Comparing online and blended learner’s self-regulated learning strategies and academic performance

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Abstract

The existing literature suggests that self-regulated learning (SRL) strategies are relevant to student grade performance in both online and blended contexts, although few, if any, studies have compared them. However, due to challenges unique to each group, the variety of SRL strategies that are implicated, and their effect size for predicting performance may differ across contexts. One hundred and forty online students and 466 blended learning students completed the Motivated Strategies for Learning Questionnaire. The results show that online students utilised SRL strategies more often than blended learning students, with the exception of peer learning and help seeking. Despite some differences in individual predictive value across enrolment status, the key SRL predictors of academic performance were largely equivalent between online and blended learning students. Findings highlight the relative importance of using time management and elaboration strategies, while avoiding rehearsal strategies, in relation to academic subject grade for both study modes.

Keywords: Online learning; blended learning; Self-Regulated Learning (SRL) strategies; grade; higher education; distance education

Highlights

- Few studies have online learner’s and blended learners SRL strategy use & grade
- Online and blended learners differed in their SRL strategies use
- Individual predictive value of SRL strategies differed for online/blended learners
- Overall predictors of grade were equivalent for online and blended learners
- Time management/elaboration/rehearsal strategies key for predicting grade 1.
**Introduction**

The transition from primary and secondary to tertiary education is typically characterized by a reduction in structured class time per week, less direct contact with one’s teachers, and greater reliance upon self-regulated learning. Within this higher education context, it is well established that the strategies students employ to self-regulate their learning impact their academic performance (Richardson, Abraham, & Bond, 2012). It is also clear that students differ in the strategies they employ to self-regulate their learning (Barnard-Brak, Lan & Paton, 2010), as well as the frequency with which they utilise these strategies (Dörrenbächer & Perels, 2016). While these individual differences likely reflect the strategies learners have been taught previously and/or found to be helpful, strategy utilisation preferences may also reflect the constraints of one’s learning environment. The present study explores this latter possibility by evaluating whether students in a wholly online study mode versus those in a blended learning environment differ in their use of various self-regulated learning strategies and/or the predictive value of these strategies for academic performance.

To be described as a self-regulated learner, the learner must be motivated, meta-cognitively involved, and an active agent in his or her own learning process (Zimmerman, 1986). Self-regulated learners plan, set goals, and engage in strategies to achieve those goals. Through evaluation and reflection, these strategies are monitored and modified to enhance one’s progression towards goal achievement. Self-regulated learners are motivated, persistent, manage their time effectively, and seek assistance when necessary (Pintrich, Smith, Garcia & McKeachie 1993). Although there are several different self-regulated learning (SRL) models, each from different theoretical perspectives, they all feature common characteristics—that is (a) a cyclical process,
(b) comprised of cognition, metacognition, motivation, and emotion, and (c) a set of skills that can be developed and learned (Panadero & Alonso-Tapia, 2014).

Pintrich’s (2004) model of SRL comprises the most comprehensive set of self-regulatory strategies, which can be measured using the Motivated Strategies for Learning Questionnaire (MSLQ; Pinrich, Smith, Garcia & McKeachie, 1991). Pintrich et al., 1991) identified three categories of SRL strategies that learners can apply to regulate their learning: (1) cognitive, (2) metacognitive, and (3) resource management strategies. According to Pintrich et al., cognitive strategies are a combination of basic and complex strategies for retaining information, and include strategies such as rehearsal (e.g. rote learning), elaboration (e.g. connect prior knowledge with new material), organization (e.g. outlining and note taking), and critical thinking (e.g. synthesizing and evaluating). Metacognitive strategies are those that help to regulate and control cognition in order to accomplish a goal, and include strategies such as goal setting, planning, self-monitoring, and self-regulation. Resource management strategies, on the other hand, help learners to control external resources, and include time and environment management (e.g. planning), effort regulation (e.g. maintain focus), and peer learning (e.g. using peers to collaborative understand) and help seeking (e.g. asking for assistance). Despite the apparent breadth in the number of learning strategies available to a student, permissibility of these various strategies may be somewhat constrained by the way course content is delivered and accessed.

Traditionally, on-campus instructional approaches typically featured content taught in a classroom at a prescribed time by a teacher, that was supplemented with prescribed readings and assessment tasks (writing assignments, exams, quizzes, etc.) (Allen & Seaman, 2013). With the development and integration of online learning technologies, however, blended learning is quickly becoming the norm in the higher
education sector (Masi & Winer, 2005). Although it may be defined in a variety of ways (e.g., see Driscoll & Carliner, 2005), blended learning in the present study is defined as the adoption of educational web-based technology (e.g., a learning management system) for online learning, which is used in combination with face-to-face, located instruction from teaching practitioners.

