PILOT OF A SERIES OF ONLINE RESOURCES TO HELP STUDENTS TRANSITION TO FIRST YEAR ENGINEERING

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Abstract – Transitioning from high school to university can be a difficult time for students. A significant element in this transition is related to heightened self-responsibility and self-regulation for one’s own learning. A series of eight online screencasts (consisting of narrated video with activities and quiz questions) was created and introduced at the University of British Columbia in 2018 as a pilot project. The goal was to help first year engineering students with their academic transition by providing evidence-based principles of effective study strategies and attitudes. Materials were delivered in the academic setting, rather than through traditional orientation and support channels, as a way to elevate this content and to reach as many students as possible. Materials were optional but a small grade incentive was included.

Students appear to have found the resources beneficial as roughly half of the class viewed at least half of the screencasts. The opportunity to earn a small course bonus mark was cited as a key incentive, but approximately half of students identified academic and university transition benefits as their primary reasons for viewing. A course survey conducted five months after the final screencast in the series revealed positive student attitudes towards the materials, with approximately 70% of students identifying the materials as helpful or very helpful. In addition, students who had viewed a particular screencast gave significantly more favourable responses in prompts regarding perceptions of effective study practices. Finally, a positive correlation was observed between the number of screencasts viewed and course final exam grade (+0.8% on the final per screencast viewed).

Overall, the results of this pilot suggest the use of online screencast materials to aid students in the transition to university is effective.

Keywords: First-year engineering, university transition, metacognition, online resources.

1. INTRODUCTION

Transitioning from high school to university is a major life step for students. In addition to personal and social transitions, there are numerous academic changes relating to classroom size and format, instructional methods, assessment techniques, and the relationship with peers and teachers. Significantly, university involves a much greater degree of self-responsibility and independence than students have experienced prior. The transition has been associated with various negative student impacts, including increased stress and diminished wellness. [1]

Most (presumably all) universities include programs and information to help students transition to this new environment. The University of British Columbia (UBC) is no exception, with optional multi-day orientation sessions running before the official start of term, a large university-wide orientation and welcome on the first day of term, and numerous activities, resources, and personnel available throughout the year to help students in the transition. While these activities and resources are invaluable, they are delivered outside of the course setting, primarily by advisors and other students, and with a broad focus. As such, they do not carry the same weight or perceived relevance for all students that curricular content delivered within courses does.

Based on anecdotal findings from faculty members and feedback from advising staff and student leaders, the need to further assist students in the academic transition to university was identified. Also recognizing the need to develop independence in students’ ability to manage and regulate their learning, a decision was made to develop a series of online interventions broadly related to metacognition—awareness, knowledge, and regulation of one’s own thinking. It is well established in the literature that metacognitive awareness is positively correlated to favourable course outcomes [2],[3],[4],[5] and that introducing students to metacognition and related concepts leads to improved learning outcomes [6],[7]. Importantly, significant benefits have been observed with minimal interventions consisting of simply introducing concepts of metacognition [8]. With the above in mind, a series of
online resources was developed and deployed within a core first year engineering course at UBC.

1.1. Motivation

The primary motivation behind this work was to integrate resources on transitioning to university learning—broadly focusing on metacognition—within the academic setting. The goal was to broadly reach and support as many students as possible, and to provide initial exposure to these topics. The intent was to complement other existing resources, including advising services, workshops, specialized training, and so on, and to direct students in need to these other resources. The secondary goal behind this work was to assess the effectiveness of providing transitioning to university learning materials within the academic setting.

1.2. Methodology

Online resources consisting of a series of eight “screencasts” were created. The screencasts featured narrated video with interactive exercises and quiz questions. The use of these materials was piloted in a 900-student first year introduction to engineering course in the fall of 2018. As discussed further in Section 2, these materials were prepared and delivered in the same way as other technical material in the course; however, unlike the technical material, these resources were optional and a small bonus mark incentive was given.

Effectiveness of the materials were gauged by tracking usage rate, correlating usage to academic performance, and soliciting student feedback through a survey.

