Keeping everyone OnTask: Gauging the impact of personalised feedback through academic case studies

Lisa Lim
Teaching Innovation Unit
University of South Australia

Sandra Barker
School of Management
University of South Australia

Anthea Fudge
UniSA College
University of South Australia

Steve Kelly
School of Art, Architecture and Design,
University of South Australia

Student-directed feedback is an important factor in student achievement. However, contemporary higher education presents challenges for instructors to be able to provide timely and personalised feedback, especially in the context of large courses. Learning analytics can be employed as a viable solution to the challenges of feedback provision, as it draws on learner engagement data and individual progress to enable personalised learning feedback to students. Many student-facing LA reporting systems have been developed, but these have been criticised as being too generic to be useful for stakeholders. Recently, research has begun to explore more contextualised LA-based approaches to feedback, which allow instructors to select relevant metrics of engagement to provide personalised feedback to students. This paper describes three case studies currently being carried out at one Australian higher education institution, which employs one such system, referred to as *OnTask*. The considerations of using such systems are discussed.

Keywords: learning analytics, higher education, large enrolment courses

Introduction

Student-directed feedback is a significant factor in student achievement (Hattie, 2014). In particular, personalised feedback has a significant impact on student self-regulated learning (Butler & Winne, 1995; Hattie & Timperley, 2007) and therefore, overall academic performance (Hattie, 2014). However, the challenge for 21st century higher education instructors is in providing feedback to large and diverse cohorts in an effective way. While quality teaching practice necessitates the provision of effective and high-quality feedback (Biggs & Tang, 2007), evidence points to students' dissatisfaction with their given feedback (Carless, 2006; Pitt & Norton, 2017). Learning analytics can provide a viable solution to the challenges of feedback provision, by drawing on learner engagement data and individual progress to provide a basis for personalising student learning feedback. This innovative approach positions "one of the most influential aspects in the quality of the student learning experience, feedback, within the current research space of the EDM [educational data mining] and LA [learning analytics] communities" (Pardo, Poquet, Martinez-Maldonado, & Dawson, 2017, p.168). This paper describes three cases of work-in-progress to use technology-mediated, learning analytics-based feedback to support students in different teaching contexts.

Feedback to support learning

When directed to students, feedback refers to advice or comments given to work that is done by the student, in order to improve that work (Boud & Molloy, 2013). The research on student-directed feedback is vast, resulting in the proposition of various theoretical models (e.g., Butler & Winne, 1995; Kluger & DeNisi, 1996). These have further been distilled into key principles for effective feedback that supports learning, of which the following are examples:

1. Effective feedback focuses on the learner's process and self-regulation (Hattie & Timperley, 2007). This entails providing information to students about how they can produce work or complete a task to the desired standard or enhancing their self-evaluation or confidence to pursue the learning task. In this way, students' mastery and deep learning are impacted.
2. Effective feedback is given in a timely manner (Shute, 2008). For feedback to improve learning, there must be uptake by students. If students receive only one point of feedback at the end of summative assessment in a course, this will have limited impact on their ability to act on the recommended actions to improve their learning in the course. Thus, timely feedback should be given either immediately after a learning activity or formative assessment task, and also at multiple points during the course.
3. Effective feedback is actionable, giving specific instruction for learners (Price, Handley, Millar, & O'Donovan, 2010). Related to Point 1, feedback is only effective when learners understand what they need to do from it. Hence, feedback provision should not be adopted as merely an administrative task, but with

the view to help students adapt their learning in order to attain the desired outcome or goal.

4. Effective feedback has a positive tone and prompts dialogues about learning (Nicol & Macfarlane-Dick, 2006). Negative feedback affects students' emotions, such that students are less motivated to act on it (Ryan & Henderson, 2017). Therefore, students' interpretations should be taken into consideration when constructing feedback (Carless, 2016).

Though the above principles have been demonstrated widely through research, in practice, they are not without challenges. Contemporary higher education is characterised by large, academically diverse cohorts (Pardo, Poquet et al., 2017), thereby affecting instructors' ability to provide personalised feedback that is timely and actionable.

Learning analytics as an evidence-based approach to feedback

Learning analytics

Learning analytics (LA) can be leveraged as a solution to the twin challenges of providing timely, actionable, personalised feedback, and doing so for diverse and/or large cohorts. LA capitalises on big datasets produced by technology mediation in education, e.g. the use of learning management systems or other online learning platforms and tools (Ferguson, 2012). Interactions with these technologies leave digital footprints or traces that may be used as indicators of engagement, potentially providing insight to key stakeholders—institutions, instructors, students—about students' learning progress (Dawson, Gašević, Siemens, & Joksimovic, 2014).

