Exploring independent learning (IL) and its relationship to mindset, motivated strategies for learning and academic performance

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Abstract

Purpose – This study addresses gaps in the existing literature on students’ understanding of Independent Learning (IL), whilst exploring the link between levels of IL, growth mindset, motivated strategies for learning and academic performance.

Design/methodology/approach – Three hundred and eighty-six university students recruited via opportunistic sampling completed an online survey to measure: understanding and level of IL, Motivated Strategies for Learning (MSL) (Duncan and McKeachie, 2005) and growth mindset (Dweck, 2000). Interaction with the university Virtual Learning Environment (VLE) and academic grades were also measured. A correlational design was implemented, and a Spearman Rho was calculated to explore the relationship between level of IL, MSL and growth mindset. A between-subjects design using independent measures t-test was employed to determine the significance of any difference in level of IL and VLE engagement according to academic grade.

Findings – Whilst most students considered themselves an IL and understood what IL was, the majority erroneously believed it meant learning alone or without help. Level of IL, however, was positively associated with motivational beliefs (self-efficacy and mindset), cognitive strategies (rehearsal, elaboration, organisation and critical thinking), and metacognitive strategies (time management and self-regulation). Further, those with grades A-C scored significantly higher than those with grades D and below on cognitive strategies (elaboration and organisation). Those attaining higher grades also interacted with the VLE significantly more frequently and regularly than those attaining lower grades.

Originality/value – This study adds to the existing literature by highlighting the positive relationship between level of IL, MSL, mindset and academic achievement. It also addresses the under-explored potential for VLE engagement in predicting grades amongst on-campus courses. Given that cognitive strategies and VLE engagement differentiate the high and low achievers, interventions to develop such skills may enhance academic achievement.

Keywords Independent learning, Self-regulated learning, Motivational strategies for learning, VLE engagement, Academic achievement

Paper type Research paper

Background

There is increasing interest in the role of independent learning in higher education and its impact on academic performance. Indeed, Anthonysamy et al. (2020) note that self-regulation has been recognised as one of the most vital competencies for the twenty-first century (OECD,
Independent or self-regulated learning is a process which includes meta-cognitive, motivational, emotional and behavioural strategies that students employ to master their academic skills (Zimmerman, 1986) and which are thought necessary for lifelong learning. Self-regulated learners are motivated to plan, set goals and engage in strategies to achieve those goals, they also, however, monitor and adapt these strategies to enhance their progression towards goal achievement (Pintrich et al., 1993).

Cognitive strategies include rehearsal, elaboration, critical thinking and organising to acquire knowledge and retain information (Bazelais et al., 2018). Metacognitive strategies, on the other hand, refer to the strategies used to monitor, regulate and plan learning (Yukselturk and Bulut, 2007). Motivational skills refer to expectancy, value and affect (Duncan and McKeachie, 2005), this relates to learners’ belief in their ability to accomplish a task (self-efficacy), the belief that outcomes are contingent on their own actions (expectancy) and the value they place on such outcomes (value). According to the self-regulated learning model, students have the potential to actively monitor and therefore adapt their goals, learning strategies and motivation (Lynch and Trujillo, 2011).

This aligns with Bandura’s Social Cognitive Theory (2009). According to Bandura (2009), people seek to develop a sense of agency over their lives and such agency is influenced by their self-efficacy, outcome expectations, goal setting and self-regulation (Schunk, 2012). Bandura (2009) notes that nothing is more influential than one’s belief in their personal efficacy, that is the belief that one can successfully perform specific behaviours and produce desired outcomes. According to Schunk (2012), individuals actively influence their learning by interpreting the outcomes of their actions, which, in turn, impacts their environment and informs their future actions. Rather than see learners as passive recipients, the social-cognitive view proposes that learning is more than a fixed trait, and instead that motivation and learning strategies can be improved to achieve success (Duncan and McKeachie, 2005; Broadbent and Poon, 2015).