Growing in popularity too is online learning (Allen, Seaman, Poulin, & Taylor Straut, 2016), defined here as educational instruction that occurs using web-based technology, which may be engaged in completely asynchronously or with components of synchronous learning, and with no located face-to-face class time. Online learning is thought to have several advantages over traditional face-to-face and blended education, including flexibility and accessibility to study anywhere, at any time, without requiring one’s physical presence at a campus location (Means, Toyama, Murphy, Bakia, & Jones, 2009; Van Doorn & Van Doorn, 2014). While online learning can often include synchronous interactions and communication with instructors and peers, as well as deadlines and structure, it also provides for asynchronous learning in which space and time are not barriers (Means et al., 2009). This affords online learners the ability to live great distances from campus locations, and juggle their studies with other priorities such as work or family. These benefits are often obtained at a cost, as the online mode may also result in reduced opportunities for student-to-teacher and student-to-student interactions and communication, and as time is not typically structured around fixed instruction, online learners may need to provide their own structure around learning, determine for themselves when and how to engage with course content, manage their time efficiently, and persist in study despite competing life demands (Kilzilcec, Pérez-Sanagustín, & Maldonado, 2017; Moore & Kearsley, 2005).
For this reason, blended learning, if done well, may combine the benefits afforded by online technologies, with structure and social aspects of face-to-face time, to give an overall richer experience (Van Doorn & Van Doorn, 2014). A blended learning environment provides flexibility, but orientates students to a specific time and location each week to attend on-campus classes. It also allows students to customise their learning, while teaching staff are still able play a pivotal role in providing structure, organisation, scaffolding, and time management to the learning experience for students (Aldhafeeri, 2015; Artino & Jones, 2012). Several indirect lines of evidence, when viewed together, suggest that the self-regulation strategies employed and their impact on performance may differ across study mode.

A recent, large meta-analysis by Richardson et al. (2012), which compared the findings of 126 studies of SRL strategies used by students in higher education settings found that the strategies of effort regulation, time management, metacognition, elaboration, critical thinking, help seeking, and concentration significantly predicted student’s grades; weighted mean correlations ($r$) ranged from .15 to .32. In particular, effort regulation, time management, elaboration and metacognition were found across studies to have the highest correlation with GPA. However, this meta-analysis did not differentiate on the basis of traditional versus blended learning formats.

In comparison, relatively few studies ($n = 12$) have been conducted focusing on the SRL strategy use of online-only learners, and their relationship with academic success in the last 10 years (Broadbent & Poon, 2015). Puzziferro (2008) found, from 815 online liberal arts students, that those who scored higher on the subscales of effort regulation and time management received higher final grades. However, none of the other SRL strategies employed (rehearsal, elaboration, organisation, critical thinking, metacognition, peer learning, or help seeking) were found to be significantly related to
grade. Similarly, Carson’s (2011) large study of 4909 first year online students also found that effort regulation and time management, as well as metacognition had a small positive correlation with grade. Indeed, a meta-analytic review by Broadbent & Poon, (2015) found that only four learning strategies were significantly associated with online learner’s grades: metacognition, time management, effort regulation, and critical thinking. Their weighted mean correlations (ranged from .05 to .14), were weaker than those found by Richardson et al. (2012). Broadbent & Poon, (2015) concluded that although SRL strategy use in more traditional settings appear to generalise to online learning environments, the effects of SRL strategies may be “dampened in the online learning environment” and “we should not assume that online learning in itself fosters SRL strategies use or development (p.12)”.

However, none of the studies from the Broadbent & Poon, (2015) meta-analysis directly compared online learners with blended learners. One study, by Klingsieck, Fries, Horz, and Hofer (2012), compared a distance education sample with a ‘traditional university’ sample, but no information was given about whether the traditional students studied with any online components. The authors found significant negative correlations between elaboration and rehearsal with grade, and a significant positive correlation between metacognition and grade for online learners. No comparison to the traditional students could be made, as these data were not reported by the authors.

While little to no work has been done comparing the influence of SRL strategies on academic performance across study mode, Means et al. (2009) conducted a meta-analysis of 56 experimental studies to compare the effect sizes of traditional, blended, and online educational settings. Online and blended learning students outperformed students in more traditional settings (with larger effects for blended vs
traditional learners), but did not significantly differ from each other. Perhaps, no
differences occurred because blended and online learning attracts different types of
learners (Bernard, Borokhovski, Schmid, Tamim, & Abrami, 2014), each of which are
attracted to the learning context that suits their needs and learning styles. It is likely
that the type of learner who chooses to study in a blended study mode does so because
they like structure, and the social presence associated with study context, while online
learners are likely to be attracted to the high level of flexibility and independence.
 Possibly too, learners who choose to engage in online learning may already employ
numerous self-regulated learning strategies and thus feel comfortable learning in a
more autonomous environment. As such, differences between these groups may
instead be observed in the learning strategies they employ and/or the impact of various
learning strategies on their learning outcomes rather than directly observable
differences in performance. However, as there are few studies comparing the SRL
strategy use of blended and online learners in relation to grade, this is of course
speculative.

