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Targeting student learning needs: the development and preliminary validation of the Learning Needs Questionnaire for a diverse university student population

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ABSTRACT

This article outlines the development and preliminary validation of the Learning Needs Questionnaire (LNQ). The LNQ is intended to provide information for optimising resources in establishing targeted academic support structures within institutions of higher learning with a focus on teaching. Owing in part to the lack of an instrument applicable to *teaching* universities with a diverse student population in Singapore, the LNQ sought to measure and provide information about moderators of student learning needs. Three stages were undertaken to establish evidence supporting the validity of the LNQ. Stage 1 saw the development of items based on feedback from university instructors, a review of relevant literature and expert judgement. Data was collected in Stage 2 as the LNQ was administered to students ($N = 1178$). In Stage 3, exploratory factor analysis ($n = 589$) and first-order confirmatory factor analysis ($n = 589$) suggested a four-factor model (perceived academic competency, time management, preferred tutor's characteristics and use of technology) with a reduction of 41 to 33 items. A second-order confirmatory factor analysis suggested that the four identified factors could be associated with an overarching measure, though interpreting subscale scores presented a more plausible approach. Practical applications and limitations of the LNQ are discussed.

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Introduction

The typical impression of most institutions of higher learning (e.g., universities) is a campus filled with fresh post-secondary school graduates (i.e., conventional university students), who enrolled into full-time university programmes immediately after high school graduation (Panacci, 2015). Higher education (e.g., university) prepares students for the next phase of their lives, which is often full-time employment. However, this demographic homogeneity is increasingly becoming more complex within most institutions. One reason is the change in student demographics due to increased enrolment of adult learners into higher education or university programmes (Osam et al., 2017; Ross-Gordon, 2011). To better manage this change, an instrument that caters to this new mix of students, and

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can assess their learning needs would help institutions of higher learning optimise resources when establishing targeted academic support structures. This study outlines the development of the Learning Needs Questionnaire (LNQ) for such a purpose.

Adult learners in universities are deemed non-traditional compared to conventional university students as most of them enrol in part-time programmes after a delay from high school graduation while juggling full-time employment and multiple social responsibilities (Ross-Gordon, 2011). Adult learners return to school for various reasons. The knowledge-based economy is a key motivation for them to return to school to upskill, re-skill and re-train to ensure employability (Committee on the Future Economy [CFE], 2017). Technological advances have also brought flexibility to how lessons are usually conducted, from mostly face-to-face sessions to a more blended or fully online mode. With this affordance of blended and online learning, an increasing number of adults are more encouraged to return to school as this flexibility would allow them to juggle their various commitments better (Gast, 2013). This partly results in a shift in demographics of the university student population, with more adult learners in the same classroom together with conventional university students.

While the enrolment of adult learners in universities may have increased, the majority of the student population reading undergraduate programmes comprises largely conventional university students (Woods & Frogge, 2017). However, the case university in this study is an exception. Based in the Republic of Singapore, it is the only publicly funded university that champions lifelong learning and caters to a student population comprising mostly adult learners (Singapore Ministry of Education [MOE], 2017). Adult learners in the case university are offered a variety of undergraduate, postgraduate and continuing education programmes, from business, science and technology, human development, humanities and behavioural sciences, to law. These are largely part-time programmes, with classes conducted in the evenings or weekends via fully online or blended modes. Concurrently, the case university also offers a limited number of full-time programmes to conventional university students, which makes up about 15% of the student population. This presents the case university as distinctive in Singapore as there are more adult learners than conventional university students; the MOE had also intended for the case university to be unique and clearly differentiated from the existing universities in Singapore, adding further diversity and choice to the local higher education landscape (MOE, 2017).

With its unique student composition, a key challenge for the case university is to provide an education that caters to the different learning needs of its adult learners and the conventional university students concurrently; learning needs of adult learners and conventional university students vary due to different characteristics inherent in these two groups of learners. Generally, the defining characteristic of adult learners is that they juggle many social commitments while attending school, usually, on a part-time basis at the same time (Ross-Gordon, 2011). This characteristic of adult learners having to multi-task and balance different responsibilities has also been observed by faculty members who had taught adult learners (Day et al., 2011). In this regard, the time constraints faced by adult learners may not be similarly faced by conventional university students.

A manifestation of the time constraints faced by adult learners is the significant reduction of time available for other on-campus activities and outside-classroom interactions as compared to conventional university students (Panacci, 2015). With adult

learners mainly engaging with their institutions of higher learning during formal lessons, institutions catering to adult learners need to be aware and ensure that learning outcomes are achievable via formal lessons. Simultaneously, these institutions also need to innovate and engage adult learners beyond formal lessons, and yet work within adult learners' busy schedules. With these significant differences, institutional support for time-strapped adult learners would need to be different from responses to conventional university students (Fairchild, 2003; Panacci, 2015).

