Modelling psychological factors for predicting the success of non-traditional students

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Abstract

Psychological factors underpinning student success have received some attention in the higher education literature but remain relatively unexplored. The present study utilised structural equation modelling to construct a model that integrates psychological factors and predicts measures of student success, namely student satisfaction and grade point average. Fifty-six participants from a population of non-traditional university students completed an online survey, which predominantly consisted of self-report measures based on those created in light of previous theory. The final model was deemed an acceptable fit of the data, and suggested that that (a) Lizzio's (2006) Five Senses Framework predicts student satisfaction, (b) preference for particular clusters of cognitive styles predict grade point average, and (c) the Five Senses Framework predicts preference for cognitive styles. The results of this study provide evidence for the need to incorporate numerous psychological factors into the design of transition and support programs.

Introduction

The contributions of psychological constructs to the discussion of student success have not yet reached their full potential (Kozhevnikov, Evans, & Kosslyn, 2014). Despite criticisms of their field concerning a lack of empirical rigour and an unwillingness to "speak a common language" (Kozhevnikov, 2007; Peterson, Rayner, & Armstrong, 2009), valuable contributions to the understanding of student success have been made by a number of psychological researchers (e.g. Biggs, 1987a, 1987b; Larmar & Lodge, 2014; Lizzio, 2006; Sternberg, 1988; Sternberg & Grigorenko, 1997; Zhang, 2000; Zhang & Sternberg, 2000). The present study was an attempt to build on previous research by exploring statistical and theoretical relationships between existing psychological constructs through the use of structural equation modelling. The modelling incorporated psychological constructs that have previously been hypothesised to relate to student success, with the primary aim to construct a systems model of psychological constructs that accounts for variance in measures of student satisfaction and grade point average. Understanding the contributions of psychological constructs to student success may provide insight into student experiences of university, and enable universities to cater to the needs of their students more completely.

Context

Continued changes to the political and economic context of the tertiary sector warrant new exploration of successful outcomes for students at university (Goedegebuure & Schoen,

2014). This exploration is particularly important given that one in seven students will withdraw from University within the first six months of study (Department of Education, 2014). A large body of literature has identified potential risk factors of attrition such as previous academic performance (McKenzie, Gow, & Schweitzer, 2004), studying part-time (McKenzie & Schweitzer, 2001), through distance education (Tucker, 2001), and/or who come from non-traditional backgrounds (Bean & Metzner, 1985; Xuereb, 2014). Given trends toward more flexible education options & increased diversity in student populations, many institutions have responded to this body of research by introducing orientation and transition programs and support systems addressing issues faced by students at risk of attrition (Hillman, 2005). The programs often focus on easily identifiable factors (such as the ones above), and take an institution-centric approach aiming to improve outcomes through environmental interventions. Research into psychological mechanisms that underpin risk of attrition may provide a useful contribution in future discussions (Bowles, Dobson, Fisher & McPhail, 2011).

Measuring student success

Whilst attrition and progression rates can provide some insight into the discussions of student success, the present research utilised grade point average (GPA) and student satisfaction to account for a broader understanding of the construct. Both measures have limitations (Greenwald, 1997; Soh, 2010), however GPA and student satisfaction have been conceptualised as measures of academic and non-academic success, and reflect important outcomes from the perspectives of both students and institutions. GPA is acknowledged by students, institutions and potential employers as a key measure of academic success, on which opportunities for employment, scholarships, and further studies may depend. Student satisfaction has been directly linked to attrition (Roberts & Styron, 2010) and is a key performance indicator within a context where the attraction and retainment of students is of great importance to universities (Goedegebuure & Schoen, 2014).

Predictors of success

Several lines of inquiry have examined possible factors that could reliably predict student success as per the measures described above. For example, Lizzio (2006) produced a conceptual summary focusing on five ‘senses’ that could possibly decrease attrition rates and increase student success when developed in students as they transitioned to university studies. Lizzio suggests that in order to be successful in the transition period (and beyond), students need to build their senses of capability, connectedness, purpose, resourcefulness and academic culture.

