Measurement models of factors influencing academic achievement and completion of tertiary studies

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Abstract

Studies involving both technical and further education (TAFE) students and university students have identified social integration, motivation and quality of teaching as important factors influencing non-completion and academic achievement. The aim of the current study was to develop and test a measurement model that captures these constructs in tertiary students. Questionnaire responses were collected from 165 TAFE marketing students and 148 university undergraduate psychology students. A three-factor independent cluster measurement model comprising latent factors for social integration, motivation and teaching was specified and tested using confirmatory factor analysis. While the three-factor model was found to fit the data well for the students from TAFE, contrary to expectations, this model was not valid for university students. The lack of congruence between the results may be partly due to the greater degree of skewness of the items comprising the motivation factor in the university cohort. A two-factor model comprising only the teaching and social integration factors was subsequently specified for the university sample and was found to have adequate fit. Further research is warranted to determine the extent to which the measure might be generalised to other tertiary student populations.

Introduction

Studies examining psychosocial and educational factors influencing academic outcomes and course completion or course withdrawal in tertiary university student populations are common in the literature, for example, McKenzie (2002). In contrast, few studies exist that examine these factors in tertiary students who do not initially
undertake university courses. This also means that few measures capturing educational psychosocial factors that may influence decisions to continue or discontinue courses have been developed specifically for non-university tertiary student populations. The purpose of this study was to develop a measure of factors that might distinguish those students in technical and further education (TAFE) courses who persisted with their course from those students who withdrew from their course. Such factors were found to include motivation, quality of teaching and social integration.

**Motivation**

Findings by a number of studies confirm the importance of motivation in relation to the perseverance required to complete a course of study (e.g., Burgum, Martins, & Northey, 1993; McInnis, James, Evans, Peel, & Dobson, 1999). In a study conducted by Sharma and Burgess (1994), just over half of the respondents reported feeling unmotivated and therefore decided to withdraw from their studies. In a survey of lecturers and students at the University of Newcastle, Killen (1994) reported that self-motivation was ranked second by students and first by lecturers in success items and second by both lecturers and students in failure items.

Motivation is a complex construct and a number of items can be used to measure different aspects of this construct. Typically, goal commitment as expressed in terms of the importance of completing a qualification is well documented in the literature (e.g., Burgum et al., 1994 and Pascarella & Terenzini, 1980) and hence the item “Completing the advanced diploma was extremely important to me” was written to capture goal commitment. Another aspect associated with motivation relates to the reasons for enrolling in a course. The importance of this factor is stressed by Cleary and Nicholls (1998) in their report for the Office of Training and Further Education (OTFE), which dealt with understanding and improving module completions for TAFE Institutes in Victoria. One motivation for enrolment is the vocational relevance of the course and the item “My employment opportunities were improved by the course” addresses this measure. Researchers including Naylor and Naylor (1982) and Bean and Metzner (1985) have identified this as a relevant factor when addressing the issue of non-completions. Mill (1991) found that a motivation for enrolling in a technical course at Moorabbin College of TAFE was the desire to get entrance to
another course. This measure is addressed in the item “The course was intended as a stepping stone to a degree”.

Teaching quality

A number of researchers including Parkinson, Hayton and Strachan (1987) and Streckfuss and Waters (1990) found that teaching was an important factor related to retention. In fact, Yorke (1999) concluded that the quality of teaching was the dominant influence for students deciding to withdraw from tertiary courses. Moreover, according to the Staff College Research cited in Martinez (1995), students who had withdrawn could be distinguished from those who had persisted on the basis of the significantly lower opinions that they held of the college and, in particular, the teachers.

In addition to the overall quality of teaching, Martinez and Munday (1998) found that other issues related to teaching which assisted in distinguishing persisters from withdrawers included whether students got enough help with their work, whether teachers were well prepared for their lessons, and whether students got enough feedback on assignments. Other researchers including Naylor and Naylor (1982), Brougham (1978), Mill (1991), Parkinson, Hayton and Strachan (1987), Johnson (1994) and Yorke (1999) have also found these aspects of teaching important in determining whether students persist with courses. Hence the quality of teaching factor comprised items reflecting each of these three aspects as well as an item reflecting the overall standard of teaching.