Need for a contextualised Learning Needs Questionnaire (LNQ)

The case university is similar to other conventional universities in that the programmes it offers are common to those by most other universities. However, it is non-traditional because of the charge by the MOE for it to be a champion of lifelong learning, and its unique student composition which comprises a majority of part-time adult learners and a minority of full-time conventional university students. The unique composition, coupled with the diversity in the types of learners and the accountability it holds to the state as it is publicly funded, does not allow the case university to make assumptions about the learning needs of its student population. In order to appreciate and support the learning needs of its students, the case university requires a learning needs instrument tailored for its unique student population.

Many factors underpin a student's academic performance. Factors known to influence academic performance include a student's cognitive, conative, and affective functioning, and the teaching-learning environment like instructors' teaching and assessment methods (Entwistle & McCune, 2004; Finch et al., 2016). One intervention that can help students improve their academic performance is to assess their study methods and provide support where needed. Inventories that evaluate a student's learning processes can be used for such assessment. Entwistle and McCune (2004) described several inventories of study strategies such as the *Approaches to Studying Inventory* (*ASI*), the *Study Processes Questionnaire* (*SPQ*), the *Inventory of Learning Processes* (*ILP*), the *Learning and Study Strategies Inventory* (*LASSI*), the *Motivated Strategies for Learning Questionnaire* (*MSLQ*), the *Inventory of Learning Styles*, and the *Approaches to Learning and Studying Inventory* (*ALSI*). These are established inventories that provide a detailed analysis of the student's learning processes such as how rehearsal is conducted, the student's learning orientation and motivational inclinations. These details are useful for designing targeted intervention because the inventory distils the component processes of student learning behaviours.

Several inventories have also been developed to assess the learning needs of adult learners, specifically in the area of self-directed learning (SDL). The association of adult learning with SDL can be mainly attributed to the influential work of Knowles. Knowles's proposition of adult learners' learning motivation and orientation leads to a need for adult learners to be self-directed in their learning (Knowles et al., 2015).

One such inventory of SDL is the *ODDI Continuing Learning Inventory (OCLI)* as described in Merriam and Bierema (2014). While Suh et al. (2015) argued that SDL is not fully compatible with Asian cultural attitudes, they concurred that collaborative learning utilised in all classrooms, including Asian classrooms, fit within the SDL framework. Hence, they developed and validated a Self-Directed Learning Inventory specifically for

Korean university students. A similar diagnostic tool, in this instance for Singapore adult learners enrolled in higher education, was also developed and validated by Khiat (2015).

The efficacy of these inventories are determined by how well the information gathered from them fit the purpose of the assessment, regardless of whether they are assessing learning processes or SDL. For the case university, an inventory that can assess its student learning needs for the purpose of developing institutional-wide academic support structures would be ideal. Hence, inventories that assess learning processes, while useful, may be too specific for the case university; the more resource-intensive alternative would be to have students complete all the established instruments that assess different dimensions of learning processes across time but this would understandably bring about some dissatisfaction amongst students. Inventories that assess SDL are also narrow in scope and purpose for the case university. Existing learning needs questionnaires used by universities and other educational institutions are usually contextualised to their own purposes and may not meet the same purpose as the case university (Woods & Frogge, 2017). This calls for a need to develop the Learning Needs Questionnaire (LNQ) that caters to the case university's unique student population and charge to be a champion of lifelong learning.

Methodology

The LNQ was developed based on classical measurement theory (DeVellis, 2017) with its validity evidenced on the unified concept of validity posited by Messick (1993). There were three stages in this study: (1) item development and gathering evidence to support content appropriateness, (2) data collection, and (3) exploratory and confirmatory factor analyses to establish the psychometric validity of the LNQ.

Stage 1

The LNQ was designed with the intention to discover key attributes of the learning needs of students in the case university. Owing to the lack of suitable instruments within relevant literature, items were developed on a deductive approach (i.e., based on teaching faculty's observation of needs and a past non-validated learning needs questionnaire conducted by the case university). As the past learning needs questionnaire conducted was solely for adult learners, items had to be re-worded and contextualised appropriately to its general student population, which now included conventional university students.