Early research in this field tended to focus on institution-level concerns particularly retention (Colvin, Rogers, Wade, Dawson, Gašević, Buckingham Shum, & Fisher, 2015). The last five years has seen an increase in interest to adopt LA approaches to 'close the loop' (Clow, 2012) by way of providing feedback to students based on their own learning data. Such data-driven feedback could take many forms, especially learner dashboards, and also recommender engines and intelligent tutoring systems (see Bodily & Verbert, 2017, for a review).

With the increase in LA approaches being employed in education, a constant criticism that has been levelled at the field is that such approaches tend to be one-size-fits-all (Gašević, Dawson, & Siemens, 2015). Even learner dashboards, which show students their pattern of engagement or their tracked progress, have been argued to be too generic to be of any use (Teasley, 2017). Essentially, it is argued that feedback provided based on LA must be contextualised to the instructional design or context (Gašević, et al. 2015).

In response to this criticism, research has begun to explore more contextualised LA-based approaches to feedback. In these recent developments, the focus is on putting the data into the hands of instructors (Pardo, Poquet et al., 2017), allowing them to select only those metrics of engagement which are relevant to their own courses, and using these as evidence of students' learning progress to provide feedback.

OnTask

OnTask (Pardo et al., in press) is an LA-based application that collates information about students and their learning in a course, such as online engagement activity (from learning management system data), lesson attendance, and academic performance. The platform allows instructors to develop "if-then" rules to generate personalised messages to all students in their course. The same platform is then used to send out these emails (see Figure 1). An important aspect of *OnTask* is that instructors choose the metrics that serve as indicators of engagement specific to the course, thereby providing more contextualised feedback and support, a process lacking in many generic LA-based systems (Liu, Bartimote-Aufflick, Pardo & Bridgeman, 2017).

OnTask is open-source software, which is currently available in three versions (see https://www.ontasklearning.org/tool/). The versions differ in terms of the underlying platform, namely NodeJS and Django, but have the same functionality of generating a matrix containing student data, creating rules for providing personalised feedback, and delivering the feedback emails. The version of the software used in these case studies was installed at an institutional level and integrated into the institution's learning management system (LMS) which in this case is Moodle. This means that the application is linked seamlessly with the Moodle course database which stores students' interactions with the LMS. Instructors can work from their own computers to access the application within their course LMS and decide on the relevant metrics to use to provide students feedback.

OnTask facilitates instructors to carry out effective feedback practices, as described in Lim, Gentili, Pardo, Dawson, & Gašević (2018). It has been trialed in a few courses in higher education institutions in Australia (e.g., Pardo, Jovanovic, Gasevic & Dawson, 2017) with promising initial results on student satisfaction.

The remainder of this paper will describe three case studies of the use of this LA-based system for giving feedback.