In summary, the existing literature suggests that SRL strategies are relevant to
student performance in both online and blended learning contexts, and the variety of
SRL strategies that are implicated and their effect size for predicting performance may
differ across context due to characteristics and student challenges unique to each.
Despite this, explicit tests of differences in the relative contributions of SRL strategies
across online and blended learning contexts have seldom been previously undertaken,
if at all. Such knowledge would provide greater insights into the key drivers of
performance that are generalizable across these two learning contexts, as well as
identify potential SRL strategies that may be more important for one context than the
other. In turn, these insights may be leveraged to produce more effective study
resources for students, and enhance SRL interventions tailored to their learning context.

The aims of the current study were threefold: (1) to assess differences in perceived frequency of use of self-regulated learning strategies in two different learning modes (blended learning vs. online learning); (2) to examine the relationships between SRL strategies and subject grade for both groups; and (3) to explore whether contributions of the SRL strategies for subject grade differed across the two groups. It was predicted that (1) because of the increased autonomy of the online environment, online learners will utilise more self-regulated learning strategies than blended learners; (2) in line with the findings of Broadbent and Poon (2015) and Richardson et al. (2012), there will be a dampened effect of strategy use on subject grade for online learners compared to blended learners; although (3) in line with the findings of Means et al. (2009) where blended and online learners performed academically similar, it is predicted that when viewed altogether the contributions of the SRL strategies will contribute to final subject grade equivalently across blended and online learners.

2. Method

2.1. Participants

Participants were 606 undergraduate students attending a University in Melbourne, Australia during the period of 2014-2016. Participants had a mean age of 23.50 years \((SD = 7.78, \text{ range 17-67 years})\). Participants were completing a range of courses, but the majority studied in the Faculty of Health (67%); Faculty of Arts and Education 13.5%; Faculty of Arts and Education / Health 6.4%; Faculty of Science, Engineering and Built Environment 5.6%; Faculty of Business and Law 5%; Faculty Business and Law / Arts and Education 1.3%; Faculty Business and Law / Health 1%; Faculty of Arts and Education / Science, Engineering and Built Environment 0.5%).
Most participants were female ($n = 516, 85.1\%$), in their first year of higher education ($50.5\%$; second year $22.9\%$; third year $16.7\%$; fourth year $9.9\%$), had a mean subject grade of $72.78 (SD = 12.45; range 10-90)$, and studied in a blended learning environment (traditional face-to-face learning but with access to resources through an online learning management system; $n = 466, 76.9\%$).

Online-only students (all learning occurred through an online learning management system; $n = 140$) were significantly older ($\text{M}_{\text{age}} = 28.99$ years, $SD = 9.71$, range 17-56 years) than blended learning students ($\text{M}_{\text{age}} = 21.85$ years, $SD = 6.23$, range 17-67 years, $t_{(604)} = -10.31, p < .001, d = .87$). However, there was no differences between online and blended students in terms of mean subject grade $t_{(604)} = -.72, p = .470, d = -.07$. The number of online students that participated in this study ($23.1\%$) was deemed a representative sample of the University, whose own online student enrolment ranged from 20-25% during the time of data collection.

2.2. Materials

2.2.1. Demographics.

Participants were asked their (1) age, (2) gender, (3) class level (e.g., year of study in a three or four-year undergraduate bachelor degree or equivalent), (4) Faculty of study, and (5) enrolment mode (blended or online). Blended study typically comprised of face-to-face instruction, which included weekly lectures and weekly tutorials and/or laboratory or other practical face-to-face time. Face-to-face time varies between subject, but typically comprises of a weekly 2-hour lecture and 1-2-hour tutorial or laboratory session. Blended students also had access to resources (typically lecture slides and lecture and tutorial recordings, readings, discussion boards, etc.) in an online learning management system. Online-only students studied through the same
learning management system subject sites as they blended students with access to the
same above described resources. To the authors knowledge some subjects also ran
weekly non-compulsory online tutorial classes using Blackboard Collaborate. These
sessions were recorded, and were typically more likely to be utilised asynchronously
(e.g., as a recording) than synchronically (e.g., by attending the session). Online
students did not attend any face-to-face on-campus classes. They could access the
learning management system as well as interact with peers and the instructors as little
or as much as they liked. No data were collected on the amount of time spent in the
learning management system by either the blended learning students or online only
students, student’s lifestyle factors, or whether they were part or full time students.

2.2.2. Subject grade

Performance within a specified subject was measured by the official final
subject grade for a subject taken from University records; the participant specified the
subject. Grade included all the assessments for the specified subject and was scaled
from 0 to a maximum of 100, with higher scores reflecting better performance. As
students were able to self-select the subject, their performance within each subject was
assessed via different assessment methods. The subject specified by students for this
question was used as a point of focus for all other scales in the questionnaire. Students
were asked to answer all remaining questions within the context of this specified
subject, which linked to their grade for this subject. Grade range was 10 to 95 with a
mean of 72.78 (SD = 12.45).