1.3. Content Resources

The topics covered in the screencast series were determined through extensive consultation with various groups, including members of the first year engineering teaching team, educational developers, students, student advisors, and staff in the UBC Wellness Centre. Other resources extensively used in the development of screencast content included the following:

- How Learning Works (Ambrose [3]);
- How People Learn (National Academy Press [2]);
- Grit (Duckworth [9]);
- Mindset (Dweck [10]);
- Metacognition (McGuire [6]); and
- New Science of Learning (Doyle and Zakrajsek [11]).

2. DEVELOPMENT AND DEPLOYMENT

The course context in which these materials were deployed is outlined below, followed by additional information on material development.

2.1. Course Context

Starting in the 2015-16 academic year, two new introduction to engineering courses, APSC 100 and APSC 101, were offered at UBC [12]. The APSC 100 course is taken by all first year engineering students at UBC (approximately 900), while the APSC 101 course is taken primarily by direct entry (i.e. non-transfer) students (approximately 800). The APSC 100 course runs in the fall term and consists of four modules: introduction to design and prototyping; introduction to stakeholders and decision-making; CAD and rapid prototyping; and professionalism and ethics. The materials described in this paper were piloted in the APSC 100 course.

The courses are taught in a blended learning format, with extensive use of online video and exercises to develop initial competency with material. The courses draw extensively from the Team-Based Learning approach[13], and feature a repeating weekly cycle of online material, opening large class with team quiz, studio (i.e. lab/tutorial), and concluding large class.

2.2. Material Development

Materials were developed and delivered in the same manner as other (technical) course content. They were packaged as weekly “screencasts” delivered through the course learning management system (LMS). Unlike the technical content, these materials were optional, but students were incentivized to participate with a course grade bonus of up to 2% based on performance in the video quizzes relative to performance in other parts of the course. The bonus was structured such that the screencast quiz grade replaced lower marks in specific elements of the course, and otherwise had no effect.

Screencasts were developed as a PowerPoint slideshow, narrated and captured using the Camtasia screen recorder (www.techsmith.com), and then formatted and packaged using Articulate Storyline 3 (articulate.com/p/storyline-3). Each screencast was approximately 6-8 minutes in length and focused on a different topic, as summarized in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mindset</td>
<td>Dispelling myths about learning; the growth mindset; grit</td>
</tr>
<tr>
<td>2</td>
<td>Models</td>
<td>Bloom’s Taxonomy and Perry’s Scheme</td>
</tr>
<tr>
<td>3</td>
<td>Neuroscience 1</td>
<td>How learning works; memory</td>
</tr>
<tr>
<td>4</td>
<td>Neuroscience 2</td>
<td>Multitasking; distraction; retention</td>
</tr>
<tr>
<td>5</td>
<td>Health</td>
<td>The science of sleep, diet, and exercise impacts on learning</td>
</tr>
<tr>
<td>6</td>
<td>Stress</td>
<td>Understanding and managing stress</td>
</tr>
<tr>
<td>7</td>
<td>Metacognition</td>
<td>Understanding and regulating learning</td>
</tr>
<tr>
<td>8</td>
<td>Strategies</td>
<td>Deliberate practice and other learning strategies</td>
</tr>
</tbody>
</table>
Screencasts also included various self-assessment questionnaires and instruments drawn from the literature, as a way to engage students with the material. It included the following:

- A questionnaire on mindset, [10]
- A questionnaire on grit, [9]
- A questionnaire on intellectual stage, [14]
- A questionnaire on lifestyle (sleep, diet, and exercise),
- The Perceived Stress Scale (PSS) instrument, [15]
- The Metacognitive Awareness Inventory (MAI), [16]

These self-assessments were intended to make the screencast content more personally relevant and meaningful, and therefore make the screencasts more interesting. They also gave students feedback on where they were on various scales (e.g., fixed mindset versus growth mindset; Perry’s Scheme of intellectual development, etc.), or on how they compared to other groups (e.g., comparison to how other first engineering development, etc.), or on how they compared to other groups (e.g., comparison to how other first engineering students rated their stress). This content was anonymous, optional, and ungraded. It came with strong wording that the ratings were for fun and personal exploration only, and were not fixed nor were they predictors of future success.