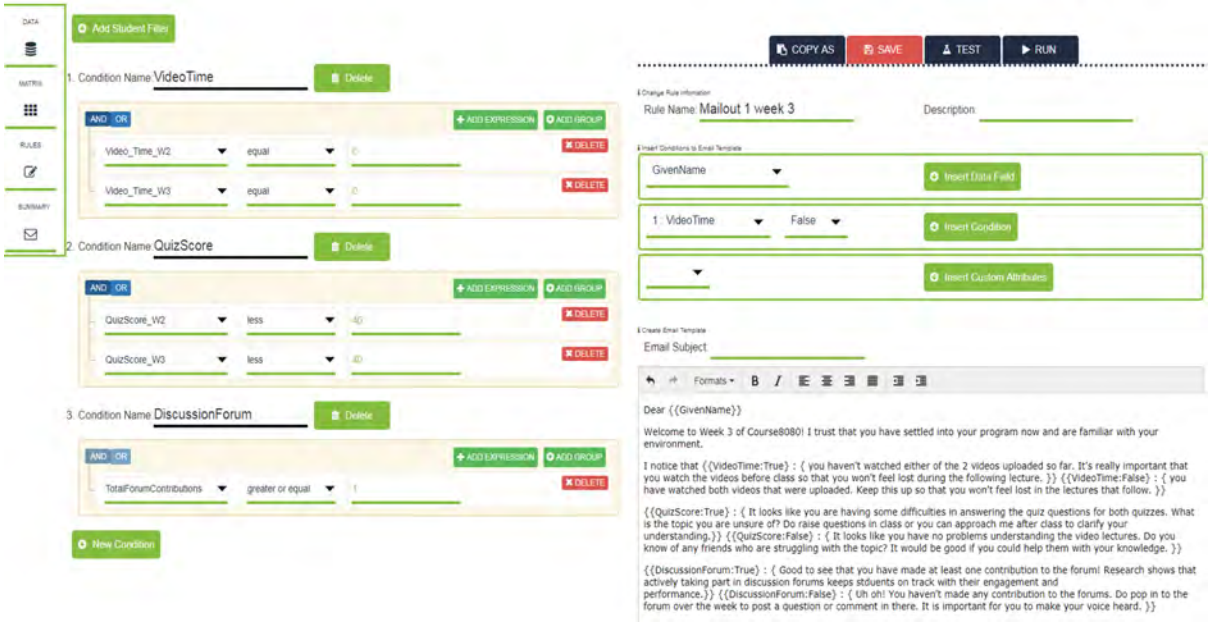

Figure 1: The OnTask interface showing "if-then" rule generation for personalised feedback

The case studies

Case Study 1: *OnTask* for Student Engagement

This case study was conducted with a group of third year undergraduate business students in the course Managing Decision Making. Students are required to undertake a number of formative and summative exercises throughout the study period as scaffolding for their major assignment. The course coordinator currently implements a non-automated system sending emails sent through MS Word email merge at key points throughout the study period to remind students to engage with the course materials as well as the formative and summative tasks required for completion that support the scaffolding of the major project. The focus of this case study is the encouragement of students to engage in the completion of the formative quizzes which allow both the student and the staff to understand their abilities with MS Excel software.

In 2017 the course coordinator was introduced to the *OnTask* software. *OnTask* has the ability to be set-up prior to commencement of the course(s) with the goal of improving the student learning outcomes that have been identified, through previous course coordinator knowledge, as not being achieved by some students. Pardo et al. (2017) identified that the use of this technology allows the instructor to "transform [my] expertise into highly situated, personalised student feedback" (p. 9). This feedback can be specifically tailored and personalised email feedback as per key triggers, interventions or directions/guidance as needed.

Table 1 below compares the demographic data for the two cohorts examined in this case study. Cohort 1 is pre-*OnTask* from the first semester of 2017 whilst cohort 2 is the *OnTask* trial group, first semester 2018.

Table 1: MS Excel quiz comparison data

	Cohort 1 (2017)	Cohort 2 (2018)
Total student enrolments	137	154
Internal students	99	97
External students	38	57
Quiz type	Formative	Summative (low %)

Quiz open	17th Feb – 24th June	19th Feb – 29th April
Course material identification of quiz	20th Mar	23rd April
Reminders given	27th Mar (in course materials and in-class) 3rd April (course materials)	26th Feb, 5th Mar and 2nd April (in-class)
Email reminders (*OnTask*)	None	26th April (pm)

As can be seen in Table 1 above, the cohorts of both offerings of this course are reasonably similar. In the review of the 2017 offering the teaching team felt that the lower than previously experienced results in the group project could have been improved if the formative assessment activities used for scaffolding the project, including the MS Excel quiz, were updated to summative assessment. This should then enforce that students had undertaken the preliminary support activities and as such improve all around group performance. The MS Excel quiz was therefore included in a series of three online activities in the 2018 offering, each weighted at 5% of the student's overall grade. Prior to this change it had been the course coordinator's opinion and experience that students generally disregarded low stakes assessment items to concentrate on the major pieces of assessment.

The results of the analysis of the two cohorts, shown in Table 2 below, identified that using the in-class and course material reminders produced similar completion results with 46.7% of the 2017 cohort completing the quiz whilst 49.3% of the 2018 cohort had completed the quiz with these standard reminders. The inclusion of the *OnTask* email being sent to students 3 days prior to the closing date of the quiz in 2018 led to an additional 47.4% of the class completing the quiz. It could be argued that the change from formative to summative assessment did have some impact on the total number of students completing the quiz however it is the opinion of the course coordinator that the intervention email from *OnTask* had a greater impact on this completion rate.