This aligns with Zimmerman (2008), who proposes that learners who are self-regulated have the skills necessary to monitor, control and adapt to the demands of their learning environment whilst also achieving academic success. Indeed, numerous studies have found important differences between high and low-achieving students in relation to self-regulated learning strategies (Richardson et al., 2012), especially in terms of goal setting, monitoring, self-efficacy (Difrancesca et al., 2016; Pintrich and De Groot, 1990; Zimmerman, 1990, 2008) and critical thinking (Broadbent, 2017). Difrancesca et al. (2016) for example found that high-achieving students were more likely to set specific goals and employ more effective study strategies such as spaced studying (Son and Simon, 2012). On the other hand, low-achieving students were more reliant on repetition and flashcards. This is supported by the findings of a meta-analysis conducted by Richardson et al. (2012) who found that critical thinking, elaboration, concentration, time/study management, effort and peer learning were positively correlated with GPA within the traditional learning environment. These findings were replicated in a systemic review, by , whereby metacognition, time management, effort regulation and critical thinking were found to be significantly associated with academic achievement among online learners.

Furthermore, research suggests that motivational beliefs can also foster and support IL (Yan et al., 2014), which in turn enhances academic progression, retention and the student experience (Pintrich, 2004). Indeed, research by Schunk and Zimmerman (2008) noted that self-efficacy beliefs are positively related to persistence, effort and achievement; whilst Broadbent et al. (2021) found self-efficacy to be the strongest predictor of assessment task performance for both online and blended learners.

Another factor thought to impact student achievement and progression is a growth mindset. Those with a growth mindset adhere to the incremental theory of intelligence,
believe that people can become more intelligent with effort (Dweck et al., 1995) and are likely to experience greater academic achievement (Karlen et al., 2021, Sisk et al., 2018). Indeed, numerous studies note a positive correlation between a growth mindset and academic achievement in primary and secondary school pupils (Dweck, 2000 in Bazelaïs et al., 2018; Blackwell et al., 2007). The effect of mindset on academic achievement among university students, however, remains unclear (Bazelaïs et al., 2018). Bahnik and Vranka (2017) found a very weak and non-significant association between scholastic aptitude and mindset among university applicants. However, Aronson et al. (2002) found that a brief intervention to encourage a growth mindset led to greater enjoyment, engagement and higher grade point averages among university students. Further, a meta-analysis by Sisk et al. (2018) found a very small correlation between mindset and academic achievement among children, adolescents and adults. This was especially true, for students who had failed previously and those with a low socioeconomic status.

One reason that mindset influences academic achievement is its relationship to motivation and adaptation (Burnette et al., 2013; Karlen et al., 2019). Those with a growth mindset are more likely to adapt their learning strategies, persevere when things are challenging (Lou and Noels, 2016), use deeper processing strategies (Grant and Dweck, 2003; Ommundsen, 2003) and engage in self-directed learning more easily. This is supported by research by Yan et al. (2014) who found that those with a growth mindset were more likely to understand the pedagogical importance of self-testing, restudying learned materials and revising “old” course materials than those with a fixed mindset. Similarly, Bai and Wang (2023) found that a growth mindset was significantly related to monitoring, effort regulation, goal setting and planning.

Further evidence of the importance of IL comes from the increasing use of learning analytics data in pedagogical studies (Romero and Ventura, 2010). Indeed, numerous studies have reported a link between levels of online engagement and academic success in online courses (Namoun and Alshanqiti, 2020; Rodgers, 2008; Ryabov, 2012; Soffer and Cohen, 2019). Soffer and Cohen (2019) for example, found a significant difference in VLE engagement, between students who completed the course and those who did not. They also found that engagement with course materials and reading online forums predicted exam success. Many on-campus courses, now make use of the VLE to supplement face-to-face teaching and as a platform to deliver course materials. There is little research, however, that explores the influence of VLE engagement on academic performance among on-campus students.