3. RESULTS AND DISCUSSION

Results and discussion are provided below, organized in four topics: participation rates, student motivations, impacts, and student perceptions.

3.1. Participation Rates

Completion rates for the screencasts are shown below in Fig. 1. Here “Opened” indicates the proportion of students in the course who started the screencast, while “Completed” indicates the proportion who finished the screencast (i.e. pressed “submit” at the end of the screencast and sent quiz results to the LMS).

Overall, Fig. 1 indicates broad usage of these (optional) resources, with approximately 400 students reached on average each week. As would expected, as the term progressed and students became increasingly busy with other courses, completion rates dropped. In the case of the first screencast (Mindset), there were students who mistakenly thought it was mandatory (even though it was labelled optional in the LMS); this partially explains the higher numbers for this screencast. In total, 84% of students completed at least one screencast, 45% completed half or more, and 21% completed at least seven of the eight.

3.2. Student Motivations

In a survey conducted at the completion of the academic year (approximately five months after the last transitioning screencast), students were asked to identify their primary reason for viewing the optional screencasts. While there were only 35 responses to the survey (4%), some clear and useful trends emerged. Responses, from most to least common, were

- To earn the bonus marks: 43%
- To help academically: 29%
- To help understand what to expect at university: 23%
- To learn about the topics: 3%
- Mistakenly thought they were mandatory: 3%

Of the students who completed the survey but did not view any of the screencasts, half identified the bonus marks being too small as the reason, and half indicated that they did not believe the screencasts would be beneficial.

3.3. Impacts

Comparing completion of screencasts to course grades, a regression analysis was performed in IBM SPSS 25. A correlation was noted between student performance on APSC 100 final exams and the number of screencasts completed (0.73%/screencast slope, r = 0.24, p < 0.001). In the subsequent course (APSC 101), the effect on individual grades (exams and individual assignments) was even more pronounced (0.91%/screencast slope, r = 0.26, p < 0.001). These are strong effects, suggesting a roughly 6% grade impact for those who complete all screencasts. In addition, a univariate analysis in SPSS was conducted with the above grades and considering completion of individual screencasts as factors (main effects only, no interactions). These analyses suggested completing screencasts 1 (mindset), 3 and 4 (neuroscience), and 5 (health) were statistically significant (p < 0.05) factors related to course performance. There were also statistically significant interaction effects noted with the remaining screencasts (suggesting they also had an effect when paired with screencasts 1, 3, 4, or 5), but those results are too detailed to report here. Lastly, care must be taken with these findings as they measure correlation not causation; observed effects may be due to students with healthy study habits being more likely to complete optional screencasts.

As another measure of impact, in the survey described in Section 3.1, there were seven questions relating to understanding and/or appreciation of screencast topics. Students were asked to use a five-point Likert scale (strongly disagree to strongly agree) in response to these question prompts, shown in Table 2 below. Average Likert
scale ratings for those who viewed the associated screencast and for a control (i.e. did not view) are shown in the table. Three of the prompts were intentionally phrased in reverse (indicated by “[R]” in the table), such that a “strongly disagree” response would be expected from those familiar with the topic. Scores of 1 to 5 were assigned to Likert ratings, with the top score of 5 corresponding to “strongly agree” in the regular prompts and to “strongly disagree” in the reverse prompts (i.e. in all cases a higher number shows greater understanding and/or appreciation of the topic).