Within the psychologically focussed literature, cognitive styles provide a further range of possible predictors. Cognitive styles refer to “psychological dimensions representing consistencies in an individual’s manner of acquiring and processing information” (Ausburn & Ausburn, 1978). Theorists in this area have debated the usefulness of cognitive styles for educational practice. Whilst researchers such as Sternberg and Grigorenko (1997), and more recently Kozhevnikov et al. (2014), have touted cognitive styles as useful predictors of success at university, others have questioned their value (Pashler, McDaniel, Rohrer, & Bjork, 2008). The field has been criticised for a lack of ecological validity, invalid measurement tools and an unwillingness to share a common language (Peterson et al., 2009). Theories such as Sternberg’s Mental Self-Government (Sternberg, 1988, 1999), Biggs’ Approaches to Learning (1987a, 1987b) and the Dual-process theory (Evans, 2010; Kahneman, 2003) have largely not been explored in tandem, with notable exceptions by

Zhang and Sternberg (Zhang, 2010; Zhang & Sternberg, 2010). In these studies, Zhang & Sternberg found that deep approach scales correlated positively with thinking styles that require more complexity such as the hierarchical, judicial and legislative styles. Conversely, surface approach scales correlated with styles requiring minimal complexity of task perception & performance (e.g. monarchic, executive, oligarchic). Detailed discussion of these theories is beyond the limitations of the present paper, with readers to be directed to the original studies, and to Kozhevnikov's (2007) comprehensive summary of the field. It should be noted, however, that investigation of the above theories' respective constructs provide opportunities to better understand how students think, and to subsequently enhance student success.

Present Study

Whilst a number of constructs that have previously been linked to student success, few attempts have been made to integrate these constructs into a systems theory. The present study built on a limited body of literature by exploring the contributions of psychological constructs to the understanding of student success within a sample of non-traditional students from an Australian university. The study represented an attempt to address concerns about the lack of a shared language (Peterson et al., 2009) by utilising structural equation modelling. A primary aim of the study was to relate previously unintegrated psychological measures to establish empirical and theoretical commonalities, and contribute to a shared language of cognitive styles and a cohesive narrative describing student success. Of particular interest were (a) the relationships between measures of different psychological theories (do measures cluster into factors supporting the independence of the theories or is the data better explained by integrating measures of various theories according to latent psychological factors) (b) the relationships between the latent factors created by the principle component analysis, and (c) the value of these constructs in predicting measures associated with student success.

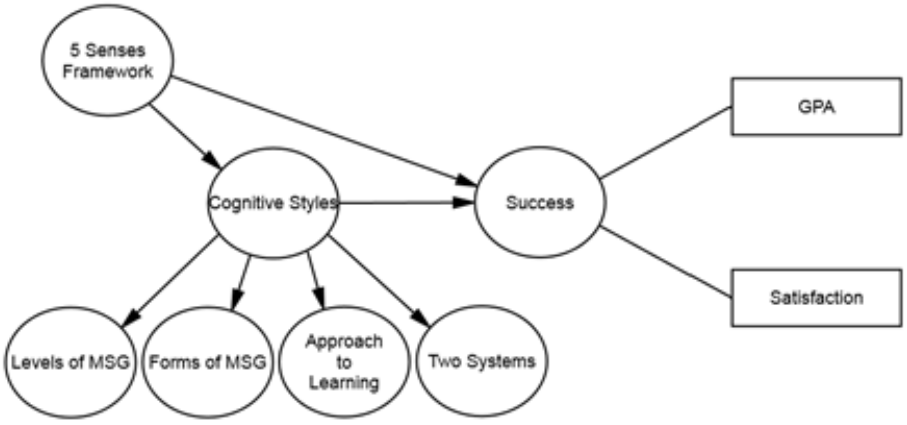

Figure 1. Conceptual summary of possible model predicting student success

Method

Participants

Fifty-six participants (4 males, 52 females), ranging in age from 18 to 56 years (M = 34.84, SD = 11.28), completed the survey. Participants predominantly identified themselves as mature-aged (45) rather than as a school-leaver (11), and as studying via distance education

(42) over studying on campus (14). Thirty-one participants indicated that a family member had previously attended university, while 25 identified themselves as the first of their family to attend university. Participants were studying a variety of degree programs, with education (10 participants), psychology (8 participants), and information studies (7 participants) being the most represented disciplines. Whilst the sample was not representative of the population of students at universities in Australia, it was representative of the student population of the institution at which the study was conducted and is representative of a population of non-traditional students.