A total of 44 items associated with perceived learning needs of students were developed initially. Of these, three were removed based on feedback from an expert panel that comprised three academics in higher education (an associate professor, a senior lecturer and a lecturer) and five professional staff involved in planning and supporting teaching for higher education programmes within the university. For example, the items '*Cares about student learning* and '*Is empathetic to student learning needs*' were discarded based on feedback from the panel that the wording of the items were vague and repetitive. Subsequently, the items were judged to be appropriate for the intended purpose and accessible to all students regardless of their study option (full-time/part-time), study mode (face-to-face, fully online or blended) or gender.

Rating scale and scoring

A seven-point Likert scale (*strongly agree, agree, somewhat agree, neutral, disagree, somewhat disagree, strongly disagree*) was used for the LNQ so that it would be consistent with a self-directed learning measure administered earlier in the case university (Khiat, 2015). Responses were scored one to seven points with one corresponding to *strongly disagree*.

Stage 2

The LNQ was administered via an online questionnaire hosting platform. Email invites to complete the questionnaire were sent to all students in the case university and the LNQ could be accessed via a hyperlink. To encourage participation, students who completed the questionnaire were entitled to a sure-win lucky draw with prizes that ranged from electronic devices to stationary supplies. The LNQ was administered within eight weeks (August to September 2018).

Participants and procedure

1178 complete participant responses were used for the validation of the LNQ (see Table 1). Duplicate participant responses and participant responses with at least one missing value were excluded from the validation process.

Stage 3

In Stage 3, SAS (9.4) was used to conduct exploratory and confirmatory factor analyses (EFA and CFA). EFA was used for item reduction as well as to establish the factorial structure of the LNQ. CFA served to assess the dimensionality of the LNQ and determine the appropriateness of the factorial structure established through EFA. For the purpose of cross-validation, the sample was partitioned and each half was used for EFA and CFA. Each half of the sample was comparable in terms of school the student was matriculated, χ^2 (5) = .07, $p > .05$; age group, χ^2 (5) = .26, $p > .05$; cumulative grade point average tier, χ^2 (7) = 3.03, $p > .05$; years of study with the university, χ^2 (5) = 1.43, $p > .05$; degree programme (full-time/part-time undergraduate, postgraduate) χ^2 (2) = .11, $p > .05$; highest educational level attained prior to being matriculated as a student, χ^2 (4) = 3.49, $p > .05$; and gender, χ^2 (1) = .01, $p > .05$.

EFA

While Mardia tests of multivariate normality and tests of univariate normality (Shapiro–Wilk, Kolmogorov–Smirnov, Cramer-von Mises and Anderson–Darling) indicated that all variables had a modest departure from normality, the skewness and kurtosis of the variables were within the thresholds for structural equation modelling suggested by West et al. (1995).

Table 1. Profile of participants and preceding test format.

Programme	*n*
Full-time undergraduate	297
Part-time undergraduate	833
Postgraduate	48

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .94 and the Barlett's Test of Sphericity was significant ($\chi^2(528) = 14044.62$, $p < .001$) suggesting the suitability of the data for EFA, the sufficiency of the sample and that the items had sufficient correlations.

Horn's parallel analysis, Cattell's scree test, Kaiser's eigenvalue criterion and the amount of variance explained were used to determine the number of factors. Items with loading less than .32 or had cross-loadings were discarded (Costello & Osborne, 2005). The EFA identified four factors and resulted in a reduction of eight items. The four factors were interpreted meaningfully as student preference of tutor's characteristics (SPT), use of technology (UT), perceived academic competency (PAC), and time management (TM); these corresponded with 61.01%, 21.04%, 11.49% and 6.45% of variance explained. Table 2 presents the inter-factor correlations, means and standard deviations, and Table 3 presents the final factor loadings.

Reliability

Item-total correlations, Cronbach's α and Tucker and Lewis's Reliability Coefficient (TLRC) suggested adequate internal consistency (Kline, 2000; Tucker & Lewis, 1973); α = .93 and TLRC = .86. Item-total correlations ranged from .20 to .75 with the exception of the items 'I read my classmates' comments/contributions to discussion forums' (.18), and 'I organise my study using a daily/weekly to-do list- (.18). Based on the recommended item-rest correlation threshold of .2 (Everitt, 2002), these two items were surfaced for review but given the modest deviation from .2 and that the items were deemed fit for purpose, the items were retained.

CFA

The four-factor measurement model of the LNQ specified by the EFA was subsequently examined by a first-order CFA. As the sample had a modest departure from normality, and for more precise goodness-of-fit statistics, the maximum likelihood with Satorra-Bentler (MLSB) scaled chi-square statistics for model fit, which adjusts the chi-square statistic and standard errors for data non-normality, was used (Motl et al., 2005).