Table 2: MS Excel quiz completion data

	Cohort 1 (2017)	Cohort 2 (2018)
Total student enrolments	137	154
Total attempts	96 (70%)	149 (96.7%) *
Completed prior to identification in course material	21	42
Additional completions prior to major reminder	43 (26th Mar)	34 (26th Apr am)
Additional completions between major reminder and quiz close	13	73
Open attempts automatically submitted on close of quiz	19	0

** two students who did not complete quiz also did not submit any assessment items for the course.*

In addition, it should be noted here that it was not only the non-completers who were sent the *OnTask* email. All enrolled students were sent a personalised, targeted email based on completion of the quiz and the score achieved in the quiz. Students who had achieved full marks were congratulated and asked to be support tutors in the following week's class where the use of MS Excel would be discussed. Students who achieved passing, but not full marks were encouraged to review their responses and look carefully at the functionality that they answered incorrectly whilst students who achieved a fail mark were encouraged to attend the following week's class to obtain personal assistance in improving their MS Excel skills. A full list of the email criteria and email content can be seen in Appendices 1 and 2 of this paper.

The results of this small, pilot use of *OnTask* have encouraged the course coordinator who is now in planning to use this method of communication to replace all current non-automated, large scale emails that are sent to the students, particularly in the early weeks of the course to ensure students are engaging with the course materials and given every chance to contribute to the learning process within the course. This has certainly provided an efficient method for providing proactive feedback to students regarding their engagement with the course materials and assessment items.

Case Study 2: OnTask for Large classes

When teaching a diverse student cohort in the enabling education space at a university pathway college (UPC) with mid-high course numbers (from 200+ to 600+) this can be an intensive process to be able to address all student needs individually. The context of this case is to assist in personalising of feedback for large classes and

is to be trialled initially in the core University Studies course (200+ students) and to be implemented in the following iteration of this core course (600+ students). Students are new to the University system and with that may lack appropriate study skills and a sense of belonging within University culture and online study environment. In addition, UPC students may have limited positive past educational experiences and have a range of influencers including first in family, low socio-economic status (LSES), culturally and linguistically diverse (CALD) background or have been out of the schooling system for some time. These are similar issues that face large first year University courses and are complex considerations for decreases in student engagement, retention and potentially grades over a semester.

Using *OnTask*, as discussed in Case Study 1 above, allows the identification of specific trigger points at which feedback can be sent to students to prompt them to take appropriate action. Examples of triggers identified in this course include; engagement with the course site, assignment submissions, and performance in assessment. Data from these triggers allows the coordinator to target specific responses based on the level of engagement, submission and performance. Previous manual identification of these levels was specifically aimed at helping only students with critically low levels in each of these areas. However, *OnTask* not only enables this but also gives the coordinator the opportunity to remind and reward students who are active and performing well with ultimate goals of elevating performance by improving grades in all grade brackets together with increased student retention and engagement. Acknowledging and rewarding good use of digital tools or resources that assist with learning through the course site can improve individuals' engagement and performance through timely, relevant feedback with specific suggestions. The course coordinator, knowing the design of the course and therefore the key trigger points, can set-up *OnTask* parameters aligned with the intended course learning outcomes and LMS activities critical to course objectives.

Educators are already doing this manually and in conjunction with learning analytics data from course dashboards or students participation data however it is a very involved and time-consuming process. Due to limited time available, they generally only implement this with students at risk (low engagement/low grades) but are unable to do this with those students who, with further support, would have had the assistance to aim higher. For example, those students with P's to achieve C's or D's to HD's. It is not currently sustainable or the best use of an academic's time and therefore this automated (albeit personalised) system can assist with correcting (or reinforcing) positive learning behaviours and strategies.

In the context of this case study, the course coordinator currently implements a non-automated system sending individually constructed emails to students identified as being at risk through limited or no engagement with the LMS or low assessment grades. Using LA, LMS Dashboard, key roadblocks and assessment points across the semester, students were identified as 'at-risk' and personally emailed, messaged via the LMS or contacted by phone. As previously identified, this is a very time-consuming process particularly as course numbers grow or workload increases considering the pressures and changes to the higher education landscape. For a course coordinator to be investigating, emailing and/or contacting students at multiple time points throughout a study period is considerably demanding and becoming unsustainable. Currently the course coordinator only has sufficient time to capture those who completely non-engage or students on the pass/fail border to improve their outcomes if these interventions are early and timely. However, the coordinator also wants and understands the significance of supporting and connecting with students to elevate their grades to the next grade to further support and acknowledge the students' efforts.