While there is consensus on the benefits of developing students as “independent learners”, there is no simple definition of what the term means (McKendry and Boyd, 2012) and limited research to explore students understanding of it. As a result, students may fail to understand what is expected of them as independent learners, whilst institutions and academic staff fail to develop effective interventions to enhance IL.

The uniqueness of the study
This study adds to the existing literature by increasing our understanding of the relationship between levels of IL, MSL, mindset and academic progression, whilst exploring the less studied understanding of IL and the impact of VLE interaction among on-campus university students. The findings of this study can inform the development of tools and teaching resources to be employed by universities to improve and support academic achievement, progression and retention by enhancing the growth mindset, level of IL (including VLE interaction) and MSL of its learners.
Objectives and hypotheses
This study aims to determine students’ understanding and level of independent learning, whilst exploring the relationship between IL, MSL, growth mindset and academic achievement. The following four hypotheses were tested.

1. There is a positive relationship between the level of IL and MSL
2. There is a positive relationship between the level of IL and MSL with mindset
3. The level of IL and MSL are higher amongst those with higher grades and
4. The level of VLE engagement is higher amongst those with higher grades.

Method
Research design and context
This study employed an online survey design. Hypotheses 1 and 2 were tested using correlational design to determine the relationship between the level of IL, MSL and growth mindset. Hypotheses 3 and 4 were tested using a between-subjects design to compare levels of IL, MSL and VLE engagement between students with lower and higher grades. The study was conducted University-wide, and the survey was distributed across a range of undergraduate and postgraduate modules at a Scottish University via email and the VLE. The courses were delivered using a blended learning model whereby on-campus teaching is supplemented by materials and activities via the VLE.

Participants
Opportunistic sampling was used to recruit 386 students who completed the questionnaire, which included 148 males, 233 Females, 2 who preferred not to say and 3 who identified as other. Age ranged from 16 to 56 with a Mean age of 32.08 (SD 8.43). In terms of ethnicity, 118 identified as White, 8 as Mixed Race, 21 as Asian, 183 as African, 27 as Caribbean and 14 as other ethnic groups. Seventy-five were undergraduates and 311 were postgraduates. Of the 386 participants, 180 gave permission to access their grades and VLE engagement levels. This sub-sample included 64 males and 114 females, 156 postgraduates and 24 undergraduates with a mean age of 32.87 (SD 7.50).

Materials
An online questionnaire was designed to measure students’ understanding and level of IL, Motivated Strategies for Learning (MSL), Mindset, academic performance and VLE engagement. To measure their “understanding of IL”, students were presented with the 7 definitions of an independent learner listed in Table 1 and asked whether or not they agreed. They were also given closed questions to determine if they considered themselves to be an independent learner and whether they had heard of the term before. “Level of IL” was measured using a self-report question on the number of hours they engaged in IL per 15-credit module per week. “MSL” were measured using 7 scales from the Motivated Strategies for Learning Questionnaire (MSLQ) (Duncan and McKeachie, 2005), a self-report instrument designed to assess students’ motivation, cognition and metacognition. Motivation was measured in terms of expectancy for success and judgments of one’s ability to accomplish a given task through the scale for self-efficacy for learning and performance (Cronbach’s alpha 0.93). Cognition was measured in terms of the strategies employed by students to process the information gained through reading and teaching. The latter included scales for rehearsal (strategies to enhance attention and encoding of material in working memory; Cronbach’s alpha 0.69), elaboration (strategies to enhance long-term memory storage by connecting
information with previous knowledge; Cronbach’s alpha 0.75), organisation (selecting the appropriate information and making connections between materials to be learned; Cronbach’s alpha 0.64) and critical thinking (applying previous knowledge to new situations or making critical evaluations of ideas; Cronbach’s alpha 0.80). *Metacognition* was measured in terms of strategies that help students control and regulate their own cognition, namely self-regulation (Cronbach’s alpha 0.79) and time management scales (Cronbach’s alpha 0.76). The MSLQ was selected based on its previous use in research on university students (Duncan and McKeachie, 2005), its high validity and the option to use each sub-scale independently (Roth et al., 2016). Indeed, the MSLQ is the most used measure of self-regulated learning (Roth et al., 2016) and self-efficacy (Honieke and Broadbent, 2016) in students. “Mindset” was measured using the 8-item Intelligence Questionnaire (Dweck, 2000) which was scored on a 6-point Likert scale from Strongly Agree to Strongly Disagree. The score was then calculated by averaging the response to each question, with a maximum score of 6 (indicating a growth mindset) and a minimum score of 0 (indicating a fixed mindset). Students also provided permission to access and use their academic performance and VLE engagement. “Academic performance” was measured in terms of the module grade achieved, which ranged from A to F. “VLE engagement” was measured in terms of average clicks each day on the module VLE page. The number of days accessing the VLE was also examined. Both the number of clicks and the number of days were also measured as a percentage of the cohort mean. This allowed for comparison across modules, given that some modules will have more engagement opportunities than others. The survey also included questions about age, gender, ethnicity, level of study and school of study.

