Relationships between learning approach, procrastination and academic achievement among first year university students

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Abstract

Individual differences in student learning influence academic performance, and two aspects influencing the learning process are the particular learning approach the students use and procrastination behaviour. We examined the relationships between learning approaches, procrastination and academic achievement (measured one year later as the grade point average, GPA) among 428 first year university students. Deep and strategic learning approaches positively predicted GPA, and a mediation analysis showed that the strategic learning approach also partly mediated the effect between deep learning approach and GPA. Less procrastination was associated with a strategic learning approach, but procrastination tendencies did not predict GPA. Recommendations are made for educating new students in cognitive and meta-cognitive strategies, helping reduce their procrastination and facilitating the use of deep and strategic learning approaches.

Keywords: learning approach; procrastination; academic achievement; GPA

Introduction

Academic achievement is associated with later job performance (Roth et al. 1996), salary (Roth and Clarke 1998) and life satisfaction (Salmela-Aro and Tynkkynen 2010). Exam grades are the most frequently used proxy measure of academic achievement (Richardson et al. 2012). Beyond the role of intelligence (Naglieri and Bornstein 2003), learning behaviours are among the most important contributors to academic success in general, and academic achievement specifically (Yen et al. 2004). An important reason for examining learning behaviours is that teachers may easily help their students improve these behaviours.

Many facets of learning behaviours that promote performance may be investigated, such as the particular learning approach a student uses when seeking to learn study material. However, certain behaviours related to the learning process may also hinder academic performance. One behaviour that has aroused considerable interest in educational research during the last two decades is procrastination. Procrastination is a voluntary but irrational delay of an intended course of action, with non-beneficial consequences (Steel 2007). It is a behaviour that may permeate many situations - non-academic ones included - and directly compromise the completion of goals or tasks. In the present context, we treat it as a learning related behaviour that negatively affects the learning process, the learning approach used and ultimately, academic achievement (Tice and Baumeister 1997; Goda et al. 2015). The mutual relationship between learning approach and procrastination has rarely been studied. Hence, the present study examines the combined significance of learning approaches and procrastination for exam grade point averages (GPA) among first year university students.

Learning approaches

Students early in their university curricula process tend to report rather naïve conceptions of what learning actually means, for instance focusing on reproduction and

memorisation rather than abstraction of meaning and deeper understanding of concepts (Norton and Crowley 1995). A widely used model for studying student learning was introduced by Marton and Säljö (1976b) who divided academic learning into two qualitatively different processes, or approaches: *deep-level* and *surface-level.*

Deep learning approach is characterised by an interest and a search for meaning and comprehension. A student using the deep learning approach wants to understand the content of the text she reads, i.e., "*what is signified"* (Marton and Säljö 1976b), and she is driven by intrinsic motivation (Biggs 1979). She may therefore be less dependent on the study syllabus (Entwistle et al. 1979), because she regards comprehension of the subject as more important than simply passing exams.

Surface learning approach, on the other hand, is characterised by memorizing, feeling a lack of purpose and fear of failure. A student using the surface learning appraoch is fixated on the actual text, i.e., "*the sign"* (Marton and Säljö 1976b), and she is more concerned with reproducing the content rather than understanding it. Her motivation is more extrinsic, i.e. passing exams, and she is more syllabus-bound than a student adopting a deep learning approach.

Biggs (1979) proposed a third learning approach, *achieving,* also called *strategic approach* (Entwistle et al. 1979; Ramsden 1979). A student adopting the strategic learning approach tends to be good at time management, study organisation and progress monitoring. This approach can include both deep and surface strategies - depending on the task - and the motive is primarily to perform well (Biggs 1979; Ramsden 1979).

Presumably, the deep and strategic approaches promote learning processes that facilitate a higher achievement than surface learning approach does. A comprehensive meta-analysis on predictors of GPA by Richardson et al. (2012) confirmed that learning approaches correlated

as expected with performance, yet, the correlation coefficients are weak (*r:* deep = .14, surface = -.18 and strategic = .23).

Situational factors such as workload and the nature of the assessment may affect the choice of learning approach, too (Ramsden 1991). For example, if a student is struggling to cope with the amount of reading required, or she is studying for an exam requiring the reproduction of material (e.g., naming anatomical structures), a surface learning approach may be most adaptive. This suggests that having the flexibility to change the learning approach as needed represents an important executive function which is important for learning (Garner 2009). This flexibility may be considered a core characteristic of being a self-regulated learner, that is, a student who actively reflects upon and monitors her own learning process (Zimmerman 1986).

