over the past three decades (for meta-analyses, see Credé & Phillips, 2011; Richardson, Abraham, & Bond, 2012). However, most of these studies were conducted among campus-based college students. Less is known about the relationship between learning strategies and academic performance for distance education (DE) students, while this group of learners is growing (Eurostat, 2016). The present study was carried out to investigate the relationship between learning strategies and academic performance in DE.

1.1. Learning strategies

Learning strategies are "procedures for acquiring, organizing, or transforming information" (Alexander, Graham, & Harris, 1998, p. 132) that can be used to succeed in one's study. For students, it is important to know how to study in a way that the acquired knowledge and skills endure (Weinstein & Underwood, 1985). Knowing which learning strategies are most helpful for academic success is not only important for students, but also for their instructors, who can implement effective supportive techniques in their curriculum (Donker, de Boer, Kostons, Dignath van Ewijk, & van der Werf, 2014).

In the research literature, different classifications are made for learning strategies. For instance, learning strategies can be divided into deep, surface, and achieving strategies (Biggs, 1987), or into strategies related to cognitive, motivational, and self-regulation components of strategic learning (Weinstein, Schulte, & Palmer, 1987). Another widely accepted classification was first described by McKeachie, Pintrich, Lin, Smith, and Sharma (1990) who classified three types of learning strategies: cognitive strategies, metacognitive strategies, and resource management strategies. Cognitive strategies include both simple and complex strategies (e.g., rehearsal, organization) and are directly applicable to a certain task or course (Alexander et al., 1998). Metacognitive strategies are strategies in which students think about their thinking. These strategies include planning, monitoring one's own understanding, and modifying one's own mental processes (Duncan & McKeachie, 2005; Zimmerman, 2002). Resource management strategies are non-cognitive strategies including effort regulation (i.e., persisting in studying in the face of dull, hard or uninteresting material), managing both time and place to study, seeking help from teachers or peers, and working together with other students or friends (Duncan & McKeachie, 2005). To measure these three categories of learning strategies, Pintrich, Smith, Garcia, and McKeachie (1993) developed part B of the Motivated Strategies for Learning Questionnaire (MSLQ-B).

The relationship between learning strategies measured with the

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MSLQ-B and academic performance has been investigated extensively for campus-based college students. In 2011, Credé and Phillips conducted a meta-analysis to investigate this relationship in these campus-based college students and included 59 articles within their study. As there is a discrepancy in the literature as to whether learning strategies are context dependent (Duncan & McKeachie, 2005; Rotgans & Schmidt, 2009) or independent (e.g., Warr & Downing, 2000), Credé and Philips investigated the relationship between learning strategy use and grades in individual classes (i.e., context dependent) from 35 independent samples, separate from the relationship between learning strategy use and grade point average (GPA; i.e., context independent) from 24 independent samples. Their results showed that the strongest relationships (i.e., sample size weighted mean correlation, r^{+}) of reported strategy use with individual grades were effort regulation ($r^{+} = 0.27$), time and study environment management ($r^{+} = 0.22$), and metacognitive self-regulation ($r^{+} = 0.18$). For the relationship between learning strategies and GPA they found similar results, although the effect sizes were mostly smaller. Effort regulation ($r^{+} = 0.16$), time and study environment management ($r^{+} = 0.17$), and metacognitive self-regulation ($r^{+} = 0.17$) were the strongest. The remaining learning strategies proved to be unrelated to academic performance.

In 2012, Richardson, Abraham, and Bond conducted a systematic review and meta-analysis of the relationship between learning strategies and GPA for campus-based college students. They investigated both correlations between learning strategies and GPA as well as a model with learning strategies as predictors of GPA. Similar to the results obtained in the meta-analysis of Credé and Phillips (2011), of the nine MSLQ-B subscales, effort regulation had the strongest sample size weighted mean correlation with GPA ($r^{+} = 0.32$), followed by time and study environment management ($r^{+} = 0.22$). Furthermore, a small positive correlation was found with metacognitive self-regulation ($r^{+} = 0.18$), critical thinking ($r^{+} = 0.15$), elaboration ($r^{+} = 0.18$), and help seeking ($r^{+} = 0.15$). They did not find GPA to be related to rehearsal, organization, and peer learning. Furthermore, they performed a regression analysis to analyse which learning strategies predicted GPA. In the regression model, they included elaboration, critical thinking, metacognitive self-regulation, effort regulation, help seeking, and time and study environment management, as these all correlated with GPA above 0.10. The analyses showed that effort regulation was the strongest positive predictor of GPA ($\beta = 0.32$). The betas of the remaining subscales as predictors of GPA were rather small, ranging from 0.02 to 0.07. Combined, these learning strategies accounted for 11% of the variance.