This multi-strategy approach is summarised below:

- The less time spent sending individual emails and looking up student data equals more time for the course coordinator to provide elsewhere to help learners in deeper and more complex ways.
- There is a scalability component of the process and it can also be used for future course iterations.
- To enhance student engagement and further improve student retention.
- Develop students further with their grades and understanding i.e. from C's to D's or D's to HD's.
- Help to increase support provided to students and also reward those who currently tracking well (or are in the higher-grade ranges) that with limited time the coordinator does not have the time to focus on if they are busy trying to help students at the cusp of passing to be able to pass the course.

A comparison will be drawn with a previous course iteration with no specific feedback provided (2016), to the following year with increased feedback (albeit manually in 2017) to the 2018 cohort with the automated *OnTask* emails delivered. Evaluation of the intervention will be conducted using student feedback via MCE questions and delve further into student experiences with focus groups and/or a small survey. The evaluation would focus on investigating how the *OnTask* feedback intervention improved; final completion rates (attrition), student satisfaction, increased LMS engagement through assessment and/or activity logs via LA and overall grades as

one particular student success measure. This system can also reinforce engagement with online materials and activities by reaching out, making connections and communicating with students.

Further enhancement and tracking of emails will be trialed by embedding short URL's into the initial email to test whether this data is able to track how immediate the response can be from a student and how this situated and personalised feedback with specific links to support or activities within a course can assist students.

Case Study 3: *OnTask* for Student Wellbeing

In addition to Case Studies 1 and 2; engagement and performance, this case study will discuss the inclusion of *OnTask* interventions assessing student wellbeing as an emotional state of mind. The proposed use of *OnTask* is to develop a series of specifically targeted, personalised feedback emails which will provide students with suggestive correctional changes to improve their wellbeing and, as a result, their academic performance.

In the context of this case study, the course coordinator currently implements a non-automated system sending emails with remedial guidance for early engagement, low participation and poor assessment and has been additionally trialling corrective advice concerning personalised self-regulatory self-assessment of a student's state of mind at various points in course progress.

The aim of this case study is to develop and evaluate student positioning on a graph representing common emotional experiences or states of mind that generally occur in the course. This study is situated in a first-year design course targeting attrition and retention and will be subsequently rolled out in a second-year digital communications course targeting the reduction of student worry and anxiety, and motivation to improve their performance through emotional stability. These courses displayed high student attrition, unsustainable levels of staff involvement and poor student knowledge retention. Ellis and Goodyear refer to this as "surface and achieving", where the student focusses on short-term performance rather than deep learning (Ellis & Goodyear, 2009).

A recent course redesign has followed Clow's Closing the Loop (Clow, 2012) realigning objectives, outcomes and assessment with a strong grounding with learning analytics through effective interventions. The redesign incorporated scaffolded learning activities aligned to course objectives and outcomes. Assessed online quizzes tested application of knowledge learnt in activity workshops however, these provided little individual feedback. Workshop activities allowed an environment to understand and test the skills required for each task and set appropriate challenges to test content understanding and comprehension. As the semester progressed, challenges increased in difficulty and required less staff support.

Two outcomes drive developing the use of learning analytics and data-driven responses. Reflecting on the approaches from case studies 1 and 2 above, the desire to increase personalised feedback within the current environment where academic staff have a reduced capacity to provide individual students advice on academic progress. The second driver extends Wright, McKay, Hershock, Miller & Tritz's (2014) concept of 'Better than Expected', where learning analytics are used to extend student achievement at all levels, to student experience and expectation of performance.

Staff observation and student feedback of previous courses identified a range of (emotional) experiences from worry and stress to confidence and boredom related to the in-class tasks, activities and exercises. These 'states of mind' align with Vygotsky's Zone of Proximal Development and Csikszentmihalyi's Flow Theory. Terms such as of scaffolded learning, "in the zone" or "in the groove "and "in the Flow" are central to Vygotsky's and Csikszentmihalyi's theories and provide an opportunity to realign teaching intentions with course learning objectives and form the basis for the design of the student questionnaire (Shernoff, Csikszentmihalyi, Schneider & Shernoff, 2014).