Procrastination

The strategic learning approach is a positive form of self-regulation. Procrastination, on the other hand, is not, Procrastination is associated with low self-control and impulsivity (Steel 2007; Ferrari 2001). It may be considered a normal phenomenon as 20-70% of the university students procrastinate (Schouwenburg 2004), and they do it one-third of the study time (Pychyl et al. 2000). Procrastination correlates negatively with GPA (*r* from two meta-analyses ranges from -.16 to -.25) (Richardson et al. 2012; Steel 2007), and positively with excessive worry (Stober and Joormann 2001), perceived stress (Tice and Baumeister 1997) and depressive symptoms (Martin et al. 1996).

Procrastination may have greater negative consequences for university students than students in secondary school because of more complex tasks, greater demands for independence and less feedback on own performance. The academic tasks often involve writing papers, which is a solitary task with delayed rewards, if any. Likewise, as they work,

university students may lack sufficient meta-cognitive awareness to know when they are sufficiently prepared for an exam or when a paper is good enough to receive the grade that they desire. Meanwhile, first-year university students are also often young and not fully matured with regard to impulse control (Casey et al. 2008), and they find themselves in an environment with plenty of social distractions and temptations. The deadlines for their work often lie far ahead in time increasing a proneness to procrastinate.

Steel (2011) argues that people tend to pursue goals that have a good chance of an attractive result. If the desired end state is difficult to define, for example what it takes to get an A on an essay, it may be difficult for a student to judge when the task is finished and thus undermine the outcome expectancy. Existing research suggests that students lacking an adequate repertoire of learning strategies or skills procrastinate more (e.g. Klingsieck et al. 2012; Cao 2012). Howell and Watson (2007) found no significant relationship between deep and surface processing and procrastination, but to the best of our knowledge, no other studies has investigated the contribution of procrastination on students' learning approaches.

The present study

The aim of the present study was to examine the joint contribution of learning approaches and procrastination on grade point average (GPA) achieved during the first year after admission to the university. In line with previous research, we hypothesised that deep and strategic learning approaches would positively predict GPA, while surface learning approach and procrastination would negatively predict GPA. We also adjusted for upper secondary school GPA in the analyses. A range of other factors have been connected with academic attainment or achievement, such as age and gender (Richardson et al. 2012), learning difficulties (Gregg 2007), achievement motivation (Richardson and Abraham 2009; Robbins et al. 2004), study skills (Robbins et al. 2004) and physical or mental health (Jackson

2009; Haas and Fosse 2008; Esch et al. 2014; Richardson et al. 2012). Hence, these variables were included as covariates for adjustment purposes.

In order to use what we learn to proffer the best advice for students, we thought it wise to clarify the relationships between learning approaches and procrastination. We hypothesised that procrastination would negatively predict a strategic learning approach because of the focus on self-regulatory behaviours and preference for structured study habits. Our hypothesis for the deep learning approach was the same, originating from the link between deep learning approach and the intrinsic drive to learn. Self-control is associated with both academic performance (de Ridder et al. 2012; Hofer et al. 2012) and procrastination (Steel 2007). In order to separate the contribution of procrastination from the effect of self-control, we adjusted for the latter.

Finally, as a mediation analysis is suitable to examine tentative explanatory models, we conducted such an analysis to identify factors accounting for any linkages between learning approaches (as predictors or mediators) and GPA. Since we had no theory to guide the specification of a specific learning approach as a predictor or a mediator, we used empirical criteria.

Method

Participants and procedure

All 1st year students enrolled at UiT The Arctic University of Norway during autumn 2013 were invited to participate ($N = 4616$). The study was conducted 7-12 weeks after the beginning of the semester. The students received an invitation email describing the aims of the study, together with a URL link to a consent form and the possibility to register their contact information. The consenting students ($N = 555$) then received a link to the web-based

questionnaire (www.questback.com), to which 430 responded. The questionnaire took about 20 minutes to complete. No honorarium was offered. Two students withdrew their consent afterwards, leaving 428 respondents.

We had access to demographic information of all students through the university registry; hence, we were able to compare participants with non-participants. The groups (participants vs. non-participants) were comparable with regard to age (M = 25.4 and SD = 8.4 versus M = 26.1 and SD = 8.3, respectively, t_{4614} = -1.59, p = .11). They were not equal with regard to gender (67.8 % vs. 58.9 % women, respectively, $\chi^2(1) = 12.34$, p = .001) and mean GPA from upper secondary school (range 0-6, M = 4.2 and SD = 0.73 vs. M = 4.0 and SD = 0.66, t_{2791} = 3.55, $p < .001$). The standardized mean difference for the GPA, Cohen's d = .33, represents a small-to-medium effect size (Cohen 1988).

