

Data-informed advisories to support the adult learner in higher education

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Providing learners with continuous advisement and feedback is a key part of encouraging positive learning behaviours. This paper presents the development of data-informed learning advisories for the adult learner in higher education. As part of the university's learning support, this set of data-driven advisories were designed and targeted to nudge the adult learners to improve course-taking and online learning behaviour. As many have to balance work, study and family commitments; the advisories are designed to encourage and share positive academic practices that are drawn from the data. The advisories also nudge struggling learners into awareness that their learning behaviour differs from that of more successful peers. Reminder nudges assist adult learners in their decision-making. The advisories take into account both the phrasing and mode of communications in order to clarify information, assist planning and increase engagement.

Keywords: learner advisement, data-driven advisories, adult learners, learning analytics

Introduction

In the past decade, universities have experienced a “massive expansion in adult enrolment” (Eduventures, Inc., p.5, 2012). Technological developments and a knowledge-centric economy in the workplace in Singapore have led to a demand for a highly skilled and knowledgeable workforce. To further complicate the situation, Singapore is facing a rapidly ageing population coupled with declining birth rates. These developments are both disruptive and positive for the economy and the society. While workers are being displaced, new job opportunities are made available. Strategic policies and provisions are required to build and support an educated and skilled workforce. Policies and provisions included widened access of education to various non-traditional communities, such as adult learners. This is significant, as more adults are turning to higher education institutions to start, continue or complete their degrees (Finn, 2011; Chong, Loh & Babu, 2015). Many pursue learning to enhance their competitiveness in the workforce, attain a professional requirement and be enriched intellectually.

With increasing adult learner enrolments in colleges and universities, adult learners, more than ever, will require support and nudges to help them successfully transition into student life (Sandman, 2010). Adult learners enrolled in higher education face several challenges. Adult learners juggle competing demands on their time from study, family, work, and other commitments. With more adult learners seeking to enter higher education than ever before, there is a growing need to provide appropriate and targeted advisement for the adult learner. “The experiences of adult learners in higher education and their learning needs, interests, styles, and overall success have largely been neglected” (Kasworm, Sandmann, & Sissel, 2000, p.17).

As institutions amass data, adopting an evidenced-based approach is key to improving and maximising learners' outcomes. Data collected from and about the adult learners can better inform teaching and learning as well as put in place advisories that nudge learners towards positive learning. Higher education institutions are able to identify predictors of university success for the adult learner population. These advisories are a key source of nudging constructive and productive learning practices as well as providing open avenues for communication with the learner.

Advisories in the form of nudges have been used by governments to change behaviours around health, finances and recycling. This use of behavioural economics can be used in education to promote learner success. However the advisories or nudges will require an understanding of how and why adult learners make the decisions they do. As such, universities can employ analytics tools to target their nudge interventions. These tools use existing data to determine patterns of successful behaviour, predict future outcomes, and inform interventions that put learners on the path to success. In this context of advisories and nudges, guidance that are data-informed rather than based on anecdotal advice is usually more beneficial to the learners (Cuseo, 2008). This paper presents a set of data-informed advisories that were used to improve course taking and online learning behaviour in a Singapore university for adult learners. To craft and develop the advisories, data is collected from explicit learner actions,

such as completing assignments and taking exams, and from tacit actions, including online interactions as well as other types of learner data to provide insights for purposeful teaching and learning.

Context & Scope of Study

As Singapore's only university targeted primarily at working adults and adult learners, the university created a unique flexible learning environment that enables learners to learn at their own time, place and pace. In addition, to better serve its learners the university adopted a web-based learning management system in 2007 and a substantial portion of learning in the university is situated in this online learning environment. The online learning platform becomes an important touchpoint where learners and instructors engage to exchange information and knowledge; hence, online engagement invariably revolves around the learning management system, its online access and is associated with learner-to-learner, learner-to-content, and learner-to-instructor interactions (Wong & Chong, 2018). Importantly, the proxies of online learning behaviour together with other attributes associated with course-taking behaviours can be associated with different patterns of learning behaviour. These patterns of course-taking and online learning behaviour, together with other potential determinants of academic performance, are associated with particular levels of academic success for translation into learning advisories.