Based on these meta-analyses, it can be concluded that effort regulation is the most important learning strategy associated with academic performance, followed by time and study environment management and metacognitive self-regulation, all in a positive direction. In predicting academic performance with a regression analysis, only effort regulation turned out to be a strong predictor. Again, however, all of these studies were conducted among campus-based college students. Within distance education (DE) students, research on the relationship between learning strategies and academic performance is very limited, if not non-existent.

1.2. Distance education

Nowadays, knowledge and information quickly become outdated (Mushayikwa, 2013). In this light, employers expect their employees to continue to develop their skills and knowledge to keep up with new developments and information and the employees themselves need this to ensure that they do not become ‘obsolete’ (Cedefop, 2010). As a result, the number of adults taking part in formal adult education is growing: In 2014, 10.7% of European adults between 25 and 64 years old were enrolled in formal education (Eurostat, 2016). These students, however, have a significantly different profile than campus-based college students. Traditional, campus-based college students typically enroll college or university directly after finishing high school, study full-time, mostly depend on parents' financial support and do not work or work partly (U.S. Department of Education, 2002). Non-traditional, DE students are typically older, enroll college or university after a delay, study part-time, are financially independent, and have to harmonize their study with their work and family responsibilities (Eurydice, 2011; U.S. Department of Education, 2002). Many, also, often do not have time to study at fixed times or to follow classes. For these students, DE is a suitable form of education, as they can study from their own home in their own pace.

One of the biggest concerns in education in general is the high dropout rate. This rate is even higher for DE compared to traditional education (Berge & Huang, 2004; Yukselturk, Ozekes, & Türel, 2014). Students being aware of which learning strategies are beneficial to academic performance and which learning strategies are detrimental might help to heighten the retention rate.

Within DE, research on learning strategies associated with academic performance is limited. Richardson (2007) investigated the relationship between learning strategies, measured with the Revised Approaches to Studying Inventory (RASI; Entwistle, Tait, & McCune, 2000), and academic performance. His sample was very similar to the sample in the present study, as those students were enrolled in a comparable DE university in the United Kingdom. Richardson (2007) found that only 3 out of 13 subscales predicted students' grades: two strategic approaches (organised studying, achieving) and one surface approach (fear of failure). However, the RASI focusses on other facets of learning strategies than the MSLQ-B. Furthermore, Trueman and Hartley (1996) found that age and time-management were both weak predictors of academic performance. They showed that older mature students (i.e., students above age 25) had better time-management skills than their younger fellow students. However, in their study, these adult students were campus-based, who can be quite different from DE students.

To our knowledge, only one study investigated this relationship, and they only used a part of the MSLQ-B measurement. Hsu (1997) found positive correlations with course grade for metacognitive self-regulation ($r = 0.32$), time and study environment management ($r = 0.32$), and effort regulation ($r = 0.19$). Help seeking was not correlated to course grade. Although three out of four scales were correlated to course grade, all four scales were non-significant in predicting academic performance in a regression model. The remaining five MSLQ-B subscales were not investigated.

The MSLQ-B was originally developed for campus-based college students. As DE students adopt different learning strategies than campus-based college students in traditional education (Agricola, Blind, & Traas, 2012; McKenzie & Gow, 2004), different factor structures of the MSLQ-B may exist for these different populations (Credé & Phillips, 2011; Duncan & McKeachie, 2005). As Hsu (1997) partly investigated the learning strategies of the MSLQ-B, he may have overlooked that the original factor structure of the MSLQ-B was not suitable for DE students. Meijs et al. (2019) investigated the factor structure of the MSLQ-B for DE students, and indeed, found that the original MSLQ-B factor structure did not fit this target group: While the MSLQ-B originally consisted of 9 factors, they found that a 5-factor structure was a better fit for DE students. For instance, DE students study from their own home and have less face to face contact with peers and instructors compared to campus-based college students. For campus-based college students, the threshold to seek help from peers might be lower and easier to achieve than seeking help from instructors, while for distance students, seeking help from peers or from instructors is likely to be the same threshold. This is also clear from the 5-factor structure of Meijs et al. (2019), as items from the original MSLQ-B subscales *help seeking* and *peer learning* are combined to form one subscale, namely *contact with others*. As the adapted version of the MSLQ-B is more suitable for DE students than the original, the adapted version was used in the present study (see Appendix A).