Social integration

Research conducted by Pascarella and Terenzini (1980) and Martinez and Munday (1998) confirmed the importance of social integration in relation to persistence. Martinez and Munday (1998) reported that students were more likely to withdraw if they experience difficulty in making friends. In the Further Education Unit (FEU) survey cited in Martinez (1995) it was reported that a greater proportion of completing students felt welcome and enjoyed the support of other students and staff than with withdrawing students.
Measures of social integration typically include the nature of relationships with teachers outside of class time, student friendships on campus and the extent of involvement in extra-curricular activities (Bean & Metzner, 1985). However, given the amount of work that many students are required to undertake to support themselves while studying, involvement in extra-curricular activities was not included as an item in this study. Items relating to the overall perception of students of their social life, how well a student gets on with other students and the extent of regular contact with teachers outside of class, were used in this study to capture the construct of social integration.

The current study

In the instrument developed for this study a number of items were used which were believed to capture the constructs of motivation, teaching and social integration. To provide some validity for these items, an a priori three factor model comprising the factors of motivation, teaching quality and social integration was hypothesized. The specific aim of the study was to test this three-factor independent cluster measurement model using confirmatory factor analysis (CFA) for students who were currently studying at TAFE. A further aim was to determine whether, if this measurement model was valid for TAFE students, this measurement model would also apply to tertiary students who were studying at a university.

Method

Participants

Participants were drawn from TAFE marketing students and undergraduate psychology students from campuses of a tertiary institution in Victoria. In total, 165 TAFE students and 148 undergraduate students participated in the study. Because the TAFE sample included a significant number of part-time students over three quarters of the TAFE students were over 21 years of age. In contrast, the majority of the undergraduate students were between 18 and 22 years of age. Both samples included a higher proportion of female than male students.
**Measure**

A 10-item questionnaire designed to capture the three constructs of motivation, quality of teaching and social integration was developed. The three items associated with motivation related to goals on enrolment in the course and the utility of the course. Such items, as operationalised in this research, are generally regarded by educational psychologists as being related to constructs of motivation referred to as goal orientation and task value. Task value refers to the degree to which students think that the course they are undertaking is interesting, important and useful. The four items associated with teaching quality covered issues such as satisfaction with standards of teaching, adequacy of teacher feedback, helpfulness of teachers and preparedness of teachers for lessons. Three items designed to measure social integration dealt with the quality of social life at a tertiary institution, the quality of relationships with other students and the degree of contact with teachers outside of classes. For the undergraduate students a number of the items relating to each construct were amended to reflect the different pedagogy of higher education compared with the TAFE sector. For example the item “Teachers are always well prepared for lessons” administered to the TAFE students was amended to “Lecturers and tutors are always well prepared for lectures/tutorials”. For each item, respondents indicated on a 5-point Likert scale the extent to which they agreed with each item.

**Procedure**

For the study involving the TAFE students 1031 questionnaires were mailed to TAFE students enrolled in the advanced diploma of marketing at a tertiary institution. One hundred and sixty-five completed questionnaires were returned. The undergraduate psychology students completed the questionnaire during lecture times as part of a larger battery of questionnaire measures.

**Statistical analyses**

Exploratory factor analysis is frequently used to examine the structure of a newly-designed questionnaire. However, exploratory factor-analytic techniques are very limiting in construct validation because the items forming the factors frequently do not fit together conceptually (Ayers et al., 1996). While the measure devised in
this study had not previously been validated, it was expected that the items in the measure would support a three-factor independent cluster model. In such instances, the use of confirmatory factor analysis (CFA) is preferred (Bollen, 1995). Hence the responses from the participants were employed in CFAs using maximum-likelihood estimation procedures on the covariance structures in the AMOS 5.0 program.

Both pattern and structure coefficients were considered in evaluating the full measurement structure and multiple criteria were employed to assess the goodness-of-fit of the models (Thompson, 1997; Thompson & Daniel, 1996). The chi-square likelihood ratio was used to determine the statistical fit of the models. The indices used to measure the descriptive fit of the models were the root mean square error of approximation (RMSEA), the Tucker-Lewis Index (TLI), the goodness-of-fit index (GFI), and the comparative fit index (CFI) (Kline, 1998; Thompson & Daniel, 1996). The criteria for indices of a good-fitting model were a non-significant value of $\chi^2$, values below .08 for the RMSEA, and values exceeding .90 for the GFI, TLI and CFI.