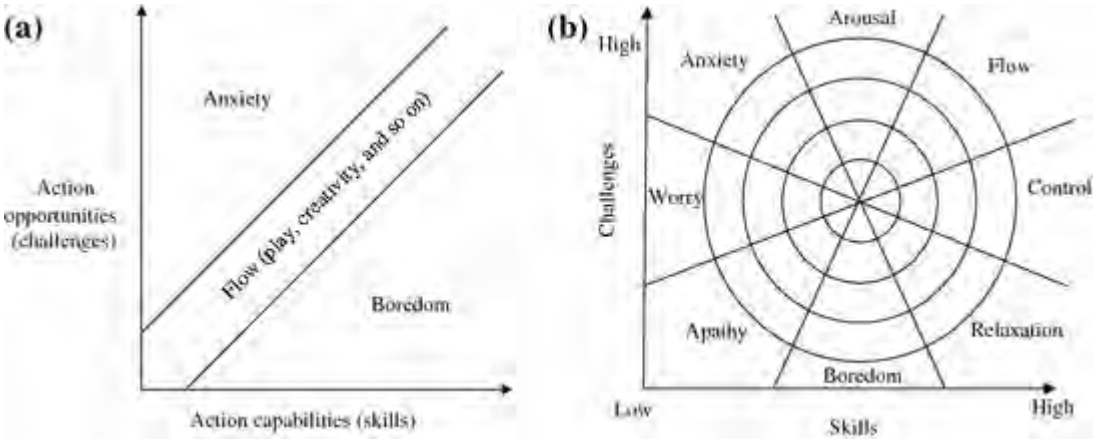

Figure 2: Csíkszentmihályi's Flow theory (Nakamura & Csikszentmihalyi, 2014)

Delivery of the questionnaire will occur at two key points throughout the semester. This questionnaire will allow students the opportunity to self-assess their positioning on an adapted version of Figure 2(b) above. A response will offer understanding and supportive acknowledgement of this placement and suggestions or techniques to return to a balanced position in the flow. For example, a student who identifies with worry will receive an automated response from *OnTask* indicating that the subject matter that they have recently been learning may be difficult to understand at first. Suggesting that the student revisits the course content and develops the skill set required. This will help alleviate their stress and reduce the worry or concern that they have indicated they are currently experiencing. In future iterations of the survey, student responses will trigger specific suggestions for attaining the required skill set.

Designing techniques for evaluating student development and engagement enables a closing of the loop (Clow, 2012) including greater alignment of objectives and continuous feedback (Biggs, 2012). The data gathered through the student surveys will ascertain identification and accuracy of the classifications, to determine whether re-direction from either side of the 'Flow' graph is helpful as a feedback tool and ultimately whether data driven interventions reinforce learning, promote and extend application of knowledge and contribute to a healthier ecology in the course (Ellis & Goodyear, 2009).

Conclusion

The common theme in the three case studies presented in this paper is the desire of the course coordinator to be able to efficiently and effectively identify, elevate and acknowledge student performance, leading to increased engagement with the curriculum and therefore reduce attrition and increase student grades. Case Study 1 has shown that not only was this achieved but has enabled a reduced academic workload for future iterations. Case study 2 complex large cohort approach seeks to help students feel empowered with their learning and enhances what the course coordinator has undertaken in the past with guidance, feedback and support. The outcome of this strategy is to assist in transitioning students to independent learners. Case Study 3 extends the use of *OnTask* to facilitate support in assessing student wellbeing as an emotional state of mind. This is achieved through the early intervention emails providing feedback and personalised responses to targeted students.

An area of reflection from the perspective of the course coordinator is the apprehension of utilising the feedback software replacing traditional student communications i.e. email and discussion forums. It is the view of the authors that automated feedback systems that utilise the coordinator's voice and that are specifically focused on personalised feedback, create a more efficient and effective method for communicating with the learners. Automation of these processes supports and reinforces best practice in teaching and learning by allowing a structured approach to the provision of feedback when the student needs it most.

Further research into the use of *OnTask* is already underway with the course coordinators from Case studies 2 and 3 above implementing a range of applications in late 2018 and proposed additional work for 2019. Case study 2 has commenced work on the pilot addressed above with a cohort of 300 students which will be expanded to a core course in early 2019 with an anticipated enrolment of around 700. It will also be used in non-core science courses with an aggregate of over 300 students. These studies will also consider the student perceptions of the emails that they receive from *OnTask*.

Case study 3 will be specifically targeting a second-year digital course (80 students) where students self-assess their state of mind which enables skill and challenge levels within the course to be evaluated (see Figure 2). The roll-out of the pilot study in case study 3 was undertaken in anticipation of embedding these opportunities in this second-year course. A full evaluation of the student experience and outcomes of the personalised feedback will be reported in future publications.

The course coordinator for case study 1 is working with other academics within the Business School to implement a wider rollout of *OnTask* in early 2019. A comparative study of a variety of undergraduate courses will be considered to further explore the impact on retention and assessment results of the personalised feedback.