Table 2: Student understanding and appreciation of topics (differences with p ≤ 0.05 denoted by *)

<table>
<thead>
<tr>
<th>Prompt (and screencast)</th>
<th>Control</th>
<th>Viewed</th>
</tr>
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<tbody>
<tr>
<td>Intelligence is not fixed and can be changed with effort. (Mindset)</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Those who understand how the brain stores and retrieves memories tend to perform better academically. (Neuroscience 1)</td>
<td>2.5</td>
<td>3.7</td>
</tr>
<tr>
<td>One of the most effective exam study strategies is to reread the textbook or class notes. (Neuroscience 2) [R]</td>
<td>3.3</td>
<td>4.1</td>
</tr>
<tr>
<td>A good night’s sleep before an exam is more important than staying up 2-3 hours later to study. (Health)</td>
<td>4.8</td>
<td>4.3</td>
</tr>
<tr>
<td>We should try to eliminate stress from our daily lives. (Stress) [R]</td>
<td>3.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Once you develop effective study strategies, learning requires minimal effort. (Metacognition) [R]</td>
<td>3.4</td>
<td>3.8</td>
</tr>
<tr>
<td>It is more effective to study for three 30-min study sessions with breaks rather than one continuous 3-hour session. (Strategies)</td>
<td>3.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Those who viewed the screencasts tended to respond more consistently with effective learning approaches (average score 3.9) versus the control group (average score 3.5). On six of the seven prompts, those who viewed the screencast associated with the prompt scored higher; the exception was for the prompt regarding the importance of sleep before an exam, in which case the control scored higher. All results were statistically significant to better than p = 0.05.

3.4. Student Ratings

In the same survey, students were asked to rate their prior familiarity with the screencast topics before they had viewed the screencast, as well as the helpfulness of each screencast viewed. As shown in Fig. 2, students were most familiar with the concepts of mindset and the importance of health (sleep, diet, and exercise) on learning, and they were least familiar with the neuroscience of learning (how learning works) and the concept of metacognition. The mean rating shown on the right axis is based on “very familiar” = 4 to “not at all familiar” = 1, with “unsure” = 0.

In terms of helpfulness (see Fig. 3), students generally found all screencasts helpful. The average helpfulness rating was 2.9 (“helpful”), with 70% of students rating the screencasts as “helpful” or “very helpful” on average. Only a single screencast (Mindset) received any ratings in the “not at all helpful” category, which likely explains part of the drop in view rates summarized in Fig. 1.

Further analysis was conducted to determine if there was a relation between a student’s reported familiarity with a topic and their perception of the helpfulness of the associated screencast. The expectation was that students would find screencasts more helpful if the topics were new to them. Against expectations, a weak positive correlation (r = 0.10) overall was observed, indicating students rated screencasts slightly more helpful when they were more familiar with the topics. The correlations for individual videos ranged from a low of r = -0.27 (video 8, strategies), to a high of r = 0.19 (video 2, models). Taken together, these findings suggest students’ perception of helpfulness of the screencasts is largely independent of their prior exposure to the topics.

4. CONCLUSIONS

A set of online materials on the transition to university learning was created and deployed in a large, first year
introduction to engineering course. In total, eight screencasts consisting of narrated video, interactive questionnaires and other instruments, and graded quizzes were introduced. Although the materials were optional, students appear to have found them beneficial as roughly half of the class viewed at least half of the screencasts. The opportunity to earn a small course bonus mark was a key incentive, but over 50% of students identified academic and university transition benefits as their reasons for viewing.

In terms of impact, a positive correlation was observed between the number of screencasts viewed and course grades (+0.8% to grades per screencast viewed). In addition, in a survey taken five months after the last screencast, students who had viewed a particular screencast scored significantly better on questions relating effective study practice and core screencast messages compared to those who had not viewed the screencast. Finally, overall student ratings of the screencast series were positive, with approximately 70% of survey respondents rating the screencasts as helpful or very helpful in their studies. The degree of helpfulness did not appear to be affected by students’ prior exposure to the screencast topics.

Taken together, the above results suggest the use of online screencast materials to aid students in the transition to university is effective. The survey used to collect some of the supporting data had a low response rate; however, the results were consistent with other measures used to gauge effectiveness, such as participation rates and course grade impacts.

Given the success of this pilot, materials will be refined and used again next year. The incentive structure will likely be revisited to see if there is a way to increase participation. In addition, more rigorous measures of impact, including further analysis of correlations to grades and more detailed assessments of behavioural and attitudinal changes, will be considered.

References