2.2.3. Self-regulated learning strategies.
Self-regulated learning strategies were measured using the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). The Motivated Strategies for Learning Questionnaire was selected as it is in the public domain, economically feasible to deliver, easily scored, it is specifically for undergraduate students, is designed to measure their self-regulated learning as they relate a specific unit of study (e.g. subject; Artino, 2005), and the learning strategy scales represent an array of different cognitive, metacognitive, and resource management strategies that can be reliably distinguished from one another on both conceptual and empirical grounds (p 812, Pintrich et al., 1993). The self-regulated learning strategies component of the MSLQ comprises of 50 questions, and is divided into three types of strategies: cognitive, resource management, and metacognitive strategies. Cognitive strategies consisted of four subscales: (1) rehearsal (Example question “When I study for this class, I practice saying the material to myself over and over”; $\alpha = .66$), (2) elaboration (Example question “When reading for this class, I try to relate the material to what I already know”; $\alpha = .78$), (3) organisation (Example question “I make simple charts, diagrams, or tables to help me organize course material”; $\alpha = .69$), and (4) critical thinking (Example question “When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence”; $\alpha = .79$). Metacognitive strategies consisted of one large scale: (1) metacognition (Example question “I ask myself questions to make sure I understand the material I have been studying in this class”; $\alpha = .76$). Lastly, resource management strategies consisted of four subscales: (1) time management (Example question “I make sure I keep up with the weekly readings and assignments for this course”; $\alpha = .79$), (2) effort regulation (Example question “I work hard to do well in this class even if I don't like what we are doing”; $\alpha = .77$), (3) peer learning (Example
question “I try to work with other students from this class to complete the course assignments”; \( \alpha = .69 \), and (4) help seeking (Example question “I ask the instructor to clarify concepts I don’t understand well”; \( \alpha = .69 \)).

When answering questions about their adopted learning strategies, participants were asked to think about the subject they specified at the start of the questionnaire. Items for each subscale are measured on a 7-point end point defined Likert-type scale with 1 representing ‘not at all true of me’ and 7 representing ‘very true of me’. Questionnaires were scored according to Pintrich et al.’s (1991) scoring manual. High scores on subscales indicated greater levels of self-regulated strategy use. Each subscale was found to have an acceptable level of internal consistency ranging from \( \alpha = .66 \) to .79 which align with the internal consistencies given in the scoring manual (\( \alpha = .52 \) to .93; Pintrich et al., 1991).

2.3. Procedure

The University ethics committee approved this study. Students were recruited through University Facebook groups, in lectures, through word of mouth, and flyers placed on University noticeboards and on subject homepages of the University’s Learning Management System (LMS). Any University student could participate (and were no targeted because of their enrolment status e.g. blended or online) in the study; however the majority of students were from the same Faculty as the author (Faculty of Health; see participant section) due to more concentrated recruiting from this Faculty. Students needed to be currently enrolled at the time of participation, and within the first four years of their undergraduate degree (or part-time equivalent), as the demands of a course can differ once a student enters a post-graduate level program. All students therefore were enrolled in subjects of study worth the same amount of credit points,
and thus should be of equal difficulty. Recruitment was conducted over six semesters from April 2014 until October 2016. Students could participate anytime during the semester up until week 14. After reading the Plain Language Statement regarding the study and giving consent, participants undertook an online questionnaire, which took approximately 30 minutes to complete. At the start of the questionnaire, participants were asked to think about one specific subject when answering all the questions. Students were asked to focus on one subject so that responses could be linked to the grade for that subject (as opposed to their weighted average mark (WAM) which is their grade for all subjects undertaken across a program). Participants granted permission for the research team to access official grades from their specified subject at the end of the semester.

2.4. Statistical Analyses

All descriptive statistics and group-difference based analyses were conducted using IBM SPSS 22.0, whereas path analyses were conducted in Mplus. Between-group analyses (using ANCOVAs) of enrolment status were done to identify differences between self-regulated learning strategies across online and blended learning students. Partial eta squared was used to calculate effect size for these comparisons. Partial eta squared values greater than .01 were considered small, >.06 moderate, and >.14 large effects (Field, 2013).

A series of multi-group path analyses were undertaken to test the model shown in Figure 1. In order to test the possibility that this model behaved differently across the two groups (i.e., the significant and non-significant contributors to grades differed for blended learning and online groups), these models were run twice. In the first run, model parameters were allowed to vary across the two groups. This baseline (or
unconstrained) model was then compared against a second run (the constrained model) in which the model parameters were set to be equal across groups (e.g., the relationship between grade and SRL strategies was forced to be of equal magnitude for the online and blended learning groups). The sufficiency of a single model then for the two groups is ascertained by comparing model fit for the baseline/unconstrained model against the constrained model. A significant chi square value ($p < .05$) indicates that the constrained model is a significantly worse fit than a model in which parameters are allowed to vary across the groups, and would thus suggest the need for separate models for the two groups. In contrast, a non-significant chi square difference between the models suggests that a single model is sufficient to summarize relationships between SRL strategies and performance for all participants, regardless of group membership (blended learning and online group; Byrne, 2012).