To ensure that the intent of the feedback is understood, it is essential that clear responses are used to direct students, ensuring that the tone and specific language used are commensurate with that of the course coordinator. The key focus of all three course coordinators is that the approach must be learner centred – so that no matter where students start in the learning journey, the *OnTask* system can enable a personalised approach which builds on the skills they already possess.

References

Biggs, J. B. (2012). What the student does: teaching for enhanced learning. *Higher Education Research & Development*, *31*(1), 39-55. https://doi.org/10.1080/07294360.2012.642839

Biggs, J. B & Tang, C. S. (2007). *Teaching for quality learning at university: What the student does.* McGraw-Hill/Society for Research into Higher Education & Open University Press: Maidenhead.

Bodily, R., & Verbert, K. (2017). Review of Research on Student-Facing Learning Analytics Dashboards and Educational Recommender Systems. *IEEE Transactions on Learning Technologies, 10*(4), 405-418.

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment & Evaluation in Higher Education, 38*(6), 698-712.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65*(3), 245-281. https://doi.org/10.3102/00346543065003245

Carless, D. (2016). Feedback as dialogue. In *Encyclopedia of Educational Philosophy and Theory,* 1-6.

Carless, D. (2006). Differing perceptions in the feedback process. *Studies in Higher Education, 31*(2), 219-233.

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. In : A., Kozulin, B. Gindis, V. Ageyev, & S. Miller. *Vygotsky's educational theory in cultural context*, (pp. 39-64). Cambridge University Press, Cambridge.

Clow, D. (2012). The learning analytics cycle: closing the loop effectively. In S. Buckingham Shum, D. Gašević, & R. Ferguson (Eds.), *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 134-138). ACM. https://doi.org/10.1145/2330601.2330636

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gašević, D., Buckingham Shum, S., & Fisher, J. (2015). *Student retention and learning analytics: A snapshot of Australian practices and a framework for advancement.* Research Report. Sydney: Australian Office for Learning and Teaching. Retrieved from http://www.research.ed.ac.uk/portal/files/21121591/Final_Report_190615.pdf.

Dawson, S., Gašević, D., Siemens, G., & Joksimovic, S. (2014). Current state and future trends: A citation network analysis of the learning analytics field. In *Proceedings of the Fourth International Conference on Learning Analytics and Knowledge* (pp. 231-240). ACM. https://doi.org/10.1145/2567574.2567585

Ellis, R. A., & Goodyear, P. (2009). Thinking ecologically about e-learning. In R.A. Ellis & P. Goodyear (Eds.) *Students' experiences of e-learning in higher education: The ecology of sustainable innovation*, (pp. 16-38). London, Routledge.

Ferguson, R. (2012). Learning analytics: Drivers, developments and challenges. *International Journal of Technology Enhanced Learning, 4*(5-6), 304-317. https://doi.org/10.1504/IJTEL.2012.051816

Gašević, D., Dawson, S., & Siemens, G. (2015). Let's not forget: Learning analytics are about learning. *TechTrends, 59*(1), 64-71. https://doi.org/10.1007/s11528-014-0822-x

Hattie, J. (2014). *Visible learning for teachers: Maximizing impact on learning.* Florence, GB: Routledge.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112.

Kluger, A. N., Denisi, A., & Steinberg, R. J. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*(2), 254-284. https://doi.org/10.1037/0033-2909.119.2.254

Lim, L., Gentili, S., Pardo, A., Dawson, S., & Gašević, D. (2018). Combining technology and human intelligence to provide feedback and learning support using OnTask. In A. Pardo, K. Bartimote-Aufflick, G. Lynch, S. Buckingham Shum, R. Ferguson, A. Merceron, & X. Ochoa (Eds.), *Companion*