Based on recommended indicators to be reported by Brown (2014), and cut-off criteria of goodness-of-fit statistics by Hu and Bentler (1999) and Hair et al. (2007), the four-factor model appeared plausible (see Table 4). This four-factor model was then subjected to competing models of one-factor, a second-order and bifactor. All competing models other than the one-factor model appeared plausible. Considering the diverging Schwartz Bayesian Criterion and the Akaike Information Criterion, both second-order and bifactor models could be better alternatives to the four-factor model. While the second-order model could suggest that the four factors identified could be associated with an overarching construct, it would be premature to suggest that the second-order model had a

Table 2. S1 inter-factor correlations, means, standard deviations and Cronbach's α.

LNQ	F1	F2	F3	*M*	*SD*	α
SPT (F1)				6.06	0.80	.96
UT (F2)	.33			5.71	1.01	.92
PAC (F3)	.24	.23		5.43	0.91	.86
TM (F4)	.07	.25	.29	4.65	1.01	.76

Table 3. Final factor loadings.

Items	F1	F2	F3	F4
SPT1. Explains clearly in lessons	**.89**	-.01	.02	-.09
SPT2. Is helpful to students in addressing their learning needs	**.87**	-.05	.06	-.03
SPT3. Prepares his/her lessons well	**.85**	-.02	.02	-.05
SPT4. Is enthusiastic in teaching	**.84**	-.03	-.02	.00
SPT5. Provides high quality feedback	**.82**	.00	.00	-.01
SPT6. Motivates the students to learn	**.82**	-.01	-.05	.06
SPT7. Is dedicated to teaching	**.81**	-.07	.06	-.01
SPT8. Is approachable	**.80**	-.02	.04	.04
SPT9. Is patient with the students	**.80**	-.07	.01	.03
SPT10. Provides sufficient learning materials	**.80**	.04	.02	-.02
SPT11. Delivers interesting lessons	**.79**	.06	-.05	-.02
SPT12. Has strong subject knowledge	**.77**	.01	.04	-.02
SPT13. Respects the students	**.77**	-.01	.02	-.02
SPT14. Provides prompt feedback	**.76**	.05	-.04	.02
SPT15. Stimulates student thinking	**.74**	.05	.01	.03
SPT16. Believes in students' learning abilities	**.69**	.04	-.03	.09
SPT17. Is humorous in teaching	**.61**	.00	-.13	.08
SPT18. Relates work or life experiences to concepts taught	**.60**	.15	-.02	-.03
SPT19. Sets high learning expectations	**.36**	.11	.01	.16
UT1. Technology has positively enhanced my learning experience	-.01	**.92**	-.04	.04
UT2. Technology has made learning more flexible for me	.00	**.89**	.05	-.03
UT3. Technology has become an integral part of my learning experience	.02	**.87**	.01	-.01
UT4. I am very comfortable using technology to help my learning	.09	**.71**	.02	.03
PAC1. I am competent in writing clearly and effectively for my assignments	-.02	.01	**.87**	-.04
PAC2. I am competent in verbally presenting information with clarity and fluency	.03	-.03	**.80**	-.02
PAC3. I am competent in thinking critically	.04	.02	**.73**	.02
PAC4. I am competent in searching for information for academic work	-.08	.04	**.71**	.04
TM1. I follow my study plan and keep up-to-date on my readings	-.04	-.03	.09	**.81**
TM2. I prioritise learning tasks	.07	-.02	.05	**.66**
TM3. I set aside additional time to deal with unanticipated events	-.02	-.02	.03	**.65**
TM4. I preview the course material before attending face-to-face seminars	.02	.04	-.07	**.57**
TM5. I organise my study using a daily/weekly to-do list	.03	.01	-.07	**.53**
TM6. I read my classmates' comments/contributions to discussion forums	.05	.03	-.02	**.33**

Note: Participants were asked to indicate how much they agreed with the SPT item statements.

significantly better fit relative to the four-factor model based on results of the chi-square difference test.

As the analysis presented a plausible competing bifactor model, ancillary bifactor measures and model reliability estimates proposed by Rodriguez et al. (2016), and Reise (2012) were evaluated using the Bifactor Indices Calculator (Dueber, 2017). The general factor explained 11% of common variance (ECV) in contrast with that by the specific factors (SPT (89%), UT (96%), PAC (97%) and TM (79%)). Based on the item explained common variance (I-ECV), all items were found to measure their assigned factors better

Table 4. CFA goodness-of-fit indicators.