More than half of the participants (52.5 %) had not previously been enrolled in higher education. Students from all faculties at the university participated, representing STEM-disciplines, medicine and health, social sciences, humanities, sports and tourism, teacher training, economics, law, art and music. The parental level of education according to participant reports were relatively high, with 51.3 % of mothers and 49.9 % of fathers having a higher education background. In the general population in Norway, 28.3 % and 34.5 % of men and women, respectively, have a higher education degree. At the present study site, the city of Tromsø, 38.9 % of the residents hold a higher education degree (Statistics Norway 2015). About half of the students (53 %) had part time jobs and 16 % had children.

Measures

The web-based questionnaire contained questions about demographics, in addition to the following variables treated as covariates: Reading- and writing difficulties (or literacy

problems), mental and physical health, previous study experience, previous learning of study techniques, perceived usefulness of education and educational aspirations.

Literacy problems are, in general, negatively related to academic performance (Gregg 2007) and to the use of effective learning strategies (Kirby et al. 2008). We used a recently validated scale including eight items rated on a five-point Likert scale, from 1 (*not at all like me*) to 5 (*very much like me*), which assess current and previous difficulties with reading and writing. The scale may be summarized in a single index, has adequate item response properties and is a valid indicator of literacy problems as it predicts academic performance (Sæle et al. 2015). Cronbach's α was .87.

Mental and physical health were measured with two single items rated on a five-point Likert scale, from 1 (*poor*) to 5 (*very good*): *How do you currently evaluate your mental health?* and *How do you currently evaluate your physical health?*

We asked two questions about skills in study techniques: *To what degree do you feel that you have learned useful study techniques during elementary and secondary school?* and *To what degree do you feel that you have learned useful study techniques at the university?* The second question was included to assess whether students had already been introduced to study techniques they found valuable during the first weeks of studying. The items were rated on a five-point Likert scale, from 1 (*a small degree*) to 5 (*a very large degree*).

To assess a motivational aspect of studying, we asked: *To what degree do you think that you will make use of what you learn at university in your future work life?* We used the same Likert scale as above. Educational aspirations were addressed with five possible answer categories reflecting the highest educational level participants were planning to complete: 1 *Only single subjects*, 2 *Bachelor,* 3 *Master*, 4 *PhD* and 5 *I don't know*. We transformed these

categories into dummy variables, using *I don't know* as reference. Number of years with previous education was also included in the analyses.

Grade point average (GPA). We measured academic achievement using GPAs obtained from the university registry. Upper secondary GPAs were available through student applications to the university, and were included in the analyses as a covariate. Secondary school GPA in Norway ranges from 0 (lowest) to 6 (highest). In order to be accepted to higher education, a minimum of 2 is normally needed, making 2-6 the actual range. University GPA was calculated from grades achieved on all exams during the first year and each grade was weighted by the course credits earned. They university grade continuum (A-F) was transformed to a GPA range of 0 (lowest) to 5 (highest).

Approaches and Study Skill Inventory for Students (ASSIST). ASSIST (Entwistle 1997; Tait and Entwistle 1996) evaluates how students approach learning. The inventory covers the three approaches to learning: *deep*, *surface* and *strategic.* The original scale consists of 52 items; however, we used a short version with 24 items. The short version has shown good reliability, comparable factor structure, and predictive validity in Norwegian samples (Diseth 2007, 2001). Sample items are *I usually set out to understand for myself the meaning of what we have to learn* (deep), *I think I'm quite systematic and organised when it comes to revising for exams* (strategic) and *I concentrate on learning just those bits of information I have to know to pass* (surface). Responses were given on a five-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*). We performed a principal component analysis (PCA) and three components were extracted as according to the described structure (λ = 5.13, 2.42 and 2.10, respectively). The component solution was promax rotated. We excluded seven items as they either loaded on the wrong factor (Q7 from the surface factor), had significant cross loadings (Q4 from the strategic factor and Q8, 9, 17, and 20 from the surface factor), or had no loadings above .3 (Q18 from the deep factor) (for items, see

Entwistle 1997). The Cronbach's α were .74 for *deep*, .82 for *strategic*, and .61 for *surface learning approach.*

Irrational procrastination scale (IPS). The IPS contains nine items addressing procrastination behaviour, for instance *I delay tasks beyond what is reasonable* (Steel 2010). Steel's factor analytic studies of the scale, indicate that a single factor is sufficient to summarize the item scores adequately. The original inter-item reliability of the IPS is good (Cronbach's α = .91), which the current study confirmed (α = .89). The IPS correlates strongly with other measures of procrastination, showing good convergent validity. The Norwegian translation also supports a single factor summarization (Svartdal 2015) .