Proceedings of the 8th International Conference on Learning Analytics and Knowledge. Sydney, Australia: Society for Learning Analytics Research.
Liu, D. Y.-T., Bartimote-Aufflick, K., Pardo, A. & Bridgeman, A. J. (2017). Data-driven personalization of student learning support in higher education. In A. Peña-Ayala (Ed). *Learning Analytics: Fundaments, Applications, and Trends* (pp.143-169). Springer International Publishing.
Nakamura J. & Csikszentmihalyi M. (2014) *Flow and the Foundations of Positive Psychology*. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9088-8
Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199-218.
Pardo, A., Jovanovic, J., Gasevic, D., & Dawson, S. (2017). Using learning analytics to scale the provision of personalised feedback. *British Journal of Educational Technology.* doi:10.1111/bjet.12592
Pardo, A., Bartimote-Aufflick, K., Buckingham Shum, S., Dawson, S., Gao, J., Gašević , D., . . . Vigentini, L. (In Press). OnTask: Delivering Data-Informed Personalised Learning Support Actions. *Journal of Learning Analytics,* 24.
Pardo, A., Poquet, O., Martinez-Maldonado, R., & Dawson, S. (2017). Provision of data-driven student feedback in LA and EDM. In C. Lang, G. Siemens, A. F. Wise, & D. Gašević (Eds.), *Handbook of Learning Analytics.* Society for Learning Analytics Research and the International Society for Educational Data Mining. https://doi.org/10.18608/hla17.014
Pitt, E., & Norton, L. (2017). 'Now that's the feedback I want!' Students' reactions to feedback on graded work and what they do with it. *Assessment & Evaluation in Higher Education, 42*(4), 499-516.
Price, M., Handley, K., & Millar, J. (2011). Feedback: focusing attention on engagement. *Studies in Higher Education, 36*(8), 879-896. https://doi.org/10.1080/03075079.2010.483513
Ryan, T., & Henderson, M. (2017). Feeling feedback: students' emotional responses to educator feedback. *Assessment & Evaluation in Higher Education,* 1-13. https://doi.org/10.1080/02602938.2017.1416456
Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2014). Student engagement in high school classrooms from the perspective of flow theory. In M. Csikszentmihalyi (Ed.) *Applications of flow in human development and education* (pp. 475-494). Springer, Dordrecht.
Shute, V. J. (2008). Focus on Formative Feedback. *Review of Educational Research, 78*(1), 153-189.
Wright, M. C., McKay, T., Hershock, C., Miller, K., & Tritz, J. (2014). Better than expected: Using learning analytics to promote student success in gateway science. *Change: The Magazine of Higher Learning*, 46(1), 28-34. https://doi.org/10.1080/00091383.2014.867209

Appendix 1 – *OnTask* Criteria example from Case Study 1

Condition 1: Not Completed: Quiz Grade = 0
Condition 2: Completed but needs work: Quiz Grade >0 and <=10
Condition 3: Completed HD: Quiz Grade >10 and <15
Condition 4: Full Marks: Quiz Grade = 15

Appendix 2 – *OnTask* Email Example

Dear {{STUDENT_FIRST_NAME}},
Welcome back after the mid-break. I hope you are now working hard towards the completion of this course. Over the next few weeks we will be concentrating on completing your Group Project tasks as well as your Decisions in Meetings Blogs.
{{Not completed:True} : {I note that you have not yet completed the Excel Basics Quiz which is due this coming Sunday, 29th April. Please log in and complete this as soon as possible as we will be using the results of this quiz to customise our teaching next week when we look specifically at the use of Spreadsheets for decision making. }}
{{Completed but needs work:True} : { I see that you have been proactive and completed the Excel Basics Quiz due this week, well done. Your result of the quiz shows that there are some areas that you need to work on to improve your use of MS Excel. We will be working on these in our internal workshops and external virtual classrooms next week so please come with your questions. }}
{{Completed HD:True} : { I see that you have been proactive and completed the Excel Basics Quiz due this week, well done. Your result of the quiz shows that you have a very good knowledge of MS Excel and may only have a couple of areas to look at. We will be working on these in our internal workshops and external virtual classrooms next week so please come with your questions. }}
{{Completed Full Marks:True} : {I see that you have been proactive and completed the Excel Basics Quiz due this week, well done. Your result of the quiz shows that you have an excellent knowledge of MS Excel as shown by receiving full marks. As we will be working on these skills in our internal workshops and external virtual

classrooms next week it will be a good opportunity for you to take up the learn-do-teach philosophy of improving your knowledge by training others. I will be looking for you to assist other students in your group with how to use MS Excel.}}
[…other text added here…]
Please note: The information in this email is correct at the time of sending and does not reflect your activity after this time.
Kind regards

Please cite as: Lim, L., Barker, S., Fudge, A. & Kelly, S. (2018). Keeping everyone OnTask: Gauging the impact of personalised feedback through academic case studies. In M. Campbell, J. Willems, C. Adachi, D. Blake, I. Doherty, S. Krishnan, S. Macfarlane, L. Ngo, M. O'Donnell, S. Palmer, L. Riddell, I. Story, H. Suri & J. Tai (Eds.), Open Oceans: Learning without borders. Proceedings ASCILITE 2018 Geelong (pp. 184-193).

https://doi.org/10.14742/apubs.2018.1913