The study explored the design and implementation of data-driven advisories to encourage positive and productive learning behaviours with adult learners in part-time undergraduate programmes. The design focused on a structure of advisories that nudge current learners to benefit from the 'successful experiences and behaviours of others'. The 'successful experiences and behaviours' were based on in-depth analysis of trend data of the adult learners' course taking and online learning behaviour. This approach combined analytical insights with positive psychology and behavioural nudges – where reminder nudges are constructed from insights gleaned from analytics, and carefully construed in a positive manner to motivate and foster learning.

From data to learning advisories

Data Acquisition

Data came from six intakes of the part-time undergraduate programme of over 8,000 records. Data collected about the learners are categorically put into several phases and as they progress along their learning journey – this includes enrolment data, throughput data, and graduation data. There are two populations of interest. The first group comprises the "good performers" who managed a cumulative grade point average (CGPA)/grade point value (GPV) of > 4.0 , and the second group of learners who managed a CGPA/GPV of ≤ 2.5 and are at risk of academic attrition. Hence, a dichotomous target variable is also constructed for modelling, representing the two populations of interest (i.e., good performers and those at-risk).

Enrolment data

The use of enrolment data in predicting learner success at the tertiary level is well-documented and established across many studies; and this includes determinants such as prior academic ability, demographics and work-related indicators (Palmer, Bexley, & James, 2011). As a university that is rooted in providing life-long education to adult learners, the university's learner profile is typically characterised by a diverse range of learners from different life stages and educational backgrounds; and the learners manage the rigours of a university programme in different ways. In view of this, the enrolment data is of particular interest as they can have an association with learners' performance. Table 1 provides a sample of the enrolment data that is used for modelling.

Table 1: Variables used in effects assessment of good performing and at-risk adult learners

Phase	Data type	Data attributes
Enrolment data	Demographics	Gender, Race, Age, Marital status, Nationality, Residency, National service status
	Work-related	Employment status, Industry, Company sponsorship, Company size, Designation level, Annual salary, Relevant industry experience, (Whether degree is) Applicable to work environment
	Prior Educational	Level of academic qualification, Awarding institution, Pre-university grades, Mode of study, Relevance of prior education to degree
	Matriculation	Matriculation identifier, Matriculation information
Throughput data	University	Transfer of programme status, Restart status, Credit units exemption, Semestral grade, Student phase
	Course-taking behaviour	Number of courses taken/completed/failed/withdrawn, Credit units taken/completed/failed/withdrawn, Number of coursework-only courses taken, Number of examinable courses taken, Number of university core courses taken/completed/failed/withdrawn
	Online learning behaviour	Proxies of online learning behaviour (Wong & Chong, 2018)

Learning behaviours of good performing and at-risk learners

Various analysis and data mining techniques were used. Decision trees, specifically the Chi-square Automatic Interaction Detector (CHAID) tree algorithm, was used to associate the groups' academic performance (i.e., good performers whose CGPA > 4.0, and those at-risk whose CGPA ≤ 2.5) with enrolment variables, university variables, and course-taking behaviour variables. The resulting tree generated a series of significant splits ($p \leq 0.05$) allowing for a multivariate interpretation of the independent variables and its effect on academic performance. By introducing behavioural data into the algorithm, the resulting tree will be an informative illustration of how a sequence of determinants leads to higher probability of academic success, which can be converted into a series of learning advisories for improving learners' study habits.

Analysis of variance is used to support the validity of statistical conclusion when comparing the online learning behaviour across the two groups: high performing learners with GPV > 4.0 and the at-risk learners with GPV ≤ 2.5. Their online learning behaviour which is measured by the proxies of online learning behaviour are examined to deduce whether observed differences in the group behaviour are significant. The results are then translated into a series of learning advisories.