Participants were recruited through invitations posted on online forums and on *Facebook*. In an attempt to reduce potential sampling bias, participation was incentivised through the chance to win gift vouchers at the completion of the survey.

Materials and procedure

A web-based survey was constructed in Survey Monkey as a composite of demographic questions, established psychometric measures, and modified non-psychometric measures previously used to explore the theories of interest.

Participants were to indicate their age and gender. Details of their university enrolment were also collected, including their course; students' mode of study as distance or on-campus; student status as school leaver or mature age and whether a student was the first in their family to attend university. Other items on this page collected data that included: duration of study to date (in semesters); number of units completed; student's ATAR (if known); and student's preference for their current course and University. Finally, students were asked to indicate the time in hours spent weekly engaging in university studies and non-academic university-related activities, and to rate the contributions of a number of factors in determining the time spent engaging in these activities.

The revised two factor version of the Study Process Questionnaire (R-SPQ-2F; Biggs et al., 2001), the Cognitive Reflection Test (CRT; Frederick, 2005), and six of the thirteen Thinking Styles Inventory subscales (TSI; Sternberg & Wagner, 1991) were presented as they were in their original studies. A 72-item survey was adapted from Lizzio's (2006) evaluative tool in order to explore potential contributions of the Five Senses framework. Participants were asked to rate their level of agreement to a series of statements on a five point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores on each measure indicating that students perceived themselves to possess greater capital of the construct underlying that measure. Modifications were made to the original checklist items with the intention of reconceptualising the content as student-centric. Examples of items include "I aspire to be like the heroes and leaders in my field/discipline" and "I feel like I belong or fit and that this is the right place for me". The final survey included 16 items measuring connectedness, 20 items measuring capability, 12 items measuring purpose, 19 items measuring resourcefulness, and 5 items measuring culture.

Participants were asked to represent their GPA by estimating their average mark across their university units of study to within a five point range. Participants were also asked to evaluate their overall university experience through a 10 item Likert scale derived from surveys used to evaluate teaching quality and unit content from two universities.

Results

Modelling was initially guided by the two-step approach, as recommended by Anderson and Gerbing (1988), in that measurement models were estimated separately, and prior to, the estimation of the structural model. SPSS 22 was used to for initial screening of the data, statistical validation of the measures, and primary analysis of the relationships between the variables of interest. To maximise both parsimony and statistical power, only constructs that significantly correlated with one of the outcome variables were then included in the full modelling phase. Correlations between these constructs can be seen in Table 1.

	Capability	Connectedness	Purpose	Resourcefulness	Culture	Deep Motivation	Deep Strategy	Surface Motivation	Surface Strategy	Hierarchic	Monarchic	Oligarchic	Satisfaction	GPA
Capability	1.00													
Connectedness	.68**	1.00												
Purpose	.73**	.60**	1.00											
Resourcefulness	.86**	.74**	.73**	1.00										
Culture	.65**	.35**	.65**	.56**	1.00									
Deep Motivation	.55**	.30*	.50**	.46**	.45**	1.00								
Deep Strategy	.44**	.30*	.41**	.32*	.26	.81**	1.00							
Surface Motivation	-.43**	-.30*	-.42**	-.31*	-.61**	-.39**	-.40**	1.00						
Surface Strategy	-.38**	-.21	-.32*	-.34*	-.44**	-.41**	-.45**	.75**	1.00					
Hierarchic	.42**	.30*	.27*	.40**	.23	.34**	.40**	-.31*	-.30*	1.00				
Monarchic	-.27*	-.11	-.24	-.17	-.36**	-.34**	-.35**	.57**	.53**	.08	1.00			
Oligarchic	.19	.22	.13	.29*	-.06	-.01	-.06	.46**	.33*	.10	.40**	1.00		
Satisfaction	.75**	.53**	.68**	.69**	.64**	.52**	.49**	-.49**	-.37**	.31*	-.26	.08	1.00	
GPA	.32*	.05	.16	.16	.26	.40**	.31*	-.32*	-.24	.11	-.42**	-.36**	.18	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 1. Correlation matrix of factors predicting student success

The relevant variables were first analysed in an exploratory principal component analysis, the results of which (See Table 2) determined the initial measurement models.