*Ethics*

Full ethical approval was granted by the researcher’s School Ethical Review Panel. Participation was voluntary and students completed the survey in their own time. Only those providing informed consent took part in the study.

*Data collection*

The survey was administered online using Jisc Online Surveys (Jisc, 2020). A link to the survey was shared via the University bulletin and was embedded in several modules via the VLE.

*Data analysis*

Data were analysed using SPSS v.28. Descriptive statistics were used to determine Means (SD) and Frequencies, whilst the Spearman correlation coefficient was used to determine the significance of any relationship between the variables. Based on Cohen (1988), the strength of the relationship was categorised as small ($r = 0.10$ to 0.29), medium ($r = 0.30$ to 0.49) or large ($r = 0.50$ to 1.0). To test for differences between groups, a series of independent $t$-tests were employed. Statistical significance was deemed to have been reached where $p < 0.05$.

*Findings*

*Understanding of independent learning*

Most students (84.2%) had heard the term “Independent Learning”, considered themselves to be independent learners (66.8%) and demonstrated a good understanding of what IL is in terms of responsibility and motivation (see Table 1). Their understanding of autonomy, however, is limited with the majority erroneously believing it meant: “being able to learn on their own” (87%) and “completing assessments without any help” (56%).
Motivational strategies for learning (MSL) and mindset

As shown in Table 2, students scored highest on the measures of self-efficacy, elaboration and time management, followed by organisation, critical thinking and self-regulation. The lowest score was for rehearsal, indicating that this was the strategy least used.

In terms of Mindset, students scored a mean of 4.61 (SD 0.83) indicating a growth as opposed to a fixed mindset.

H1. There will be a positive relationship between the level of IL and MSL

In terms of the level of IL, students reported a Mean of 8.52 (SD 6.54) hours of “IL” per module per week.

Results indicated a small, positive relationship between hours of IL and the motivation subscales [self-efficacy ($r^a (n = 368) = 0.13, p = 0.05$)], the cognitive subscales [rehearsal ($r^a (n = 368) = 0.19, p < 0.001$), elaboration ($r^a (n = 368) = 0.16, p < 0.01$), organisation ($r^a (n = 368) = 0.24, p < 0.01$), critical thinking ($r^a (n = 3.68) = 0.13, p < 0.05$)] and the metacognitive subscales [self-regulation ($r^a (n = 368) = 0.13, p < 0.05$) and time management ($r^a (N = 368) = 0.23, p < 0.01$)]. This suggests that those who engage in more hours of IL are more motivated to learn and employ more cognitive and metacognitive skills to organise and enhance their learning.