Brief self-control scale (BSCS). The Self-control scale is developed by Tangney, Baumeister, and Boone (2004). We used the brief version including 13 items (e.g.: *I am able to work effectively toward long-term* goals) rated on a five-point Likert scale, from 1 *not at all like me* to 5 *very much like me*. In the original study the Cronbach's α of the brief version was .83, and it correlated .93 with the full scale. In our data, the Cronbach's α was .84.

Analyses

All questions were mandatory to respond to in the web-based system. Hence, there were no missing data on questionnaire variables. The upper secondary school GPA were missing for 30 % of participants (not recorded in the university registry) and university GPA were missing for 11 % (not completed any exams). Assumptions of normality were met. One single subject case was identified as a multivariate outlier (Mahalanobi's = 35.39, $p < .001$) and deleted from the analyses ($N = 427$).

Hierarchical regression analyses.

The prediction of the first year university GPAs was examined with a hierarchical regression analysis using the stepwise approach within each step. As the three learning approaches were of prime interest, these were entered first. In the subsequent steps, we

included procrastination and self-control in separate steps. In the fourth step, all covariates were included: age, gender, literacy problems, mental and physical health, previous years of education, study techniques learnt, perceived usefulness of the university education and educational aspirations. Parents' educational background, part-time job and family situation did not contribute significantly and were thus excluded from the regression model. In the final step, the upper secondary GPAs were included, which reduced *N* considerably due to missing data. As the upper secondary GPAs follow a well-known scale (range: 0 to 6), unstandardized beta coefficients were presented. The standardised coefficients were additionally reported in the final step, as well as the R^2 change and total adjusted R^2.

The second regression analysis with learning approaches as dependent variables followed a similar hierarchical procedure. As procrastination was of prime interest, it was entered first followed by self-control (second step), the remaining learning approaches (third step), the covariates (fourth step), and finally, upper secondary school GPA.

Mediation analysis. A mediation analysis requires the following conditions (Baron and Kenny 1986): The correlations between the predictor and the outcome (the direct effect), the predictor and the mediator and the mediator and outcome variables should all be significant. A full mediation effect is present if the direct effect becomes non-significant (or close to zero) following the inclusion of the mediator variable. Alternatively, a partial mediation is evident if the direct effect is significantly weakened but still significantly different from zero. A partial mediation effect is common, while full mediation is rare. The process macro by Hayes (2013) was used as it allows for covariate control (adjusting for the variables age and gender), and use of bootstrapping (1000 resamplings) to estimate unbiased standard errors.

Results

Correlations

Table 1 shows the means, the standard deviations and the correlations between the variables. Deep learning approach correlated weakly to moderately positively with university GPA, strategic learning approach, study techniques learnt at the university and with reporting a PhD degree as an educational aspiration. Strategic learning approach was strongly related to self-control (positively) and to procrastination (negatively), and weakly to moderately positively correlated with university GPA, study techniques, perceiving the education as useful, and to mental and physical health. Surface learning approach had moderate correlations with literacy problems and procrastination (positive) and self-control and mental and physical health (negative). Procrastination had a strong negative correlation with self-control and weakly to moderately negative correlation with mental and physical health.

Predictors of GPA

In the first step, deep and strategic learning approaches significantly predicted university GPA (Table 2), whereas procrastination, self-control and the covariates did not. Adding the upper secondary school GPA significantly improved the model, as expected, but the deep and strategic learning approaches still maintained their significance. The total adjusted variance explained was 23%. Eleven percent of the students had not completed any exams and lacking a GPA score, which we suspected might be related to procrastination. A. *t*-test comparing the mean procrastination scores between those completing/not-completing exams was however not significant ($p = .80$). Yet, students earning less credit points had weakly higher procrastination scores (Pearson $r = -.11$, $p < .05$), which accounted for one percent of the variance in credits passed. The skewness and kurtosis for the residual scores was .046 (SE .142) and -.532 (SE .282), respectively, hence the standard errors were unbiased.

Predictors of deep and strategic learning approach

Since deep and strategic learning approaches contributed significantly to the GPA model, predictors of these behaviours were examined further.