1.3. Sex, age, and number of study hours

It is important to look into other influences on academic performance and learning strategies, to investigate the relationship between learning strategies and academic performance. For instance, Ruffing, Wach, Spinath, Brünken, and Karbach (2015) reported sex differences between the different learning strategies. They used a German adaptation of the MSLQ-B, the Lernstrategiën im Studium (LIST; Wild & Schiefele, 1994), consisting of 11 subscales. Women scored significantly higher than men on effort, organization, rehearsal, time-management, and meta-cognition, and significantly lower on relationships and critical evaluation. Also, women tend to score higher on academic performance than men (Duckworth & Seligman, 2006; Richardson et al., 2012; Robbins et al., 2004). Furthermore, age was found to be related to the individual learning strategies subscales critical thinking and elaboration, although age was not a significant predictor of the other MSLQ-B reported learning strategies (Bruso & Stefaniak, 2016). Also, research showed that GPA is positively related to age (Clifton, Perry, Roberts, & Peter, 2008; Richardson et al., 2012). Moreover, number of hours someone studies is related to academic performance (Bernt & Bugbee, 1993). To rule out these possible confounders, age, sex, and intended number of study hours per week were investigated in relation to learning strategies as well as to academic performance.

1.4. Aim of the present study

To our knowledge, the present study is unique in investigating the relationship between academic performance and all facets of learning strategies measured by the MSLQ-B for DE students. This emphasises the importance of the present study, as it is relevant to know which learning strategies are most beneficial for performance in this growing population. The present study was designed to gain knowledge about the relationship between learning strategies and academic performance for students participating in higher (i.e., university level) DE. Based on the literature research described above, we hypothesized as follows:

(1) Management of time and effort is a strong positive predictor of academic performance.
(2) Complex strategy use is a positive predictor of academic performance.
(3) Simple strategy use, contact with others, and academic thinking are not related to academic performance.

Additionally, we looked at differences between men and women on learning strategies, and on how learning strategies changed when age increased. Also, it was investigated whether age and sex acted as moderators in the relationship between learning strategies and academic performance. In line with previous findings we expected that:

(4) Women score higher than men on management of time and effort, complex strategy use, and academic thinking.

We did not have expectations on the relationship between age and learning strategies as the previous studies were mostly conducted on campus-based college students, who are typically younger than DE students. This makes it hard to compare to the sample of the present study.

2. Methods

2.1. Design

The present study is part of the ALOUD study, an observational longitudinal study into biological and psychological determinants of learning performance within DE (for more detailed information, see Neroni, Gijselaers, Kirschner, & de Groot, 2015).

The ALOUD study was approved by the Ethics Committee of the DE university and all participants gave their informed consent before they started filling out the online questionnaire.

2.2. Participants

Participants were recruited from a DE university in the Netherlands. The university had an open admission policy, with a minimum age of 18 years being the only requirement. All students ($N = 4945$) who registered for the first time to study at this university between the 6th of August 2012 and the 5th of August 2013, were invited to participate in the ALOUD study. In total, 2040 students (57.5%) fully participated at baseline measurement, and of these students, 1195 students (24.1% of the total sample) also participated at the follow-up after 14 months; the nominal length of registration in courses at this university.

Exclusion criteria were: (a) a remark at the end of the follow-up questionnaire, indicating that the student did not study during the 14 months period ($N = 41$); and (b) not attempting an exam within 14 months ($N = 396$). When students did not attempt an exam within the 14 month period, academic performance could not be determined, and were therefore excluded. Analyses were conducted on the remaining 758 participants (482 [63.6%] women, 276 men, $M_{age} = 37.8$ years, age range: 19–71 years).