In the present study, the unconstrained model consumed all degrees of freedom (saturated model), and hence model fit statistics are indistinguishable from a perfect fitting model (i.e., chi square $= 0$, df $= 0$, CFI $= 1$, RMSEA $= 0$, and SRMR $= 0$). As such, the chi square statistic for the constrained model simultaneously evaluates fit of that model and provides a significance test for comparing the two competing models (unconstrained vs. constrained). In addition to comparing the two models, standard cut-offs were used to evaluate acceptability of fit for the model in which parameters were constrained to equality: non-significant chi square value, Comparative Fit Index (CFI) $>.95$, Root Mean Square Error of Approximation (RMSEA) $<.06$, and Standardized Root Mean Square Residual (SRMR) $<.08$ (Byrne, 2012; Hu & Bentler, 1999). Standardized coefficients are reported in-text to allow for comparison of the relative contributions of the SRL predictors for the outcome, academic performance. Studies have identified that academic success differs as a function of age and class.
level (Jabor et al., 2011; Urtel, 2008). Thus, in order to provide a more stringent test of the hypotheses, age, class level, and week during the semester when the survey was completed (labeled ‘time of survey’) were added as covariates in the path models.

3. Results

Eighteen participants were removed because they did not provide a current student identification number, or had withdrawn from the subject mid-semester. Twenty-nine participants completed the survey more than once. Where participants had completed the survey more than once, their first survey completion was retained, and any subsequent surveys were removed. Three individuals with more than 50.0% missing data were removed, as were two multivariate outliers, resulting in a final sample of 491 ($n = 405$ for blended learning students, and $n = 86$ for online students). As the remaining variables had less than 5% data missing, expectation maximisation algorithm was applied to replace missing values (Tabachnick & Fidell, 2013). This approach is preferable to deletion as it retains the original sample size, and also uses available information from a participant to impute missing values.

Descriptive statistics and ANCOVAs (controlling for age, time of survey, and class level) of both online and blended student groups were calculated, and are presented in Table 1. Strategy use for both groups averaged neutral or above (indicating greater endorsement of that particular strategy) for all strategies, except peer learning and help-seeking which appeared to have lower use (neutral for blended learning students; low for online students). Elaboration, time management, and effort regulation was the most used strategies for both groups, while peer learning and help seeking the least used. ANCOVAs revealed that the use of elaboration, organisation, metacognition, time management, and effort regulation strategy use were all
significantly higher for the online students compared to the blended learning students. On the other hand, peer learning and help seeking strategy use were significantly higher for the blended learning student group compared to the online student group, with small and moderate effect sizes respectively. Online students reported using rehearsal and critical thinking strategies more often than blended learning students, however this difference was not significant.

Table 1
Descriptive statistics & ANCOVAs of online & blended students’ SRL strategy use

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
<th>η²</th>
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<tbody>
<tr>
<td>Rehearsal</td>
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<td>2.53</td>
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<td>.00</td>
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<td>Online</td>
<td>5.71</td>
<td>.96</td>
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<tr>
<td></td>
<td>Blended</td>
<td>4.89</td>
<td>1.20</td>
<td></td>
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<tr>
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<td>1.12</td>
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<td>Blended</td>
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<td>1.12</td>
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<tr>
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<tr>
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<tr>
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<td>1.12</td>
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<tr>
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<tr>
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<td>2.85</td>
<td>1.29</td>
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</table>

Blended learning students n = 466 online students n = 140; Covaried with age, time of survey, and class level. Reported p values are two-tailed.

To determine the relationships between SRL strategy use and subject grade, correlation analyses were performed separately for blended learning and online learning student groups. The Pearson’s correlation coefficients between SRL strategies and grade of blended students and online students are presented in Tables 2 and 3, respectively. As can be seen from Table 2, grade had a significant weak positive correlation (r = .18 to .29) with all of the SRL strategies except (1) Rehearsal,
(2) Critical thinking, (3) Peer learning, and (4) Help seeking for blended learning students. In contrast, only time management and effort regulation positively predicted grade significantly for online students ($r = .15$ and $.17$, respectively).

**Table 2**
*Pearson's correlation coefficients between SRL strategy use and grade for blended learning students*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<td>.24***</td>
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<td>.28***</td>
<td>.24***</td>
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<td>.43***</td>
<td>.60***</td>
<td>.42***</td>
<td>.43***</td>
<td>.14**</td>
<td>.12**</td>
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<td></td>
</tr>
<tr>
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<td>.64***</td>
<td>.49***</td>
<td>.44***</td>
<td>.20***</td>
<td>.12**</td>
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<tr>
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<td>.07</td>
<td>.22***</td>
<td>.42***</td>
<td>.24***</td>
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<tr>
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<td>.47***</td>
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<td>.28***</td>
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<td>.10*</td>
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<tr>
<td>Effort regulation</td>
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<tr>
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<td>1</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001; n = 466; Covaried with age, time of survey, and class level.