Model	χ^2	χ^2_{diff}	*df*	χ^2/df	CFI	RMSEA	SRMR	AIC	SBC
Four-factor	2110.30*	-	489	4.32	.91	.05	.05	1292.61	1607.86
One-factor	5626.41*	3516.11*	495	11.37	.64	.10	.13	3402.39	3691.36
Second-order	2113.22*	2.92	491	4.30	.91	.05	.05	1292.67	1599.16
Bifactor	1732.41*	377.9* 380.81*#	452	3.83	.93	.04	.04	1185.70	1662.95

Note: χ^2 = chi-square statistic; χ^2_{diff} is computed relative to the four-factor model; *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardised root mean square; AIC = Akaike information criterion; SBC = Schwarz Bayesian Criterion.

refers to χ^2_{diff} relative to the second-order model.

*$p < .001$.

than the general factor; the largest I-ECV was .3. Coefficient omega hierarchical (ω_H), the proportion of unique variance explained by the general factor, was 6%, as opposed to that by the specific factors (SPT (93%), UT (91%), PAC (87%) and TM (76%)). Relative omega, which represents the variance explained in the multidimensional composite due to the general factor, was 7% in contrast with that by the specific factors (SPT (97%), UT (96%), PAC (97%) and TM (81%)). *H*, an index assessing construct replicability, was .75, lower than H_{SPT} (0.99), H_{UT} (.95), H_{PAC} (.89) and H_{TM} (.99).

Taken together, these results do not support a general factor despite the bifactor model having the most desirable CFI, RMSEA, SRMR and AIC values. In light of this, interpreting a composite score would be deemed a less reliable measure of overall learning needs and, hence, interpreting subscale scores would present a more plausible approach. Further, the four-factor model was retained as the chi-square difference test did not yield a significant difference between the second-order and four-factor model.

In relation to the four-factor model, all standardised loading estimates were significant ($p < .001$) and above .7 except for items TM3 (.59), SPT17 (.59), TM4 (.47), TM6 (44) and SPT19 (.34) (see Table 5). TM4, TM6 and SPT19 were considered for deletion based on recommendations of Hair et al. (2007). Nonetheless, the items were retained as the four-factor model (with the items removed) fit did not improve substantially ($\chi^2/df =$ 4.5, CFI=.93, RMSEA=.05 and SRMR=.04).

Other than F4 (TM factor), the average variance extracted (AVE) and construct reliability (CR) coefficients were above .5 and .7 correspondingly, suggesting good reliability and acceptable error variance. The AVE for TM was .41 and the CR was .80, suggesting that TM had good reliability though there could be slightly more error than the variance explained.

Evidence of discrimination suggesting that a construct was distinct from others was established by comparing the inter-factor correlations with the square root of the AVE values (Fornell & Larcker, 1981; Hair et al., 2007). This comparison suggested that the constructs in the four-factor model were distinct as the variance extracted estimates were greater than the inter-factor correlations (see Table 6).

Discussion

Results from Stage 3 of this study suggested a four-factor model explaining the general learning needs of students within the case university. The four factors identified were student preference of tutor's characteristics (SPT), use of technology (UT), perceived academic competency (PAC) and time management (TM). As these factors lend support to the case university in its strategic efforts to support student learning needs by providing suitable academic support, a subsequent review of how these factors impact student learning was undertaken and described in the following paragraphs.

Student preference of tutors' characteristics

The SPT factor assesses students' perceptions of an effective tutor in that students indicate the type of tutors' attributes, attitudes and behaviours that they believe help their learning experience. Fike et al. (2015) conceded that there were limited studies conducted on students' perception of an ideal tutor. Nevertheless, studies on instructor-related factors, such

Table 5. Standardised loadings, AVE and CR coefficients of four-factor model.

Construct and items	Standardised loading	Reliability	AVE	CR
SPT (F1)			.60	.96
SPT1	.87	.77		
SPT2	.82	.68		
SPT3	.86	.74		
SPT4	.83	.69		
SPT5	.86	.74		
SPT6	.78	.61		
SPT7	.82	.67		
SPT8	.78	.61		
SPT9	.76	.57		
SPT10	.84	.70		
SPT11	.82	.67		
SPT12	.80	.65		
SPT13	.73	.54		
SPT14	.84	.70		
SPT15	.78	.61		
SPT16	.72	.51		
SPT17	.59	.35		
SPT18	.66	.44		
SPT19	.34	.11		
UT (F2)			.74	.92
UT1	.91	.83		
UT2	.90	.80		
UT3	.82	.68		
UT4	.79	.63		
PAC (F3)			.58	.85
PAC1	.84	.71		
PAC2	.77	.60		
PAC3	.73	.53		
PAC4	.69	.47		
TM (F4)			.41	.80
TM1	.82	.67		
TM2	.74	.54		
TM3	.59	.35		
TM4	.47	.22		
TM5	.68	.46		
TM6	.44	.19		

as personality traits like agreeableness (Kneipp et al., 2010), have shown that tutors' characteristics do impact students' perception on the quality of instruction. Further, Frenzel et al. (2018) studied students' perception of teachers' enthusiasm in class and demonstrated that students' enjoyment in class was mediated by students' perception of their teachers' enthusiasm. Alsharif and Qi (2014) also showed in their three-year study that students' perception of instructor-related factors, such as enthusiasm, was related to students' motivation to learn. By appreciating students' perception of what makes an effective tutor, the case university and other institutions can parley this information to

Table 6. Distinctiveness of sub-constructs (S2).