2.3. Procedure

Students who registered for a course for the very first time between the 6th of August 2012 and the 5th of August 2013 received an invitation by e-mail to participate in the ALOUD study. After ticking a box to indicate informed consent, participants filled out an online questionnaire and conducted three cognitive tests. In total, it took participants approximately 45–60 min to complete the baseline measurement. They were able to pause the questionnaire and return to it a later chosen time. However, they had to finish the cognitive tests at once. Non-completers and non-responders received a reminder after two weeks and a last reminder after one more week. One week after the last reminder, non-completers and non-responders were approached by phone. As an incentive, gift coupons of 20 euro were raffled, with a 5% winning chance. After 14 months, this procedure was repeated for students who participated at baseline. The time period of 14 months was chosen because this is the standard subscription period when registering for a course. In addition, after 14 months, the exam database of the university was utilised for data extraction on examination grades of the participants. For full details on the content as well as the procedure of the ALOUD study, see Neroni et al., (2015).

Note that the study of Neroni et al. (2015), which describes the validation of the instrument used in present study to measure learning strategies in DE students (see Section 2.4.1), was also part of the ALOUD study, and therefore, an overlap of participants in their analyses and the present study (i.e., participants who filled out the questionnaire after 14 months of study) exists. They included 1154 participants compared to 758 participants in present study, as they did not have to exclude participants without an exam attempt within the 14 month period.

2.4. Measurements

2.4.1. Learning strategies

Learning strategies were measured at the 14 months follow-up with the adapted version of the MSLQ-B (Pintrich et al., 1993) developed by Meijs et al. (2019), applied to DE students. This questionnaire consists of 5 subscales: (1) Management of time and effort (6 items; e.g., I make good use of my study time for a course); (2) complex cognitive strategy use (5 items; e.g., When reading for a course, I try to relate the material to what I already know); (3) simple cognitive strategy use (5 items; e.g., When I study for a course, I practice saying the material to myself over and over); (4) contact with others (4 items; e.g., I try to identify students in a course whom I can ask for help if necessary); and (5) academic thinking (5 items; e.g., I often find myself questioning things I hear or read in a course to decide if I find them convincing). For the whole questionnaire, see Appendix A. Participants were instructed to answer the items on how they studied for the past 14 months, keeping in mind all the courses they followed in that time. As students had the opportunity to follow several courses at the same time, statements were stated generally (i.e., context independent) instead of in a context dependent, course specific way. All items had to be answered on a 7-point scale, ranging from *totally disagree* (1) to *totally agree* (7), with intermediate points having descriptive labels as well. Mean scores per subscale were calculated. Meijs et al. (2019) reported Cronbach's alphas ranging from 0.70 to 0.80.

2.4.2. Academic performance

Students were free in the number of courses they preferred to study during the 14 month period. Hence, every student had a personal study path and there was no general fixed curriculum. For this reason, academic performance was calculated separately for each course per student. A mean score of all obtained examination grades within a course represented academic performance for that particular course.

2.4.3. Covariates

Age, sex, and intended number of study hours per week were inquired by a questionnaire at baseline. In addition, number of modules per course was taken into account as possible confounder. Every course consisted of one or more modules, each corresponding to 4.3 European Credits (ECs; i.e., 120 h of studying). In other words, the workload per course differed. This could result in differences in academic performance as well as in learning strategies. Finally, the educational programme (i.e., Law, Cultural Sciences, Psychology, Educational Sciences, Management Sciences, Computer Science, Environmental Science) was taken into account as a possible confounder, as it is known that academic performance differs for students at different faculties at the university. Information regarding number of modules per course as well as the educational programme was gathered from the exam database at the 14 months follow up.