Scale	Senses	Simple Styles	Complex Styles
Resourcefulness	**.90**	-.01	.25
Capability	**.85**	-.14	.34
Purpose	**.81**	-.17	.23
Connectedness	**.79**	.04	.17
Culture	**.69**	-.46	.07
Surface Motivation	-.32	**.81**	-.22
Monarchic	-.14	**.78**	-.08
Oligarchic	.35	**.76**	.08
Surface Strategy	-.23	**.72**	-.34
Deep Strategy	.14	-.26	**.88**
Deep Motivation	.30	-.25	**.79**
Hierarchic	.25	.06	**.66**
Eigenvalue	**5.37**	**2.22**	**1.17**
% of variance	**44.77**	**18.47**	**9.75**
α (Component)	**.88**	**.67**	**.71**

Table 2. Factor loadings of measures predicting student success.

The model was respecified in Amos 22 through a series of iterations to increase both the parsimony and fit of the model. Modifications were guided by the principles outlined by Anderson and Gerbing (1988), and were implemented only where justified by both theoretical and empirical considerations.

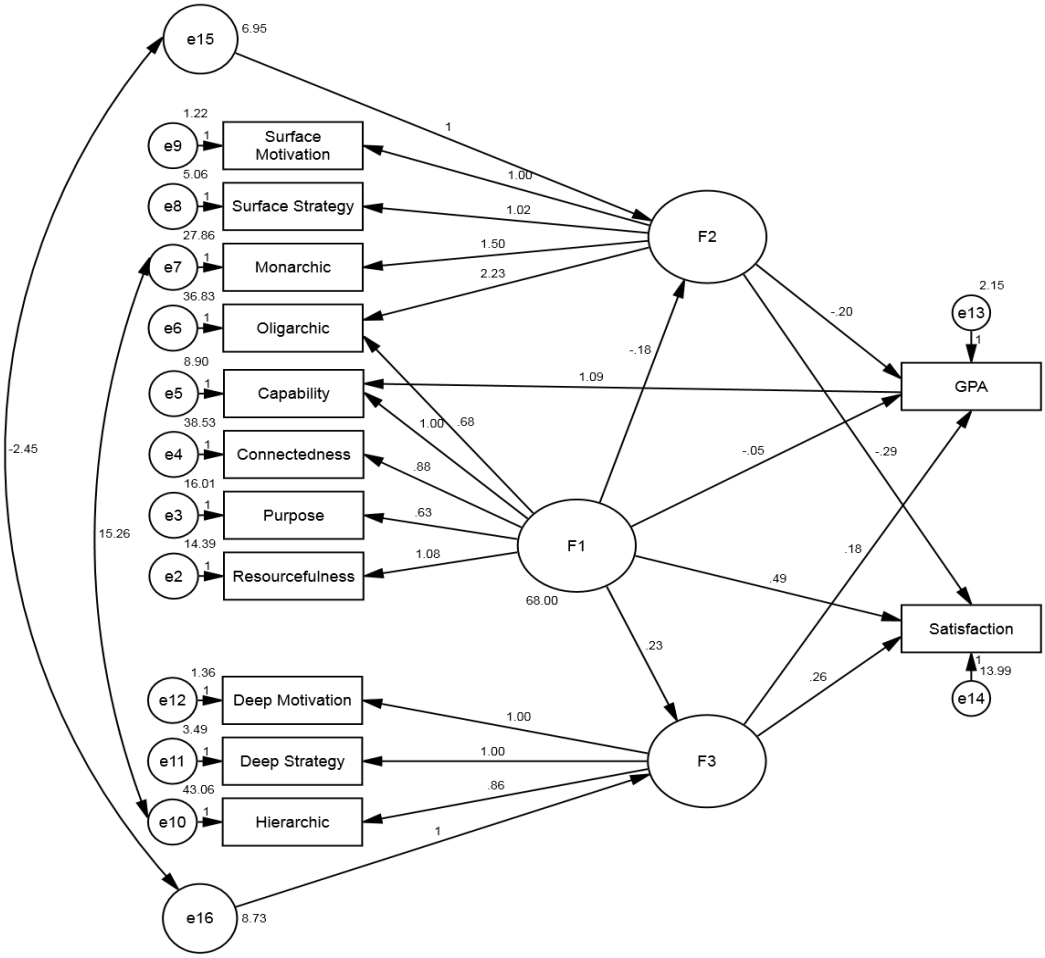

Figure 2. Final model of factors predicting student success

Discussion

The purpose of this research was to integrate measures of psychological constructs into an acceptable model that predicted successful outcomes for a cohort of non-traditional university students. The final model was found to be an acceptable fit of the data, and supports conclusions drawn in previous literature, particularly by Lizzio (2006) and Zhang and Sternberg (Zhang, 2000; Zhang & Sternberg, 2000). The predictive variables loaded onto three factors, which can be categorised in a manner consistent with proposals by Lizzio (2006), Zhang (2000) and Zhang and Sternberg (2000). Relationships between these latent factors were established, such that the latent factor formed primarily by Lizzio's five senses framework (F1) predicted two latent factors (F2 and F3) that were consistent with clusters of cognitive styles hypothesised by Zhang and Sternberg. Analysis of the model showed that the included predictive variables accounted for 26.4% of the total variance in GPA and 65.4% of the total variance in student satisfaction. In an unexpected result, student satisfaction did not correlate with GPA. This result suggested that it might not be appropriate to consider success as a latent construct formed by student satisfaction and GPA. The discussion below therefore focuses on the contributions made to predict GPA and student satisfaction separately.

Subsequent to this discussion, tentative claims can be made regarding general student success as a unitary construct.

F1: Five senses