Analysis and findings

Several determinants of academic success stood out from the analysis. The main significant findings ($p \leq 0.05$) from the CHAID tree are consolidated in Figure 1. There are consistent patterns among learners who are able to achieve a CGPA > 4.0. These patterns repeat themselves across different cohorts at various phases of their learning journey. Good performers have been observed to have taken fewer credit units (CU) per active semester. They have also withdrawn less from courses, and are found to have a better balance and spread of core university courses (UCOR) across the 1st half of their programme. In addition, good performers have better foundations in numeracy and literacy skills. Furthermore, learners with more working experience have benefitted from the applied learning approach of the university.

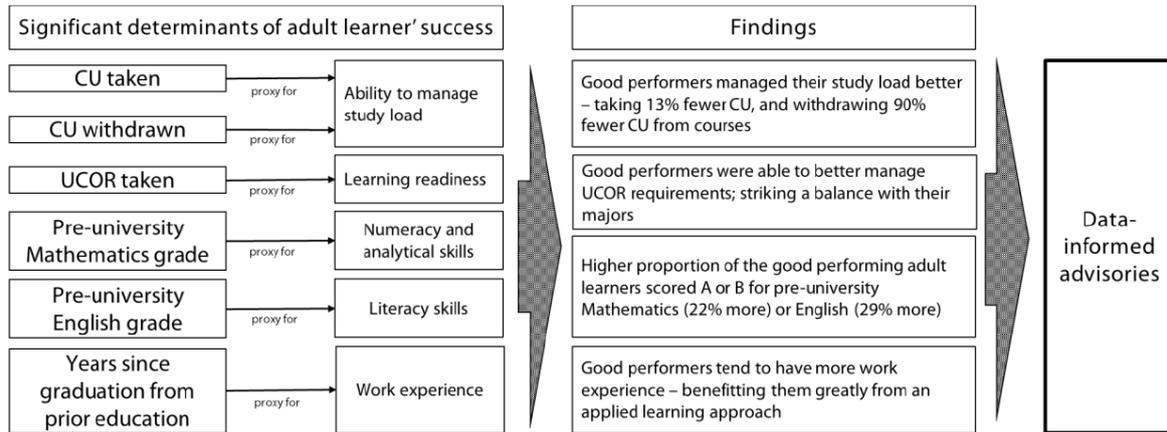


Figure 1: Summary findings from CHAID analysis of course-taking behaviour and other attributes

Collectively, the proxies of online learning behaviour explain up to 55% of the variation in the GPV of good and at-risk performers. On average and of statistical significance ($p \leq 0.05$), good performers have been observed to access their online learning materials earlier; they have also frequent the online learning activities to scaffold their learning; are associated with a wider access of online learning materials; and have been found to optimise their revision with online materials close to end-of-course assessments (see Figure 2).

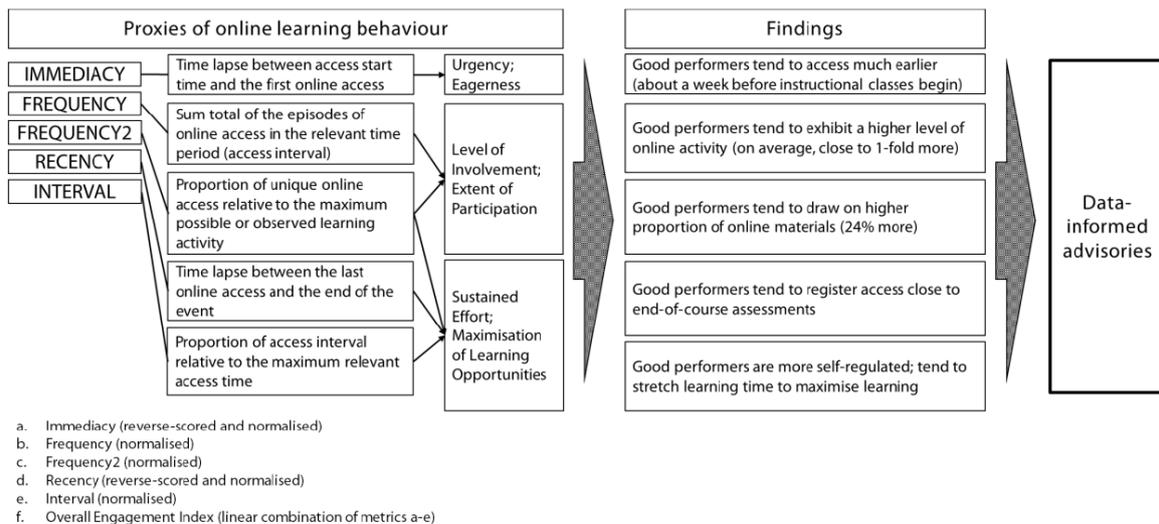
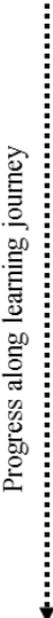