2.5. Statistical analyses

All analyses were conducted using SPSS (Version 22.0). First, means and standard deviations for all continuous variables were determined as descriptive statistics. Second, correlations and a multivariate analysis were conducted to investigate how age, intended study hours and sex were related to learning strategies. Third, a mixed model regression was performed to investigate the predictive value of learning strategies on academic performance. Because students were free in the number of courses they enrolled in, and as they could start their study at any given moment, all students followed their own study paths. Therefore, the analyses were not run with a composite score of all exam grades per student, but instead, a mixed model regression was run for grades per course nested within students, while accounting for the correlation of exam grades for different courses within students ($N = 1844$). The final model was constructed using the following steps: (1) A null model was built with only a fixed intercept, ignoring the hierarchical structure; (2) Covariates as fixed variables were added; (3) Predictors as fixed variables were added; (4) Interaction effects were added; (5) Random intercepts were added; (6) Random slopes were added. Each next step was only taken if the previous step was found to improve the model significantly, which was tested with a chi-square model comparison. One exception was when step 4 was not significantly better than step 3; in that case, the analyses continued with step 5.

Table 1
Descriptive statistics with means and standard deviations for the continuous variables, and counts and percentages for categorical variables; $N = 758$.

Variables	*M*	*SD*	Min–max	α
Learning strategies				
Management of time and effort	5.20	0.96	1.83–7.00	0.77
Complex cognitive strategy use	5.31	0.74	2.00–7.00	0.63
Simple cognitive strategy use	4.98	1.18	1.00–7.00	0.78
Contact with others	2.62	1.24	1.00–6.50	0.79
Academic thinking	4.22	1.08	1.00–7.00	0.74
Age (years)	37.76	11.46	19–71	
Intended study hours (per week)	12.88	7.51	1–50	
Academic performance[a]	6.52	1.60	1–10	
	Count	% of total		
Sex				
Men	276	36.4		
Women	482	63.6		
Number of modules per course[b]				
One	1153	62.5		
More than one	691	37.5		
Educational programme[b]				
Educational sciences	105	5.7		
Environmental sciences	39	2.1		
Law	439	23.8		
Management sciences	137	7.4		
Psychology	720	39.0		
Computer sciences	215	11.7		
Cultural sciences	189	10.2		

[a] First, a mean score per student was calculated. After that, the mean of academic performance was calculated.
[b] Counted at course level, $N = 1844$.

3. Results

3.1. Descriptive statistics

Means, standard deviations, and internal consistency for the five scales as well as demographic information are shown in Table 1. Overall, students scored highest on complex cognitive strategy use ($M = 5.31$; $SD = 0.74$), and lowest on contact with others ($M = 2.62$; $SD = 1.24$).

3.2. Learning strategies and sex, age and intended study hours

3.2.1. Learning strategies and sex

A multivariate analysis of variance showed a significant difference between men and women for learning strategies scale scores, $F(5,752) = 27.04$, $p < .001$, $\eta_p^2 = 0.15$. Univariate analyses showed significantly higher scores for women than for men on management of time and effort, $F(1, 756) = 5.02$, $p = .03$, $\eta_p^2 = 0.01$, simple cognitive strategy use, $F(1, 756) = 88.61$, $p < .001$, $\eta_p^2 = 0.11$, and contact with others, $F(1, 756) = 4.14$, $p = .04$, $\eta_p^2 = 0.01$. Men scored significantly higher on academic thinking than women, $F(1, 756) = 25.37$, $p < .001$, $\eta_p^2 = 0.03$. There was no significant difference between men and women on complex strategy use, $F(1, 756) = 1.78$, $p = .18$, $\eta_p^2 = 0.01$.

3.2.2. Learning strategies and age and intended study hours

Correlations showed that there was a significant positive relationship between age and management of time and effort, $r = 0.15$, complex strategy use, $r = 0.12$, simple strategy use, $r = 0.09$, and academic thinking, $r = 0.09$ (all $ps < .01$). Intended study hours were not significantly related to any of the learning strategies.

3.3. Learning strategies predicting academic performance

Table 2 presents the results of the linear mixed models that were performed to predict academic performance. It shows that a model

Table 2
Fixed effects for models of the predictors of students' grades.