**Table 3**
*Pearson's correlation coefficients between SRL strategy use and grade for online learning students*

<table>
<thead>
<tr>
<th>Variables</th>
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<td>.28*</td>
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<td>.24**</td>
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<tr>
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<td>.47***</td>
<td>.69***</td>
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<td>.55***</td>
<td>.54***</td>
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<td>.20*</td>
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<td>.29**</td>
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<td>.07</td>
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<td></td>
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</tbody>
</table>

*p < .05; **p < .01; ***p < .001; n = 140; Covaried with age, time of survey, and class level.

Multi-group path analyses showed that the proposed model functioned equivalently across enrolment groups; $\chi^2_{(df=12)} = 15.89$, $p = .197$; and that the constrained model had acceptable fit; CFI = .93, RMSEA = .03, SRMR = .02. Hence,
results of the model presented below and in Figure 2 are for the sample as a whole, rather than separately per group.

A shown in Figure 2, time management ($\beta = .22, p < .01$), elaboration ($\beta = .18, p < .01$), and rehearsal ($\beta = -.08, p = .04$) predicted subject grade for both online and blended learning students. No other pathways were found to be predictive of subject grade. Overall, these predictors accounted for 10% of the variance in grades.

![Path diagram of pathways](image)

*Figure 1. Path diagram of pathways (note: age, gender and class level are covariates).
Note: * $p < .05$, ** $p < .01$, one-tailed*
4. Discussion

The existing literature suggests that SRL strategies are relevant to student performance in higher education contexts (Broadbent & Poon, 2015; Richardson et al., 2012). However, due to characteristics and student challenges unique to each group, the variety of SRL strategies that are implicated, and their utility for predicting performance may differ across contexts. This is the first study that sought to identify the key drivers of performance that are generalizable across these two learning contexts, as well as identify potential SRL strategies that may be more important for one context than the other.

4.1 Self-regulated strategy use and their relationship to subject grade

The results showed that online learning students reported using all SRL strategies more often than blended learning students, except for the strategies of peer learning and help-seeking which were employed significantly more often by blended learning students. ANCOVAs revealed that these differences were significant for all strategies, except critical thinking and rehearsal strategies, which were used moderately by both groups. These findings largely support the hypothesis that students would utilise SRL strategies more often within an online learning environment.

For online learners, only time management and effort regulation strategies use were found to positively influence grade. If we assume the online learning environment is highly autonomous, it is unsurprising that both these resource management strategies are important to academic performance for this group as these strategies focus on effectively scheduling, planning, and self-managing one’s study time, while correctly allocating resources and effort despite potential distractions.
While these two strategies were also important to blended learning students, their grade was uniquely predicted by a wider range of SRL strategies, including elaboration, organisation, and metacognition strategies, indicating that planning, monitoring, regulating and higher order learning strategies such as note taking and summarising are important for success in blended learners. Neither group showed a significant relationship of peer learning, help-seeking, rehearsal, or critical thinking with grade. These findings are mostly in accord with the previous literature, although Richardson et al. (2012) found that both help-seeking and critical thinking and Broadbent and Poon (2015) found that metacognition and critical thinking were also related to academic performance.

It should be noted that despite using SRL strategies less often, blended learning students had larger effect sizes between strategies and grades than online learners. As speculated by Broadbent and Poon, (2015), it is conceivable that the effects of SRL strategies are dampened in the online learning environment, and that online students need to utilise more strategies to have a similar impact on academic performance. Indeed, the lack of difference in grades between the two groups despite the broader adoption of SRL strategies for online students supports this notion.

Significantly greater use of peer learning and help seeking strategies was exhibited in blended learning students compared to online students. However, neither blended learners nor online learners utilised these strategies very often. Understandably, it makes sense that online students might feel less social presence and sense of community (Kruger-Ross & Waters, 2013; Wei, Chen, & Kinshuk, 2012). Connection with peers is a sizeable challenge for online students, where geographic disparity, differences in time zones, and varying time commitments make it difficult for peers to connect on a regular basis. Online students who do want to connect may
have more difficulty identifying peers, gaining support, discussing, explaining, and working with other students, than students in face-to-face or blended learning contexts, particularly if they do not know how to find other students. This is in line with previous findings, which have found that peer learning and help seeking are under-utilised strategies (Blocher, De Montes, Willis & Tucker, 2002; Chen, 2012; Puzziferro 2008). At face value, it is possible that learners did not find the types of peer learning and help seeking strategies (as measured by the MSLQ) useful or accessible, and as a consequence didn’t employ them as often. When they did employ them, neither type of strategy predicted subject grade for either group.