Deep learning approach: Procrastination was added first, explaining 3% of the variance in deep approach (Table 3). Self-control (step two) was a non-significant predictor, but in step three both strategic (positive predictor) and surface learning approach (negative predictor) contributed significantly. Among the covariates, older age, study techniques learnt at university and having educational aspirations of completing a PhD or a master's degree were significant predictors, causing a minor change in the beta weight for strategic approach. The final model explained 22% of the variance in deep approach. The skewness and kurtosis for the residual scores was -.523 (SE .118) and -.002 (SE .236), respectively, hence the model was unbiased.

Strategic learning approach: Procrastination accounted for as much as 46% of the variance. Adding self-control improved the model further, however adjusting the beta weight for procrastination considerably. Further, deep learning approach, study techniques learnt at university, perceived usefulness of the university education and having educational aspirations limited to completing single subjects contributed with significant but small effects. These variables did not adjust the beta weights of procrastination and self-control notably. The final model explained 58% of the variance. The skewness and kurtosis for the residual scores was -.300 (SE .118) and -.072 (SE .236).

Upper secondary GPA was not significantly related to neither deep nor strategic learning.

Mediation effect

As the deep and strategic learning approaches significantly predicted university GPA, we examined whether the one mediated the other (Figure 1). The direct unstandardized beta

weight of deep learning approach was β = .49, 95 % CI [.27, .71], p < .001. Using a strategic learning approach may involve elements associated with both a deep and a surface approach; hence, the strategic approach may be more fluctuant than the two other approaches. Conceptually, the intrinsic motivation and genuine interest associated with deep approach may stimulate the student into developing the structured study habits associated with strategic approach. The opposite, that having a strategic learning approach should promote a deep approach, is a more difficult argument to defend. The strategic learning approach was therefore included as a mediator, and age and gender as covariates (gender removed due to non-significance). The mediation effect was β = .10, 95 % bias corrected bootstrapped CI [.04, .17], and the direct effect dropped down to β = .39, 95 % CI [.17, .61], p < .001. Hence, a partial mediation effect was present, explaining 21% of the direct effect.

Discussion

We conducted a survey of learning approaches and procrastination and relevant covariates among university students. Data on GPA were collected one year later. Our results were consistent with earlier research showing that deep and strategic learning approaches predict a higher GPA. Hence, being interested, seeking meaning and wanting to understand the study material is beneficial for academic achievement, but also being structured and spending study time wisely. Moreover, the strategic learning approach played a role as a partial mediator of the positive relationship between deep learning approach and GPA. This means that strategic learning approach may be regarded as a transmitter of the positive effect that the deep learning approach may play for academic performance, and hence both learning approaches are important for teachers to facilitate. This analysis suggests a chain of relations indicating that teachers first may facilitate deep learning approach among students, and

thereafter, strategic learning approach in order to make deep learning approach work. Surface learning approach and procrastination were not significant predictors.

A student adopting the deep learning approach operates more independently from the syllabus, compared to a student using a surface learning approach. Such a *syllabus-plus* approach is more advantageous when the main aim is to understand complex topics, because it motivates the student to hunt other sources in order to gain a deeper understanding of the material. However, it could also be a risk factor for students absorbed in what they themselves wish to learn, rather than what teachers want them to learn (Entwistle et al. 1979). This may partly explain why the relation between deep learning and GPA is not large, yet present. Student using the deep learning approach have higher educational aspirations. This may reflect a motivational aspect promoting both higher ambitions and a deep approach to learning, but it may also indicate that these students find studying more satisfactory (Ben-Eliyahu and Linnenbrink-Garcia 2015).

The strategic learning approach is described as more task-specific than deep and surface approaches to learning. Knowing when to go deep into the material and when it is sufficient to skim the surface is probably an advantageous skill to have for students who face long reading lists and a broad range of tasks. Indeed, previous research has shown that better readers use fewer strategies than poorer readers, suggesting that better learners know when to do what (Dahl 1993). However, they have to learn a repertoire of strategies in order to use them. In our data, students reporting that they had learnt useful study techniques at university scored higher on strategic and deep learning approach and lower on procrastination, thereby strengthening the argument for teaching such techniques to new students.

Our hypothesis about procrastination and its negative relation to GPA was not supported. Being less bound by the syllabus may perhaps be one reason why students using a

deep learning approach do not procrastinate any less than other students do, because the number of sources to read may be considerable. However, procrastination was negatively related to better self-control and more use of a strategic learning approach. To adopt a strategic learning approach involves organising study tasks in order to use the study time more efficiently, and may represent an antidote to procrastination. For a student using a deep learning approach, applying a strategic approach may therefore be a suitable tactic as indeed the mediation results seem to indicate. Improving structure and study plans may keep the students on the path towards adequate performance and prevent them from meandering off in pursuit of their own learning goals instead.