H2. There will be a positive relationship between mindset with level of IL and MSL

Results indicated a small and positive relationship between mindset and “hours of IL” ($r^a (N = 368) = 0.20, p < 0.01$), the cognitive subscales [elaboration ($r^a (N = 368) = 0.15, p < 0.01$), organisation ($r^a (N = 368) = 0.12, p < 0.05$), critical thinking ($r^a (N = 368) = 0.16$),

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>5.42 (1.21)</td>
</tr>
<tr>
<td>Rehearsal</td>
<td>4.76 (1.38)</td>
</tr>
<tr>
<td>Elaboration</td>
<td>5.55 (1.14)</td>
</tr>
<tr>
<td>Organisation</td>
<td>5.08 (1.24)</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>5.10 (1.22)</td>
</tr>
<tr>
<td>Self-regulation</td>
<td>4.95 (0.92)</td>
</tr>
<tr>
<td>Time management</td>
<td>5.21 (0.97)</td>
</tr>
<tr>
<td>Mindset</td>
<td>4.61 (0.83)</td>
</tr>
</tbody>
</table>

Table 2. Mean (SD) scores for MLS and mindset

Source(s): Author’s own creation/work

Note(s): *Demonstrates poor understanding

Source(s): Author’s own creation/work
and the metacognitive subscales [self-regulation ($r^2 (N = 368) = 0.14, p < 0.05$) and time management ($r^2 (N = 368) = 0.13, p < 0.05$)]. This suggests that those with a higher growth mindset engage in more hours of IL, and employ more elaboration, critical thought and self-regulation whilst employing more strategies to organise and connect their learning materials.

**H3.** The level of IL and MSL will be higher amongst students with higher grades.

As shown in Table 3, results from a series of independent $t$-tests indicated that those who pass their module at C or above ($N = 168$) scored significantly higher than those who failed ($N = 12$) on elaboration ($t (178) = 1.99, p < 0.05$) and organisation ($t (178) = 2.13, p < 0.05$). Although those who passed the module reported more hours of IL ($M = 8.95, SD = 6.66$) compared to those who failed ($M = 7.75, SD = 5.94$), this was not significant ($t (170) = 0.60, p = 0.27$). This suggests the measures of cognition as opposed to motivation or metacognition are more significant in differentiating those who pass and fail.

<table>
<thead>
<tr>
<th>MSL strategy</th>
<th>Grade C or above mean (SD)</th>
<th>Grade D or lower mean (SD)</th>
<th>t-value</th>
<th>$p$-value one tailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of IL</td>
<td>8.95 (6.66)</td>
<td>7.75 (5.94)</td>
<td>0.60</td>
<td>0.27</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>5.64 (1.10)</td>
<td>5.58 (0.77)</td>
<td>0.20</td>
<td>0.42</td>
</tr>
<tr>
<td>Rehearsal</td>
<td>5.00 (1.44)</td>
<td>4.85 (1.53)</td>
<td>0.35</td>
<td>0.36</td>
</tr>
<tr>
<td>Elaboration</td>
<td>5.87 (1.04)</td>
<td>5.25 (1.15)</td>
<td>1.99</td>
<td>0.02*</td>
</tr>
<tr>
<td>Organisation</td>
<td>5.30 (1.24)</td>
<td>4.50 (1.62)</td>
<td>2.13</td>
<td>0.02*</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>5.36 (1.17)</td>
<td>4.96 (1.24)</td>
<td>1.10</td>
<td>0.14</td>
</tr>
<tr>
<td>Self-regulation</td>
<td>5.16 (0.92)</td>
<td>4.91 (0.74)</td>
<td>0.89</td>
<td>0.19</td>
</tr>
<tr>
<td>Time</td>
<td>5.35 (0.98)</td>
<td>5.19 (0.81)</td>
<td>0.33</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Note(s): *$p < 0.05$
Source(s): Author’s own creation/work

**H4.** The level of VLE engagement will be higher amongst those with higher grades.

As shown in Table 4, results from a series of independent $t$-tests indicated that those who passed at C or above ($N = 128$) engaged with the VLE significantly more than those who failed ($N = 12$) in terms of average clicks as a percentage of cohort ($t (138) = 1.70, p < 0.05$), average days as % of cohort ($t (138) = 2.94, p < 0.01$) and days clicked ($t (138) = 2.98, p < 0.01$).