It is also possible however, that students do not recognize that they employ many types of peer learning and help seeking strategies. That is, students may not consider the diverse strategies they use and how they differ across learning contexts or situations (Winne 2010), e.g. connecting with peers on Facebook. Whipp and Chiarelli (2004) found that students rely on internet searches, online how-to manuals, and online videos when they need to better understand course material. Students may also passively use other students’ online discussions to shape their own understanding of the content and check their thinking. Certainly, there is a strong body of literature that contradicts the current findings, which suggests that peer learning helps improve learning (Yang, Quadir, Chen, & Miao, 2016), and thus should not be discounted here as a viable strategy. The methods of peer instruction (Mazur 1997), peer tutoring (Leung, 2015), collaborative learning (Sung & Hwang, 2013), peer assistance (Dancer, Morrison & Tar, 2014), and peer assessment (Li, Lui & Steckelber, 2010) have all been shown to yield significant gains in academic achievement. However, peer interaction cannot be expected to occur spontaneously, and should be deliberately planned by instructors (Xia, Fielder, & Siragusa, 2013). It is unknown in this context
whether students in the current study were required to participate in group work, or in peer interaction. If they were not required, it makes sense why these strategies were under-utilised.

As students may not recognize they employ a particular strategy, Karabenick and Zusho (2015) argue that multiple methods (e.g., self-report and objective data) should be used to collect data on self-regulated learning. Discussion forums are a good way to promote peer interaction and objectively measure peer interaction (Xia et al., 2013). In support of these two points, Broadbent and Poon (2015) meta-analysis found that studies that operationalised online peer learning as Learning Management System (LMS) discussion board activity (e.g., ChanLin, 2012; Johnson, Gueutal, & Falbe, 2009; Michinov, Brunot, Le Bohec, Juhel, & Delaval, 2011) had a stronger positive relationship to academic success than more than subjective measures (e.g., Puzziferro, 2008).

4.2. Multi-group path modelling exploring SRL on subject grade differed across the two groups

Despite some differences between the aforementioned variables across enrolment status, invariance testing indicated that the model was largely equivalent between online and blended learning groups. Thus, although the groups differed in the frequency of endorsement of various SRL strategies and several of the SRL-performance relationships were only significant in the blended learning context, the relative contributions of these SRL strategies for subject grade in a full, multivariate model did not differ across context.

Findings from the multi-group path model place the earlier findings in a more appropriate context. First, although blended learning students had more significant
correlations than the online students between SRL strategies and performance, in most
instances the absolute differences in magnitude of effects was small (< |.2| for any
correlation). Second, whereas the correlations consider the total effect of an SRL
strategy on performance – ignoring overlap with other SRL strategies – the path model
considered all predictors in competition, and showed that the key unique contributors
for performance are time management, elaboration, and rehearsal. That this pattern
emerged across groups suggests a single model and set of recommendations regarding
SRL strategies to adopt for success may be appropriate for both sets of students.

Time management was the strongest relative predictor of subject grade in the
multi-group model. In a bivariate context, time management has also been previously
found as the strongest predictor of performance for online learners (Broadbent &
Poon, 2015), and the second strongest predictor in University learners following effort
regulation (Richardson et al. 2012). Students with good time management skills are
able to complete tasks on time (such as weekly readings and assignments) and attend
class, while still maintaining social and work activities. Given this strategy is equally
important to both online and blended learning students, interventions targeting time
management skills (such as planning time effectively) should be implemented by
teaching staff, regardless of student’s enrolment status. For example, teaching students
to use a diary with a timetable for weekly planning, by creating lists of tasks and
prioritizing them, and make short, medium, and long term plans could imbed
management skills in these students. This could be further enhanced by interventions
in weekly structured virtual classroom sessions throughout the semester.

However, having time management skills and being aware of the need to meet
a deadline is not always sufficient to ensure timely task completion. Another barrier
may be avoiding tasks through procrastination; that is, the “voluntarily delay an
intended course of action despite expecting to be worse off for the delay” (Steel, 2007, p. 66). As it has been found to negatively affect academic performance (Jiao et al., 2011; Kim & Seo, 2015), students’ levels of procrastination should be taken into consideration for future research. Measures that separate knowledge of how to manage one’s time, the importance of time management, and how regularly one engages in time management versus succumbing to procrastination would help to delineate the contributions of each to performance.

Elaboration, which entails integrating and connecting incoming information within one’s existing knowledge-base, was found to be the most commonly utilized SRL strategy, as well as a significant unique predictor of subject grade for both groups. Instructional design could incorporate elaboration strategies by providing students with pre-constructed elaborations or by getting students to construct their own when learning new information (Seel, 2011). Further, students should be encouraged to form associations, paraphrase, explain, form mental images, summarise, create analogies, and use mnemonics when studying (Van Blerkom, 2011).

The present study shows that in the context of other strategy use, learners who utilised rehearsal often were less likely to get a high grade. Rehearsal refers to learning by repetition, such as a learner who listens to an online lecture repeatedly, and is the lowest level of learning in the cognitive domain in Bloom’s Taxonomy (Remembering; Anderson, Krathwohl, & Bloom, 2001). Possibly it impacts grade negatively because rehearsal is a superficial learning strategy, involving memorisation and recall of information, rather than deep understanding of, and engagement with, the content. The ineffectiveness of rehearsal as a learning strategy is supported by reviews
that have found it to be a weak or trivial correlate of academic performance (Broadbent & Poon, 2015; Credé, & Phillips, 2011; Richardson et al., 2012).