The strong negative association we found between self-control and procrastination is in line with previous research (Steel 2007). Procrastination remains a significant negative predictor of a strategic approach after adjustment for self-control, indicating that despite the strong relation, the two represent different constructs. Procrastination is perhaps *not* the most vital factor for achievement, or the learning *product*, but it may negatively colour the learning *experience.* Previous research has shown that procrastinators report lower academic satisfaction (Balkis 2013), heightened worry and depressive symptoms (Stober and Joormann 2001; Martin et al. 1996), and increased perceived stress (Tice and Baumeister 1997). In our study, we also found that mental/physical health correlated moderately negatively with procrastination and positively with a strategic learning approach and better self-control. This makes it relevant to prevent student procrastination, even if this does not directly relate to their GPA.

Strengths and limitations

A strength of this study is that previous and current exam grades were based on registry data instead of self-reported GPAs. Another is that the GPA information was collected one year after the baseline questionnaire data. In addition, we had registry data on demographic

variables that allowed us to compare whether participating and non-participating subjects deviated substantially, which they did not. The sample included students from all faculties of the university, contributing to the generalizability of the results.

A mediation analysis ideally represents a causal chain, in which the independent variable represents the logical beginning and the dependent variable the end-point (Baron and Kenny 1986). A central assumption underlying mediational effects is that the causal chain does not go the opposite way, which our chain does not as the university GPAs were measured after the collection of the questionnaire baseline data. Hence, we can be certain that the dependent variable is not causing the mediator or the independent variable. Although the current design precludes any causal inferences, the prospective design of our study more strongly suggests a causal link.

The study is not without its limitations, such as the low response rate (9.3 %). Although the sample size was large enough for statistical purposes (i.e., statistical power) and with regard to statistical effect sizes, the size of the reported associations might have been different if all had participated. On the other hand, the participating students were comparable with non-participants with regard to age, and the gender difference was not large. The analyses in this study revealed no gender differences, indicating that the higher proportion of women in the participating group did not introduce a gender effect. The most important comparison, the lack of statistically strong mean effect differences in upper secondary GPA between participants and non-participants indicate that the results may hold for poorer performing students as well as better performing students with regard to GPA scores. Moreover, Stormark et al. (2008) found that non-response introduces larger biases with regard to the estimation of mean or prevalence estimates, but smaller biases for the correlation or the regression coefficients we report. Yet, the low response rate is of major concern and calls for a future replication.

The lower internal consistency of the surface learning approach measure (Cronbach's alpha = .61) reduces the statistical power of this variable, and may be a reason for the null finding between the surface learning approach and GPA.

Implications and further research

In order to help students benefit from the deep and strategic learning approaches, educators may want to utilise active learning methods promoting understanding. Active learning involves peer discussions, case methods, self-practicing the skills in question, and critical thinking – all of which may stimulate deeper learning processes (Phillips and Graeff 2014) and performance (Freeman et al. 2014). Both deep and strategic learning approaches had smaller correlations with upper secondary GPA than university GPA in our study, indicating that these learning approaches are more important in higher education and/or that these are skills that get honed once in higher education. This highlights the importance of investing in teaching students *how* to learn - even in higher education.

A review of Baeten et al. (2010) of student-centred teaching methods and learning approaches failed to find a relationship between such teaching methods and deep approach to learning. They concluded that stimulating deep approach to learning is a difficult and complex process, as several factors may influence the outcome. Students' perceptions of course quality and workload was associated with more use of a deep approach. Moreover, teachers that used a student-centred approach, for example, aiming to change students' conceptions rather than merely transmitting knowledge (Trigwell et al. 1994), also got students that used a deep learning approach. Using student-centred or active teaching methods as sole methods are therefore perhaps not enough - teachers also need to be aware of their students' perceptions and involve themselves in the student learning process.