	Estimate	SE	95% CI
Model 0 ($\chi^2 = 6998.41$; $df = 2$)			
Intercept	6.76***	0.04	[6.69, 6.84]
Model 1 ($\chi^2 = 6943.20$; $df = 12$)			
Intercept	6.36***	0.20	[5.97, 6.75]
Age	0.01**	0.00	[0.00, 0.02]
Intended study hours per week	−0.01	0.01	[−0.02, 0.00]
Educational programme[a]			
Educational sciences	0.48**	0.17	[0.15, 0.82]
Environmental sciences	−0.10	0.26	[−0.62, 0.41]
Law	−0.19	0.10	[−0.38, −0.00]
Management sciences	0.39**	0.15	[0.10, 0.69]
Computer sciences	0.01	0.14	[−0.25, 0.28]
Cultural sciences	0.21	0.14	[−0.06, 0.49]
Sex[b]	−0.03	0.08	[−0.19, 0.13]
Number of modules[c]	0.22**	0.09	[0.06, 0.39]
Model 2 ($\chi^2 = 6677.23$; $df = 17$)			
Intercept	3.07***	0.35	[2.39, 3.75]
Age	0.00	0.00	[−0.00, 0.01]
Intended study hours per week	−0.02***	0.00	[−0.03, −0.01]
Educational programme[a]			
Educational sciences	0.52**	0.16	[0.21, 0.84]
Environmental sciences	0.11	0.25	[−0.37, 0.59]
Law	−0.10	0.09	[−0.28, 0.08]
Management sciences	0.55***	0.14	[0.27, 0.83]
Computer sciences	0.18	0.13	[−0.08, 0.44]
Cultural sciences	0.14	0.13	[−0.11, 0.40]
Sex[b]	0.04	0.08	[−0.12, 0.20]
Number of modules[c]	0.09	0.08	[−0.06, 0.25]
Management of time and effort	0.59***	0.04	[0.51, 0.67]
Complex cognitive strategy use	0.19***	0.05	[0.08, 0.30]
Simple cognitive strategy use	−0.06	0.03	[−0.12, 0.00]
Contact with others	−0.11***	0.03	[−0.17, −0.05]
Academic thinking	−0.02	0.04	[−0.05, 0.09]
Model 3 ($\chi^2 = 6436.78$; $df = 18$)			
Intercept	2.78***	0.45	[1.88, 3.67]
Age	−0.00	0.00	[−0.01, 0.01]
Intended study hours per week	−0.03***	0.01	[−0.04, −0.01]
Educational programme[a]			
Educational sciences	0.61**	0.18	[0.25, 0.96]
Environmental sciences	0.06	0.30	[−0.52, 0.65]
Law	−0.08	0.13	[−0.33, 0.16]
Management sciences	0.66***	0.17	[0.32, 1.01]
Computer sciences	0.43*	0.19	[0.06, 0.79]
Cultural sciences	0.26	0.17	[−0.07, 0.58]
Sex[b]	0.06	0.11	[−0.16, 0.29]
Number of modules[c]	−0.01	0.07	[−0.15, 0.13]
Management of time and effort	0.61***	0.05	[0.50, 0.72]
Complex cognitive strategy use	0.24**	0.08	[0.09, 0.39]
Simple cognitive strategy use	−0.04	0.05	[−0.13, 0.05]
Contact with others	−0.09*	0.04	[−0.17, −0.01]
Academic thinking	−0.01	0.05	[−0.10, 0.09]

Note. SE = Standard Error; CI = Confidence Interval.
[a] Psychology as reference.
[b] Men as reference.
[c] More than 1 module as reference.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

including all predictors with a random intercept for each participant estimated (i.e., Model 3) was the best fitting model. Interaction effects were added in two steps: First, the interaction effects between age and the learning strategies (i.e., five interaction variables) were added to Model 2. This model was not significantly better than the model without the interaction effects, $\chi^2_{change} = 6.06$, $df_{change} = 5$, $p > .05$. Second, the interaction effects between sex and the learning strategies were added to Model 2. This model was also not significantly better than the model without the interaction effects, $\chi^2_{change} = 6.98$, $df_{change} = 5$, $p > .05$. Varying the slopes across participants (i.e., Model 4) did not significantly improve the model, $\chi^2_{change} = 2.21$, $df_{change} = 5$, $p > .05$. Considering the predictive value of the learning strategy scales, management of time and effort was the strongest significant positive predictor of academic performance, $F(1, 664.19) = 123.21$, $p < .001$, indicating that students who have good time and study management and effort regulation skills received higher grades. Also, complex cognitive strategy use was found to be a significant positive predictor of academic performance, $F(1, 618.22) = 10.09$, $p = .002$. The more students used complex cognitive strategy use, the higher their grades. Finally, contact with others was a significant negative predictor of academic performance, $F(1, 649.08) = 6.47$, $p = .011$. In other words, the more students reported being in contact with other students or with instructors about the course material, the lower their grades. Simple strategy use ($F(1, 589.57) = 0.35$, $p = .55$) as well as academic thinking ($F(1, 633.87) = 0.27$, $p = .60$) were not significant predictors of academic performance.