Construct	SPT	UT	PAC	TM
SPT	**.77***			
UT	.19	**.86***		
PAC	.29	.32	**.76***	
TM	.14	.25	.36	**.64***

* refers to the square root of AVE.

instructors to develop more meaningful instructor–student interactions and, hence, support learning.

Use of technology

The use of technology is ubiquitous today. Technology is not only used in educational institutions to increase accessibility but it is also used to enhance learning (Renes & Strange, 2011; Siew, 2018). While one may be used to using technology in daily activities or for work, it may not be assumed that one may be as comfortable in using technology for learning; the idea of 'digital natives' and that they would naturally be comfortable with using technology for learning has also been dispelled by Kirschner and De Bruyckere (2017). Hence, it may not be assumed that all adult learners/students would be able to use technology for its intended purposes just because technology is now omnipresent in our lives.

Just as instructors need support in incorporating technology into their classrooms and lessons, students would also need support in using technology for learning, as supported by Diep et al. (2019), who suggested that perceived usefulness and perceived ease of use were important features to students using technology for learning. In this regard, assessing students' perceptions on the use of technology would provide critical information related to how they take to technology in learning, and the adequacy of academic support structures.

Perceived academic competency

The perception of one's academic competency presents an important aspect of student learning needs for assessment. Students' feedback on their academic competency level is critical for the case university to evaluate whether there have been adequate academic support structures for students to achieve their academic goals. As an example, PAC ratings can be correlated with students' actual academic performance. If results present a consistently high degree of perceived academic competency amongst lower performing students, the university may need to monitor the participation rate of remedial interventions of the lower-performing students other than merely providing more interventions or support (as these students in the first instance may not attend intervention sessions given that they do not think they have issues with their academic competencies).

The importance of being able to assess one's competency in a specific domain has been echoed by Peffer and Davis (2018), who also suggested that such an assessment would enable students to demonstrate their knowledge in the domain being assessed. In their study, Peffer and Davis (2018) found that students in an advanced level of a course were better at predicting their performance as they understood and learned more about their expert areas. By this token, and conversely, a student from an advanced level of course who does not have a comparable PAC rating and academic performance could be a signal to the institution that something is falling short, and that more could be done to support this student. In light of this, a periodic assessment of student PAC, and subsequently whether the student PAC ratings and academic performance are comparable, would provide critical information. This information could lead to a review of the provisions of academic support structures, quality of teaching and learning in the

institution as well as the course design. These suggest how PAC is critical for the case university and other institutions to better position intervention methods or support structures to meet student learning needs.

Time management

With multiple responsibilities and roles, adult learners need to be effective in managing their time in order to balance their personal, work and academic commitments. Conventional university students will also need to master time management since higher education relies more on students' self-regulation ability to manage their academic pursuits. Hence, it is unsurprising that time management skill has an impact on academic performance (Abdulghani et al., 2014; Kim & Ra, 2015). It is important to know whether students have issues with time management so that institutions can intervene with appropriate support strategies.

Limitations and directions for future research

The LNQ was developed with the intention for it to be extended for use beyond the case university. Nonetheless, the LNQ was developed and validated based on student responses from the case university, and any use of it on respondents from a context vastly different to the case university's should be interpreted with caution if it is not validated before use.

While the LNQ includes four factors in the assessment of student learning needs derived from the literature review and Stage 3 of the study, it may not present an exhaustive list of perceived learning needs that impact academic performance for other institutions and in the longer term, for the case university. Along with changes in the learning climate, other constructs may be added to the LNQ. Shifting student demographics also call for regular reviews of the LNQ so that it remains relevant.

As the LNQ provides information on students' perceptions of themselves, information that assesses what students think of the adequacy of academic support structures for their learning needs would be corroborative. This lends support to a subsequent study on developing an instrument for this purpose, in particular, for an institution similar in context to the case university.