The effects of induced deep learning approach on learning outcomes have been disappointing in earlier studies (Norton and Crowley 1995; Marton 1976; Marton and Säljö 1976a). However, other interventions focusing on learning activities and assessment methods promoting understanding rather than reproduction have showed promising results in terms of increased use of deep learning approach and improved course grades (English et al. 2004; Hall et al. 2004). Instructional strategies for enhancing motivation includes focusing on the meaningful aspects of learning activities and supporting the development of appropriate learning strategy repertoires (e.g. Ames 1992). Other strategies encourage students to ask "why?", like for example, encouraging students to ask questions in order to generate an explanation of why a fact is true (elaborate interrogation) or making them explain the steps involved in solving a problem (self-explanation) (Dunlosky et al. 2013). These strategies enhance the use of deep learning approach because they strengthen associations with material already known to the student and make the student use prior knowledge when structuring and understanding new knowledge. However, deep understanding of the material is not always the most adaptive method of studying, hence it may be a good idea to encourage flexibility for choosing the right approach to a given task. University teachers should be clear about what they want students to learn and how learning will be assessed, in order to make students able to employ the most adequate learning strategy in a particular learning situation (Hattie 2011). Teachers may also help students learn more effectively by telling them which strategies do *not* work very well when relied on too much, such as rereading and highlighting text (Dunlosky et al. 2013).

Causal mechanisms behind procrastination and GPA ought to be studied more closely in prospective longitudinal designs with repeated measurements of dependent and independent variables. Since procrastination is associated with a gap between intention and action (Steel 2007), the link to student dropout should also be further examined.

Conclusion

Students who more actively use deep and/or strategic learning approaches perform better in terms of GPA than those not using these approaches, and educators should consider interventions that promote these learning preferences. Teaching students study techniques promote more use of deep and strategic learning approaches.

When advising students how to study, encouraging students to acquire a deeper understanding of the material is vital, but lecturers should also teach how to improve time and task management as well as other effective approaches to studying. A combination of seeking meaning and seeking structure should prove favourable for academic performance.

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Table 1.
Correlations between the variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. University GPA (0-5)																				
2. Deep approach	.23																			
3. Strategic approach	.21	.32																		
4. Surface approach	-.12	-.18	-.19																	
5. Procrastination	-.17	-.18	-.68	.30																
6. Self-control	.15	.20	.66	-.31	-.74															
7. Age (18-69)	-.08	.18	.11	-.17	-.10	.14														
8. Gender (0= ♂, 1=♀)	.06	.01	.14	.09	-.05	.08	-.09													
9. Mental health	-.04	.09	.24	-.25	-.30	.30	.05	-.15												
10. Physical health	.06	.10	.21	-.19	-.23	.22	-.05	-.07	.34											
11. Literacy problems	-.11	.18	-.12	.26	.12	-.24	.00	-.04	-.11	-.17										
12. Previous years of education (0-10)	.05	.18	.00	-.23	.00	.07	.55	.02	.03	.04	-.13									
13. Study techniques earlier	.06	.09	.22	-.05	-.19	.17	-.02	.07	.11	.08	-.07	-.06								
14. Study techniques university	.02	.29	.30	.01	-.17	.18	.06	.02	.13	.11	-.07	.07	.19							
15. Usefulness of education	.17	.14	.22	.00	-.06	.07	-.18	.12	.03	.06	-.06	-.15	.05	.18						
16. Educational aspirations - single subjects[1]	.04	.06	.12	-.08	-.07	.08	.23	.03	.07	.08	-.04	.26	.07	.04	-.11					
17. - bachelor[1]	-.22	-.1	-.06	.07	-.05	.05	.15	-.04	.12	-.04	.10	-.10	.09	.04	-.11	-.10				
18. - master[1]	.05	-.04	-.04	.02	.15	-.09	-.16	.05	-.10	-.07	.00	-.03	-.06	-.07	.06	-.19	-.47			
19. - PhD[1]	.10	.27	.09	-.02	-.09	.08	-.05	-.01	.02	.13	-.06	.05	-.05	.10	.12	-.09	-.22	-.43		
20. Upper secondary GPA (2-6)	.44	.13	.11	-.13	-.04	.11	.09	.07	-.07	.07	-.20	.08	.21	-.04	.05	-.07	-.27	.12	.07	
Mean	2.95	4.13	3.58	3.13	3.06	3.25	25.41	.68	1.98	2.00	1.71	1.51	2.38	3.02	4.27	.04	.19	.49	.17	4.15
Std. Deviation	1.16	.58	.92	.84	.86	.64	8.39	.47	.81	.76	.65	2.21	1.14	1.17	.93	.19	.39	.50	.37	.73

Note. Pairwise deletion of missing data. Spearman's rho is presented for dichotomous variables (8, 16-19), Pearson's r for the remaining variables. *N* = 427 on all variables except university GPA (*N* = 379) and upper secondary GPA (*N* = 296). Range 1-5 if not otherwise specified.

[1] Dummy variables with *I don't know* as reference category.

Correlations higher than $r > .18$, .14 and .10 were significant at $p < .001$, $p < .01$ and $p < .05$

Table 2.