4. Discussion and conclusions

The present study was mainly set up to investigate the predictive value of learning strategies on academic performance in DE. Analyses revealed that management of time and effort was the most important and a positive predictor of academic performance. Furthermore, complex cognitive strategy use was a positive predictor, while contact with others was a negative predictor. Simple cognitive strategy use as well as academic thinking were not related to academic performance.

Management of time and effort being the most important predictor of academic performance is in line with the expectations. Previous studies found that non-traditional or mature-age students (i.e., students 24 years or older who study part-time) score higher on time and study environment management as well as on effort regulation than traditional students (i.e., students under the age of 24, who study full-time, and started their tertiary education directly after secondary education;Agricola et al., 2012; McKenzie & Gow, 2004). In other words, non-traditional students are more able to manage their study time well and are more persistent when facing challenges than traditional students. This can be explained by the fact that non-traditional students often have a busy life with work and family responsibilities (Eurydice, 2011). For this reason, it is more important for them to be able to manage their time and study environment, or to be able to cope with difficulties, than it is for traditional, fulltime students (Rønning, 2009). Even though non-traditional students score higher on these learning strategies, results of the present study showed that the relationship with academic performance remained the same: management of time and effort was found to be the most beneficial for academic performance.

Next, complex cognitive strategy use (i.e., items from elaboration and metacognitive self-regulation from the original MSLQ-B questionnaire) was a positive predictor of academic performance for DE students, which confirms our second hypothesis. This is in line with previous findings in studies with campus-based college (Credé & Phillips, 2011; Richardson et al., 2012) as well DE (Hsu, 1997) students. As research showed, non-traditional students scored significantly higher on elaboration and metacognitive self-regulation than traditional students (Agricola et al., 2012; McKenzie & Gow, 2004). Metacognitive self-regulation involves planning, monitoring their own learning, and regulating (Duncan & McKeachie, 2005). As with time management skills, metacognitive self-regulation skills might be more important to DE students than to campus-based college students to study successfully, as they often have a busy work and family life. In addition, in the age range of 18 to 25 years, metacognitive skills such as independent time management and self-monitoring are still developing, and these young adults often still depend on co-regulation from parents or teachers (Murray, Rosanbalm, Christopoulos, & Hamoudi, 2015). This might explain why campus-based college students make less use of these still underdeveloped skills than DE students.

Surprisingly, contact with others was a negative predictor of academic performance. In other words, reaching out to friends, peers or instructors for help was associated with lower exam grades. This is not in line with the majority of previous findings for campus-based college students, as seeking help was found either to be unrelated (Credé & Phillips, 2011; Hsu, 1997; Richardson et al., 2012) or positively related (Richardson et al., 2012; Ryan & Shin, 2011) to academic performance. However, help seeking was found to be negatively related to academic performance within campus-based college students before (Karabenick & Knapp, 1991). Also, a study of Daubman and Lehman (1993) in which students who sought help performed worse on a task than students who did not seek help, although this was only found for men. In contrast, in traditional education, the literature shows that high achieving students seek help more than low achieving students (Newman & Goldin, 1990; Ryan, Patrick, & Shim, 2005). Low achieving students often avoid seeking help because of anxiety for being judged by others on their lack of abilities (Ryan, Pintrich, & Midgley, 2001; Ryan & Shin, 2011). However, this might not play a role in DE because of the individual character of studying. Furthermore, the age difference between the students and their teachers is often smaller for DE students than for campus-based college students. Perhaps this makes the threshold for all students lower to seek for help, which might lower the threshold for students who need the help the most. Whether low achieving students seek more help in DE could be subject for future research. Besides these possible explanations, it is possible that help seeking and academic performance are both associated with a third variable, for instance students' difficulty with the content of the course. Possible other influencing variables should be subject of future research on the relationship between contact with others and academic performance.