Conclusion and Practical Implications

Educational institutions have the responsibility and moral duty to enable their students to maximise their potential for academic success and, hence, it is important to have comprehensive and effective academic support structures in place. However, there are limitations to contend with when it comes to providing academic support to students. Institutions have limited resources to develop, implement and sustain programmes and also limited time with students to develop their abilities and skills (i.e., the time with students is limited by the candidature period). From the students' perspectives, the fixed amount of time they have also impacts their ability to participate in every academic activity.

The LNQ holds promise as a useful tool to assess perceived student learning needs in that the information can be used to ascertain whether there are adequate academic support structures and whether these structures have been targeted for maximum yield. In this

instance, it means providing adequate and targeted academic interventions and support, that are known to have high impact on students' academic performance, to students who most need them. For example, if students' scores from the factor *Use of Technology* in the LNQ are lower compared to previous semesters' scores, the institution could review whether there were any introductions of new technology to the learning space and, if so, the institution should assess if adequate support had been provided to help students cope with the new technology. Correlating students' PAC rating with their academic performance, as discussed previously, can also inform institutions regarding who, where and how academic support should be targeted. If the needs are surfaced and focused remediation efforts are provided in a timely manner, all stakeholders (e.g., students, management, etc.) would reap the benefits of optimising resources (and minimising wastage).

The development and validation of the LNQ was to support academic support structures within the case university. Nonetheless, the LNQ would be applicable to other institutions of higher learning, given the growth in the adult learner population; the trend of an increasing number of adult learners enrolling in university courses has not changed for the past two decades, as reported by Ross-Gordon (2011) and Osam et al. (2017). Cummins et al. (2019) also found an increasing trend in enrolment patterns of adult learners between the ages of 25–64 years since the last global recession.

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References

Abdulghani, H. M., Al-Drees, A. A., Khalil, M. S., Ahmad, F., Ponnamperuma, G. G., & Amin, Z. (2014). What factors determine academic achievement in high achieving undergraduate medical students? A qualitative study. *Medical Teacher*, *36*(sup1), S43–S48. https://doi.org/10.3109/0142159X.2014.886011

Alsharif, N. Z., & Qi, Y. (2014). A three-year study of the impact of instructor attitude, enthusiasm, and teaching style on student learning in a medicinal chemistry course. *American Journal of Pharmaceutical Education*, *78*(7), 1–13. https://doi.org/10.5688/ajpe787132

Brown, T. A. (2014). *Confirmatory factor analysis for applied research*. Guildford Press.

Committee on the Future Economy (CFE). (2017, February). *Report of the committee on the future economy: Pioneers of the next generation*. https://www.gov.sg/~/media/cfe/downloads/mtis_full%20report.pdf

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, *10*(7), 1–9. https://doi.org/10.7275/jyj1-4868

Cummins, P. A., Brown, J. S., Bahr, P., & Mehri, N. (2019). Heterogeneity of older learners in higher education. *Adult Learning*, *30*(1), 23–33. https://doi.org/10.1177/1045159518812077

Day, B. W., Lovato, S., Tull, C., & Ross-Gordon, J. (2011). Faculty perceptions of adult learners in college classrooms. *The Journal of Continuing Higher Education*, *59*(2), 77–84. https://doi.org/10.1080/07377363.2011.568813

DeVellis, R. F. (2017). *Scale development: Theory and applications* (4th ed.). SAGE Publications.

Diep, A. N., Zhu, C., Cocquyt, C., De Greef, M., Vo, M. H., & Vanwing, T. (2019). Adult learners'-needs in online and blended learning. *Australian Journal of Adult Learning*, *59*(2), 223–253.

Dueber, D. M. (2017). *Bifactor Indices Calculator: A Microsoft Excel-based tool to calculate various indices relevant to bifactor CFA models*. https://dx.doi.org/10.13023/edp.tool.01

Entwistle, N., & McCune, V. (2004). The conceptual bases of study strategy inventories. *Educational Psychology Review*, *16*(4), 325–345. https://doi.org/10.1007/s10648-004-0003-0

Everitt, B. (2002). *The Cambridge dictionary of statistics*. Cambridge University Press.