Prediction of GPA by learning approach, procrastination and self-control, covariate-adjusted in a hierarchical multiple regression analysis

	1	2	3	4	Final model			
Steps/variables (score range)	B	B	B	B	B	SE B	β	Δ R^2
1. Learning approaches								.07***
Deep (1-5)	.35**	.35**	.35**	.29*	.25*	.12	.12*	
Strategic (1-5)	.19*	.19*	.19*	.19*	.16*	.07	.12*	
Surface (1-5)	ns	ns	ns	ns			ns	
2. Procrastination (1-5)		ns	ns	ns			ns	.00
3. Self-control (1-5)			ns	ns			ns	.00
4. Covariates[1]								.03**
5. Upper secondary GPA (2-6)					.63	.09	.39***	.14***
Total adjusted R^2								.23***

Note: N = 379, except in the final step, where n = 266. $\beta_{intercept}$ = -1.19. [1] Covariates included age, gender, literacy problems, mental and physical health, years of previous education, study techniques learnt earlier and at university, perceived usefulness of the education and educational aspirations. Educational aspirations of completing a BA where significant in the 4th step, but none of the covariates were significant predictors in the final model. Study program was included as a random factor in the last step, but as it was non-significant, the model is presented without it.

* p < .05, ** p < .01, *** p < .001

Table 3.

Prediction of deep and strategic learning approach by procrastination and self-control

	Deep						Strategic					
	1	2	3	4	Final model		1	2	3	4	Final model	
Steps and variables	β	β	β	β	β	Δ R^2	β	β	β	β	β	Δ R^2
1. Procrastination	-.18**	-.18**	ns	ns	ns	.03**	-.68***	-.42***	-.41***	-.40***	-.40***	.46***
2. Self-control		ns	ns	ns	ns	.00		.34***	.32***	.30***	.30***	.05***
3. Learning approaches						.09***						.03***
Deep			N/A	N/A	N/A				.19***	.13**	.13**	
Strategic			.37***	.27***	.27***				N/A	N/A	N/A	
Surface			-.14*	-.13*	-.13*				ns	ns	ns	
4. Covariates[1]						.12***						.04**
5. Upper secondary GPA					ns	.00					ns	.00
Total adjusted R^2						.22***						.58***

Note: N = 427, except in the final step, where n = 296. [1] Covariates included age, gender, literacy problems, years of previous education, study techniques, perceived usefulness of the university education and educational aspirations. *Deep approach*: The following covariates were significant in the final model: age, β = .17, p < .01; study techniques (university), β = .20, p < .001, educational aspirations of completing a PhD, β = .28, p < .001 and a Master's degree, β = .14, p < .05. *Strategic approach*: The following covariates were significant in the final model: study techniques (university), β = .11, p < .01, perceived usefulness, β = .14, p < .001 and educational aspirations of completing only single subjects, β = .08, p < .05. Study program was included as a random factor in the last step, but excluded, as it was non-significant.

* p < .05, ** p < .01, *** p < .001.

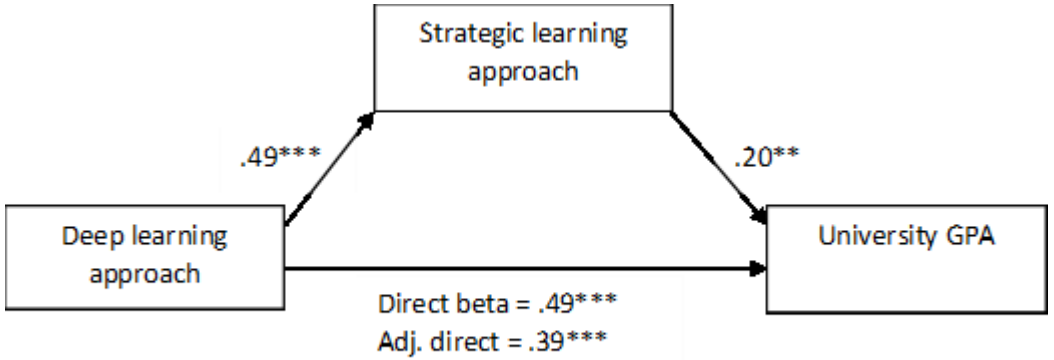

Figure 1. The direct relationship between the deep learning approach and university GPA (unstandardized beta = .49***)(*N* = 379). This effect was partially mediated by the strategic learning approach (beta=.10, 95% CI = .04, .18) as the direct path dropped down to beta=.39. The indirect path (beta=.10) was significant (p = .004).

** $p < .01$, *** $p < .001$.