Results from a series of Spearman correlations further support the positive relationship between Grade and VLE engagement. Results indicated a small and positive relationship between grade and average clicks as % of cohort ($r^2 (n = 140) = 0.21, p < 0.05$), average days as % of cohort ($r^2 (n = 140) = 0.24, p < 0.01$) and days clicked ($r^2 (N = 140) = 0.26, p < 0.01$).

<table>
<thead>
<tr>
<th>VLE interaction</th>
<th>Grade C or above mean (SD)</th>
<th>Grade D or lower mean (SD)</th>
<th>t-value</th>
<th>$p$-value one tailed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average clicks</td>
<td>0.90 (0.64)</td>
<td>0.65 (0.22)</td>
<td>1.16</td>
<td>0.12</td>
</tr>
<tr>
<td>Average clicks as a percentage of cohort</td>
<td>35.06 (36.14)</td>
<td>36.44 (19.23)</td>
<td>1.89</td>
<td>0.03*</td>
</tr>
<tr>
<td>Average days as % of cohort</td>
<td>107.74 (36.48)</td>
<td>76.35 (35.42)</td>
<td>2.95</td>
<td>0.002**</td>
</tr>
<tr>
<td>Days clicked</td>
<td>35.41 (11.94)</td>
<td>24.66 (11.21)</td>
<td>2.99</td>
<td>0.002**</td>
</tr>
</tbody>
</table>

Note(s): *$p < 0.05$ **$p < 0.01$
Source(s): Author’s own creation/work

Table 3. Mean MSL scores according to grade category

Table 4. Mean VLE interaction according to grade category
These findings suggest that higher-achieving students interact more frequently than lower-achieving students.

As shown in Figures 1 and 2, further exploration indicated that higher-achieving students’ VLE interactions are also more regular, consistent and timely. Figure 1, for example, indicates that A-grade students show more regular activity throughout the module with a gradual increase in the lead-up to the assessment and ongoing activity during the feedback period. D-grade students on the other hand take longer to engage with the module, show less frequent or regular activity, demonstrate a spike in activity at the assessment point and very limited activity during the feedback period.

All four hypotheses were supported by the data.

Figure 1. VLE interaction for A-grade students

Source(s): Author’s own creation/work

Figure 2. VLE interaction for D-grade students

Source(s): Author’s own creation/work
Discussion

Understanding of IL

Although most students have a good understanding of IL, the majority erroneously believe it means “the ability to learn on your own” and “complete assessments without help”. This has potential implications for students seeking help and fits with research by Thomas et al. (2015), whilst supporting the need for further work to enhance students’ understanding of the term.

Level of IL and motivational strategies for learning

The findings are also consistent with Yan et al. (2014) in that those who engage in more hours of IL were more likely to revise and revisit course materials, use techniques to expand and elaborate their learning, engage in more critical thought, use strategies to organise their study whilst adapting their learning to enhance their understanding. This indicates that motivational, cognitive and metacognitive factors are important. In line with DiFrancesca et al. (2016), they also scored higher on self-efficacy, which supports the proposal that those who believe they will be successful are more motivated to engage in IL.

Mindset

In line with research by Yan et al. (2014), the results indicate that those with a higher growth mindset engage in more hours of IL, more revision and rehearsal, use techniques to expand and elaborate their learning, and are more organised in their approach to studying. The findings also support Zimmerman (2008) and Sisk et al. (2018) in that those with a growth mindset are more likely to regulate their learning to enhance their understanding. This could reflect the proposal by Blackwell et al. (2007) that those with a fixed mindset tend to believe that ability alone is sufficient for learning, and the need for additional effort reflects poor ability. Indeed, the results suggest that those with a lower growth mindset engage in fewer strategies to enhance or drive their learning.