Additionally, we looked at how learning strategies differ for men and women. Results showed, in accordance with previous research (Ruffing et al., 2015) that women tend to be better in managing their time and effort, they use simple cognitive strategies more often and have more contacts with others than men. Men, on the other hand, scored higher on academic thinking than women. This only partly confirms the fourth hypothesis. Results also showed that men and women did not differ on academic performance. Furthermore, all learning strategies scores, except for contact with others, increased with age. So the older the student gets, the more use (s)he makes of these learning strategies. The prediction model showed that academic performance did not differ for different ages.

This study is characterised by several strengths. First, this is the first study that investigated the relationship between learning strategies and academic performance within DE students, using an adapted and validated version of the MSLQ-B applied to this target group. Second, this study had a large sample size which provided an adequate statistical power. Third, multiple covariates were taken into account to eliminate possible confounds. Besides these strengths, there are some limitations to this study. First, because of the observational design of the study no conclusions on causality can be drawn from this. Second, students filled out the learning strategies questionnaire retrospectively after 14 months of studying. In future research, it would be better to let them report on their strategies during (e.g., via Experience Sampling Method; Csikszentmihalyi & Larson, 1987) or immediately after studying, to strengthen the predictive design of the study. Third, as every student could follow as many courses as they wanted at the same time, and learning strategies was measured only once after 14 months, learning strategies were measured at a general level (i.e., context independent) instead of at course level. The MSLQ-B was developed with the idea that learning strategies are states rather than traits, and that it is best to measure them at a course level instead of at a general level (Duncan & McKeachie, 2005). Nevertheless, Rotgans and Schmidt (2009) did not find differences between a course-specific version and a general version of the MSLQ-B, and concluded that learning strategies are a steady disposition of the learner, and not context dependent.

This study had several important theoretical as well as practical implications. Given the result that management of time and effort is the most important and a positive predictor of academic performance, giving the students some guidelines to time management skills, or implement these guidelines in a starting course for students, might help DE students in their way to academic success. In this light, it could also be helpful to teach or to let students practice with complex cognitive strategies during courses. Furthermore, this research gave a basis for further research on the relationship between contact with others and academic performance. It would be interesting to investigate whether low achieving students differ from high achieving students in their amount and form of seeking help from peers and instructors. For students it might be helpful to have insight into the learning strategies they have, to be able to adapt to beneficial strategies to gain academic success.

Appendix A. MSLQ distance education subscales (Meijs et al., 2019)

Item nr	Item text
Management of time and effort	
43	I make good use of my study time.
60	When course work is difficult, I either give up or only study the easy parts. (REVERSED)
70	I make sure that I keep up with the weekly readings and assignments for a course.
73	I attend a course regularly.
74	Even when course materials are dull and uninteresting, I manage to keep working until I finish.
80	I rarely find time to review my notes or readings before an exam. (REVERSED)
Complex cognitive strategy use	
59	I memorize key words to remind me of important concepts in a course.
61	I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over.
64	I try to relate the course material to what I already know.
76	During studying I try to determine which concepts I don't understand well.
81	I try to apply ideas from course readings in other course activities.
Simple cognitive strategy use	
32	When I study, I outline the material to help me organize my thoughts.
46	When I study, I read my course notes and the course readings over and over again.
63	When I study, I go over my course notes and make an outline of important concepts.
67	When I study, I write brief summaries of the main ideas from the readings and my course notes.
72	I make lists of important items for a course and memorize the lists.
Contacts with others	
45	I try to work with other students to complete the course assignments.
50	I often set aside time to discuss course material with a group of students from a course.

58	I ask the instructor to clarify concepts I don't understand well.
75	I try to identify students in a course whom I can ask for help if necessary.
Academic thinking	
36	When reading for a course, I make up questions to help focus my reading.
38	I often find myself questioning things I hear or read in a course to decide if I find them convincing.
47	When a theory, interpretation, or conclusion is presented in course or in the readings, I try to decide if there is good supporting evidence.
51	I treat the course material as a starting point and try to develop my own ideas about it.
71	Whenever I read or hear an assertion or conclusion in a course, I think about possible alternatives.

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