Given the commonalities between the subscales incorporated onto the factor during the various stages of analysis, factor 1 is consistent with Lizzio's (2006) Five Senses Framework. The addition of the oligarchic subscale on factor 1 may be justified theoretically, given that the subscale's items measure students' propensity to reference their peer group in relation to task perception and performance. One of the most common forms of students' self-evaluation is comparison between their own academic standing and that of their peers (Festinger, 1954). Overall, the composition of the measurement model suggests an underlying psychological construct characterised either by evaluation of one's standing as a university student.

F2 and F3: Cognitive Style Clusters

The principle component analysis extracted two components consisting of measures of preference for various cognitive styles. Preferences for surface motivation, surface strategy, monarchic and oligarchic styles contributed to factor 2. Preferences for deep motivation, deep strategy and hierarchic cognitive styles contributed to factor 3. The construction of factors 2 and 3 are consistent with the clusters hypothesised by Zhang and Sternberg (Zhang, 2000; Zhang & Sternberg, 2000), which were characterised by the complexity of associated task perception and performance. In the present study, factor 2 was therefore conceptualised as preference for simple cognitive styles, and factor 3 was conceptualised as preference for complex cognitive styles. The conceptualisations are further supported by a number of pathways manifest in the model. First, a statistically significant negative covariance was constructed between the error coefficients of the latent constructs. This suggests that influences not included in the data have a positive relationship to one construct and a negative relationship to the other. Second, the structural relationships in the model suggest that variables tend to relate positively to one of these factors while relating negatively to the other. The above discussion implies that factors 2 and 3 may fall on two ends of the same spectrum. However, the legitimacy of Zhang and Sternberg's classification of the factors according to complexity warrants critical evaluation. Whilst the results are consistent with the clusters found by Zhang and Sternberg (Zhang, 2000; Zhang & Sternberg, 2000), critical evaluation of the measurement models suggest that these clusters may be categorised by underlying psychological constructs that are alternative to complexity of cognitive style. The following evaluates locus of control as a potential alternative categorisation of the clusters.