Academic achievement

In line with previous findings (Zimmerman, 2008, Sisk et al., 2018; Karlen et al., 2021) that individuals who are independent learners achieve more academic success, the current results indicate that higher-achieving students spend more hours learning independently and are more likely to elaborate on and organise their course materials. Interestingly, the measures of cognition as opposed to motivation or metacognition are more significant in differentiating those who pass and fail.

This study expands upon previous research among online students (Rodgers, 2008; Soffer and Cohen, 2019), indeed the current study indicates that VLE engagement is related to academic grade even amongst on-campus students. Those who achieved higher grades engaged with the VLE significantly more frequently in terms of average clicks and days clicked over the duration of the module. This study makes a unique contribution to the literature by further exploring the timing and regularity of such interaction. Indeed, the higher-achieving students, interacted with the VLE in a more regular and timely fashion, especially during periods of assessment and feedback.

Overall, the findings indicate that students who engage in more IL (including interactions with VLE at crucial points), employ learning strategies which are more elaborative, critical, organised and adaptive. They also have a stronger belief in their own ability, have a higher growth mindset and tend to achieve higher grades. Unfortunately, however, the majority believe that IL means learning alone.
Implications for practice
To improve academic progress and teaching success therefore, universities need to enhance students’ understanding of IL especially in relation to autonomy, employ an e-learning platform that is engaging and enhance the growth mindset of their students. According to Rattan et al. (2012) and Karlen et al. (2021), providing feedback that focuses on strategies which students could use to improve performance or overcome challenges may be more useful than feedback that focuses on ability. Our findings suggest that tools and interventions to enhance students’ use of organisation and elaboration strategies, together with a growth mindset could lead to significant improvements in academic achievement. Which in turn could help enhance the equality and educational opportunities for lower achieving students (Binning and Browman, 2020). The findings also suggest that the timing, frequency and regularity of VLE interaction could be a useful tool in predicting academic achievement or identifying the need for intervention even amongst on-campus students. Regular monitoring of engagement together with the use of the MSLQ could inform timely interventions from professional support teams to enhance both engagement and learning strategies.

Limitations of current study
The main limitations were the small sample size, the limited number of participants who gave access to their academic grades and VLE engagement, and the small number of low-achieving students. The study could therefore be limited by self-selection bias. Nonetheless, the study does include a heterogeneous sample of postgraduate and undergraduate students from a diverse range of backgrounds.

Recommendations for future research
This study indicates that differences exist between higher and lower-achieving students, to develop effective tools or interventions to enhance IL (including VLE engagement), mindset and motivation, however, we need to understand why this difference occurs. Future studies should, therefore, explore the underlying reasons for lower-achieving students’ lower engagement with the VLE and motivational strategies for learning.

Conclusion
In conclusion, the study findings provide valuable insights into the benefits of effective independent learning (including VLE engagement) and motivation to learn. These have potential implications for educators and online developers. By making VLEs more interactive and engaging, enhancing student motivation to learn and improving opportunities to engage in IL, universities could potentially enhance academic achievement, retention and progression. To do so, however, universities must ensure that students understand what IL is.

References


Jisc (2020), *JISC Online Surveys* [Software], available at: https://www.onlinesurveys.ac.uk/


Further reading


About the authors

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Pamela Johnston is a lecturer in the School of Computing at Robert Gordon University. Her main research areas are in deep learning, data analytics and computer vision. She has a passion for data visualisation and storytelling through data, particularly with regards to understanding student behaviours when utilising virtual learning environments.

Dr Carol Air is a Principal lecturer in Management within the Department of People, Organisations and Practice, in Aberdeen Business School at Robert Gordon University. She teaches and coordinates modules in, operations management, procurement, and in personal, professional and academic skills. Design thinking supports her interest in the development of entrepreneurial mindsets and independent learning. With an interest in student transitions into PG study, she is involved in projects using design thinking as a module development approach and is currently exploring its value in interdisciplinary research.