Figure 2: Summary findings from analysis of online learning behaviour

Structuring of the learning advisories

The findings of the high performing learners highlighted key determinants that influence academic success and these included (1) real-world working experience and applied learning to the workplace, (2) stronger fundamentals in literacy and numeracy skills, (3) better management of study load, (4) good balance and spreading out core university courses over more semesters, (5) better planning, (6) advance preparation by accessing online course materials earlier, (7) more utilisation of the online course materials to build up knowledge, (8) revision and consolidation of their learning near end-of-course assessments. These findings are consolidated and translated in a series of positive advisories depicted in Figure 3. For example, one advisory which urge learners to pick up *COR160 Essential Academic Writing Skills early* are for learners who may need to strengthen their literacy skills. Another advisory for learners who (are on course) may have already taken a few courses into their programme to be mindful *not to overload on CUs*, and to exercise greater agency to better manage their study load. This advisement is repeated again to remind learners who are near completion of their programme to keep to maintaining a good balance.

Clear communication of the advisories is a priority. The format of it (whether in print or digital), the timing of the communication, the mode of its delivery and its location (i.e., which mode or location can maximise our catchment) are some of the considerations. At the end, we adopted a multi-pronged effort – where some of these advisories were highlighted by deans during the orientation to newly-matriculated learners, which was complemented with the use of digital boards to reach the wider population of adult learners who are in different stages of their learning journey.



Start Zen: Keep calm and cool; don't rush on University Core	Hone Your Craft: Accumulate literacy & numeracy skills : e.g. pick up COR160 Essential Academic Writing Skills early	Devise a Strategy: Zoom in on online materials ; build knowledge and maintain momentum
Eyes on the Prize: Be an active learner , focus on your course objectives	Garner Experience: Real-world experience counts, apply to your learning	Stay on Course: Steady wins the race; don't overload on CUs
Sharpen your Repertoire: Enhance learning readiness with University Core	Preparation Wins All: Plan in advance , pin down all materials early , retreat, reflect and absorb	Level-Up: Take stock, revise with past-year exam papers. Keep levelling up
Practise Makes Perfect: Put theory into practice	Aim for the Finishing Line: Focus on a study plan ; be disciplined and keep to the grind	Stay Agile & Nifty: Be flexible with your CU load

Figure 3: Series of advisories

Other considerations

Student learning support is essential for reducing gaps in achievement. Advisories should be supplementary. While the advisories represent a low cost way to have a positive impact on the adult learners, the university will still need to support other retention and success efforts. Advisories or nudges without additional supports may not make significant improvements with learners who are struggling. Subgroup analyses of early alert and predictive analytics data can help identify emerging achievement gaps early. Technology-mediated advisement is another increasingly popular approach. Technology-mediated advisement can leverage on the robust data, early alert, predictive analytics, and other advisement technologies to identify and intervene with learners who need help, when they need it.

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