Factor 2, consisting of surface motivation, surface strategy, monarchic and oligarchic cognitive style measures, may be argued to represent a cluster of cognitive styles characterised by external locus of control. High scores on the surface motivation and surface strategy subscales reflect a tendency to be driven by an external stimulus in the form of an evaluative assessment. Similarly, high scores on the monarchic measure indicate that perception and performance are driven by the task demands of a single goal, with the demands of that goal outweighing all other drives. Finally, high scores on the oligarchic subscale indicate a predisposition for perception and performance to be dictated by the students' peers. Each of these measures may therefore indicate that the driver of task perception and performance lies external to the perceiver/performer.

Factor 3, consisting of deep motivation, deep strategy, and hierarchic cognitive style measures, may be argued to represent a cluster of cognitive styles characterised by internal

locus of control. High scores on deep motivation and deep strategy measures imply that perception and performance occur according to an intrinsic value/strategy system. Similarly, the hierarchic cognitive style requires the individual to employ a personal value/strategy system to prioritise competing goals.

The potential involvement of locus of control in influencing preference for cognitive styles has been suggested by McKenzie et al. (2004), who found that "locus of control" accounted for 3.6% of the total variance in "self-reported learning strategies". It might therefore be argued that the latent variables in the present study are, at least in part, characterised by locus of control. Future studies aiming to establish a shared language within the field may benefit from the exploration of the relationships between cognitive style clusters and underlying factors, such as complexity of task perception/performance and locus of control.

GPA

The estimates produced in relation to the final model lead to a number of conclusions relating to the relationships between the predictive variables and GPA. First, it was estimated that the model accounted for 26.4% of the overall variance in GPA. Simple cognitive styles accounted for 4% of the variance in GPA, whilst complex styles accounted for 3.2% of the variance in GPA. Whilst the path between the latent senses variable and GPA was not statistically significant, it is possible that the latent senses variable has an indirect effect on GPA through influencing preference for cognitive styles. This can be argued given that the latent senses variable accounted for 5.3% of the variance in preference for complex cognitive styles, and 3.3% of the variance in preference for simple cognitive styles. Overall, the variance in GPA accounted for by the model represents a potential starting point for future studies in predicting student success, particularly when considering that the model did not incorporate any direct measure of ability.

The model provides evidence for the inference that relationships between the GPA and students' sense of capability is not unidirectional in a sample that includes non-traditional students. The inclusion of a statistically significant regression line from GPA to sense of capability is justified, given the logical inference that sense of capability may in part be influenced by the grades received in previous semesters.

A major limitation of the present study is the reliance on self-reported GPA data, which may have been affected by inaccurate estimates, demand characteristics, or problems with the likert-style measure itself. It is recommended that GPA data be collected directly through institutions in larger scale studies to minimise the potential for these limitations and to facilitate more sophisticated analysis of longitudinal data.

Student Satisfaction

The estimates produced in relation to the final model lead to a number of conclusions relating to the relationships between the predictive variables and student satisfaction. It was estimated that the model accounted for 65.4% of the overall variance in student satisfaction, with 24.1% of the variance being accounted for by the latent factor characterised by Lizzio's (2006) Senses of Success. The results represent good news for institutions that have utilised Lizzio's framework to design or improve support services, given that they suggest that students who score higher on these measures are likely to be more satisfied, and by extension will be less likely to be at risk of attrition.

Pathway analyses revealed that the pathways between the cognitive style factors and measures of student success were not statistically significant, despite preference for simple and complex cognitive styles accounting for 6.8% and 8.6% of the variance in satisfaction respectively.

Summary and conclusions

Though this study included a relatively small sample, the resulting model may help to inform the design of transition and support programs that not only seek to minimise attrition rates at their institution but also improve the academic performance of their students. According to the present analysis, a support program based solely on the five senses framework may improve student satisfaction but may not directly improve academic performance. Conversely, a well-designed program based solely on cognitive styles may improve academic performance without increasing student satisfaction. It therefore follows that in the context of troubling attrition rates across Australian universities, the present study provides evidence for the need to incorporate a number of psychological factors into the design of transition and support programs for non-traditional students. With the development of more sophisticated models established by large scale, methodologically sound empirical studies, psychological research can inform educational practice more meaningfully, leading to more successful outcomes for university students.

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