Fairchild, E. E. (2003, Summer). Multiple roles of adult learners. *New Directions for Student Services*, *2003*(102), 11–16. https://doi.org/10.1002/ss.84

Fike, D. S., Fike, R., & Zhang, S. (2015). Teacher qualities valued by students: A pilot validation of the teacher qualities (T-Q) instrument. *Academy of Educational Leadership Journal*, *19*(3), 115–125. https://search.proquest.com/docview/1768629495?accountid=196406

Finch, W. H., Cassady, J. C., & Jones, J. A. (2016). Investigation of the latent structure for the learning and study strategies Inventory. *Journal of Psychoeducational Assessment*, *34*(1), 73–84. https://doi.org/10.1177/0734282915588443

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equations models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Frenzel, A. C., Becker-Kurz, B., Pekrun, R., Goetz, T., & Lüdtke, O. (2018). Emotion transmission in the classroom revisited: A reciprocal effects model of teacher and student enjoyment. *Journal of Educational Psychology*, *110*(5), 628–639. https://doi.org/10.1037/edu0000228

Gast, A. (2013, Winter). Current trends in adult degree programs: How public universities respond to the needs of adult learners. *New Directions for Adult and Continuing Education*, *2013*(140), 17–25. https://doi.org/10.1002/ace.20070

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2007). *Multivariate data analysis seventh edition*. Pearson.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Khiat, H. (2015). Measuring self-directed learning: A diagnostic tool for adult learners. *Journal of University Teaching & Learning Practice*, *12*(2). https://ro.uow.edu.au/jutlp/vol12/iss2/2/

Kim, D., & Ra, Y. (2015, Spring). What impacts success in college? Findings from the perceptions of Korean students. *College Student Journal*, *49*(1), 161–168.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education*, *67*, 135–142. https://doi.org/10.1016/j.tate.2017.06.001

Kline, P. (2000). *The Handbook of Psychological Testing*. Routledge.

Kneipp, L. B., Kelly, K., Biscoe, J. D., & Richard, B. (2010). The impact of instructor's personality characteristics on quality of instruction. *College Student Journal*, *44*(4), 901–905.

Knowles, M. S., Holton IIIE. F., & Swanson, R. A. (2015). *The adult learner: The definitive classic in adult education and human resource development*. Routledge.

Merriam, S. B., & Bierema, L. L. (2014). *Adult learning: Linking theory and practice*. Jossey-Bass.

Messick, S. (1993). *Foundations of validity: Meaning and consequences in psychological assessment*. ETS Research Report No. RR-93-51, Series 2.

Motl, R. W., Dishman, R. K., Birnbaum, A. S., & Lytle, L. A. (2005). Longitudinal invariance of the center for epidemiologic studies - depression scale among girls and boys in middle school. *Educational and Psychological Measurement*, *65*(1), 90–108. https://doi.org/10.1177/0013164404266256

Osam, E. K., Bergman, M., & Cumberland, D. M. (2017). An integrative literature review on the barriers impacting adult learners' return to college. *Adult Learning*, *28*(2), 54–60. https://doi.org/10.1177/1045159516658013

Panacci, A. G. (2015). Adult students in higher education: Classroom experiences and needs. *College Quarterly*, *18*(3). https://files.eric.ed.gov/fulltext/EJ1087330.pdf

Peffer, P. A., & Davis, M. E. (2018). Self-estimates of performance in animal sciences courses and factors that influence perceived competence. *NACTA Journal*, *62*(2), 122–129.

Reise, S. P. (2012). The rediscovery of bifactor measurement models. *Multivariate Behavioral Research*, *47*(5), 667–696. https://doi.org/10.1080/00273171.2012.715555

Renes, S. L., & Strange, A. T. (2011). Using technology to enhance higher education. *Innovative Higher Education*, *36*(3), 203–213. https://doi.org/10.1007/s10755-010-9167-3

Rodriguez, A., Reise, S. P., & Haviland, M. G. (2016). Evaluating bifactor models: Calculating and interpreting statistical indices. *Psychological Methods*, *21*(2), 137–150. https://doi.org/10.1037/met0000045

Ross-Gordon, J. M. (2011, Winter). Research on adult learners: Supporting the needs of a student population that is no longer nontraditional. *Peer Review*, *13*(1), 26–29.

Siew, P. H. (2018). Pedagogical change in mathematics learning: Harnessing the power of digital game-based learning. *Educational Technology & Society*, *21*(4), 259–276.

Singapore Ministry of Education. (2017). *Singapore University of Social Sciences bill second reading*.

Suh, H. N., Wang, T. K., & Arterberry, B. J. (2015). Development and initial validation of the self-directed learning Inventory with Korean college Students. *Journal of Psychoeducational Assessment*, *33*(7), 687–697. https://doi.org/10.1177/0734282914557728

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*(1), 1–10. https://doi.org/10.1007/BF02291170

West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed.), *Structural equation modelling: Concepts, issues and applications* (pp. 56–75). Sage Publications, Inc

Woods, K., & Frogge, G. (2017). Preferences and experiences of traditional and nontraditional university students. *The Journal of Continuing Higher Education*, *65*(2), 94–105. https://doi.org/10.1080/07377363.2017.1318567