Findings from the multi-group path analysis argue the importance of utilizing elaboration and time management strategies to improve subject grade for both online and blended learning students. However, the variance explained in subject grade was fairly low (10%), indicating that: (1) there are other, unmeasured contributors to subject grade, and/or (2) the effects of SRL strategies on performance may be moderated by other individual difference factors, such that these strategies are more useful for some students than for others. Traditional correlates such as intelligence, secondary school grades, other previous grades, or self-beliefs such as self-efficacy, motivation, or procrastination were not considered in this study. Traditional predictors of subject grade have been found to have positive, small to medium effects (Richardson et al., 2012; Robbins et al., 2004) and may be potential moderators of SRL strategies impact on subject grade. Self-beliefs, such as self-efficacy (Honicke & Broadbent, 2016) and motivation (Cerasoli, Nicklin & Ford, 2014), have also been found to contribute to subject grade. Further, emotions such as hope, anxiety, and frustration have been found to predict strategy use and these emotions’ effects on performance could possibly be mediated by SRL strategy use (Marchand & Gutierrez, 2012). Conversely, there could be other learner characteristics, not measured here, that influence the relationship (e.g., number of hours of paid employment, full-time or part-time enrolment status). While measuring intelligence, prior achievement, and self-beliefs was outside the scope of this paper, it is likely that these variables would add explanatory value to the model.

4.3. Limitations and concluding remarks
The present findings should also be considered in light of a number of other study limitations. The cross-sectional and correlational nature of the data does not allow for strong causal inferences from the study’s results. Further, it is worth noting the timing of measurement may have also impacted findings. In the present study, students could complete the SRL strategies measure at any point during the semester. This may be problematic, as Timmons and Preacher’s (2015) study of temporal design argues that large measurement intervals are associated with less accuracy in parameter estimation. Thus, despite co-varying for the time in the semester that the students completed the survey, it is possible that the impact of SRL strategies on subject grade may differ if measured earlier versus later in the semester. Although beyond the scope of the present study, future research could explore the extent to which the relative importance of the SRL strategies differ as a function of when they are assessed within a teaching period.

It is unknown whether students were directed or required by instructors to engage in peer activities. Further, it is possible that online and blended learning students do employ help-seeking and peer learning strategies, but subjective measures like the MSLQ fail to capture this, or students are not aware that they employ them. Credé and Phillips (2011) argue that both peer learning (three of three questions) and help seek (three of four questions) as measured by the MSLQ, have conditional content (Whenever X occurs, I do Y; therefore the response is contingent on X occurring to begin with) and ideal point items (where both high and low achieving student may answer the same way), which can be problematic when attempting to correlate with external variables, such as grades. Perhaps a measure such as Online Self-regulated Learning Questionnaire (OSLQ; Barnard, Paton & Lan, 2008; Barnard, Lan, To, Paton & Lai, 2008) or the Online Help Seeking Questionnaire (OHSQ;
Cheng & Tsai, 2011), designed specifically to incorporate the contextual differences in online learning, may be a more appropriate measure to capture the construct of online learner self-regulation accurately. For example, unlike the MSLQ, the OHSQ incorporates web-based communication tools, such as discussion boards, when measuring help-seeking behaviour. Alternatively, using objective measures such as LMS discussion board activity, may be a better representation of peer learning in the online environment.

Lastly, it is unknown whether students in the present study were completing degrees that allowed mixed enrolment modes at different times. That is, students have the ability to enrol in subjects online at one time point, and enrol in others in a blended learning mode at a later or earlier date. While students may have indicated that they were currently enrolled in a particular study mode (blended or online), it does not discount that they had previously studied in a different mode. It is possible, therefore, that students included in this study, at one time or another, may have had experience studying in both online and blended learning modes. At the very least, blended learning mode within this study affords much of the flexibility experienced by online students (e.g., recorded lectures, discussion boards, and online resources). This may explain why the model was largely equivalent between groups, as students may have adapted their learning strategies to suit both modes of study.

In summary, there is a need to understand how learners can best utilise SRL strategies to achieve performance success. This is the first study to compare the SRL strategies used by online learners to those of blended learners. The current study shows that despite some differences between the use of SRL strategies, and their individual predictive value across enrolment status, the key predictors of subject grade were largely equivalent between online and blended learning students. These findings
highlight the importance of using strategies such as time management and elaboration, and avoiding strategies such as rehearsal, in relation to subject grade for both online and blended learning students. These strategies should be kept in mind when designing courses for online or blended learning students. For example, Bernard et al. (2014) argue that structuring online environment with scaffolded learning opportunities and assessment that encourages goal setting, planning, and reflection can increase students’ self-regulation. Lastly, more research is warranted to understand how online students, and their face-to-face counterparts, use methods of peer learning and help-seeking to improve their subject grade. As well, the influence of self-beliefs such as self-efficacy or motivation, have on SRL strategy implementation and subject grade also deserves further investigation.

5. Role of funding sources

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6. Acknowledgements

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7. Conflict of interest

Author is employed by Deakin University. There are no other conflicts of interest.
8. References


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