**Results**

Prior to analyses, data was screened for missing values and out of range responses. A single missing value was replaced by inserting the integer item mean value for that variable. A three-factor independent cluster measurement model comprising latent variables for teaching, motivation and social integration was specified such that items were hypothesized to load uniquely on their respective latent constructs and the correlations between these constructs were freely estimated. For the first sample of TAFE students, the data was a very good fit to the model in both statistical and practical terms, $\chi^2 (32, N= 165) = 26.25, p = .53, \text{RMSEA} = .00, \text{TLI} = 1.03, \text{CFI} = 1.00 \text{ and } \text{GFI} = .97$. Figure 1 displays the factor loadings and factor intercorrelations derived from this analysis while the factor patterns and structure coefficients for the estimated parameters are presented in Table 1.
Figure 1
Standardized parameter estimates for the three-factor model for students attending TAFE
Table 1
Factor Pattern and Structure Coefficients for the three-factor independent cluster model for TAFE students

<table>
<thead>
<tr>
<th>Items</th>
<th>Motivation</th>
<th>Teaching</th>
<th>Social Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>1. Completing the advanced diploma was extremely important to me</td>
<td>.68</td>
<td>.68</td>
<td>0a</td>
</tr>
<tr>
<td>2. My employment opportunities were improved by the course</td>
<td>.68</td>
<td>.68</td>
<td>0a</td>
</tr>
<tr>
<td>3. The course was intended as a stepping stone to a degree</td>
<td>.44</td>
<td>.44</td>
<td>0a</td>
</tr>
<tr>
<td>4. Teachers were always well prepared for lessons</td>
<td>0a</td>
<td>.14</td>
<td>.75</td>
</tr>
<tr>
<td>5. Teachers were helpful</td>
<td>0a</td>
<td>.12</td>
<td>.65</td>
</tr>
<tr>
<td>6. Sufficient feedback on work is given by teachers</td>
<td>0a</td>
<td>.12</td>
<td>.62</td>
</tr>
<tr>
<td>7. I am satisfied with the standard of teaching</td>
<td>0a</td>
<td>.12</td>
<td>.65</td>
</tr>
<tr>
<td>8. My social life is good</td>
<td>0a</td>
<td>.19</td>
<td>0a</td>
</tr>
<tr>
<td>9. I get on well with other students</td>
<td>0a</td>
<td>.23</td>
<td>0a</td>
</tr>
<tr>
<td>10. I have regular contact with teachers outside of class</td>
<td>0a</td>
<td>.12</td>
<td>0a</td>
</tr>
</tbody>
</table>

Note. P = pattern coefficient; S = structure coefficient. N = 335. Factor correlations were free to be estimated. All pattern coefficients are statistically different from zero.

a. Parameters fixed at reported levels to identify the model.

All factor pattern coefficients on the respective factors ranged from a low of .44 to a high of .81. The factor, motivation, had respective correlations of .19 and .28 with the teaching and social integration factors. The correlation between these latter two factors was .38. An inspection of the structural coefficients (see Table 1) revealed that the three factors represented distinguishable constructs.

Using modified wording of the items to make them applicable to undergraduate students at university, the three-factor independent cluster model was then tested for these students. However, the solution obtained was found to be inadmissible (negative error variance for the motivation item "I get on well with other
students’). An inspection of the distribution of the items revealed that the three motivation items were extremely skewed and hence this factor was removed from analyses.

A two-factor model comprising only the items comprising quality of teaching and social integration was subsequently specified and found to be an adequate fit to the data, \( \chi^2 (32, N= 148) = 25.78, p = .02, \) RMSEA = .09, TLI = .96, CFI = .97 and GFI = .95. All factor loadings were significant and exceeded .50. The correlation between the teaching and social integration factors was .63. Table 2 displays the factor pattern and structure coefficients for the two-factor model for university students. With the exception of item 7, ‘I have regular contact with my lecturers and tutors outside of class hours’, the two-factor model displayed discriminant validity for the two constructs.

**Table 2**

Factor Pattern and Structure Coefficients for Teaching and Social Integration for students from university

<table>
<thead>
<tr>
<th>Items</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teaching</td>
</tr>
<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>1. Lecturers and tutors are always well prepared</td>
<td>.73</td>
</tr>
<tr>
<td>2. Lecturers and tutors helpful</td>
<td>.89</td>
</tr>
<tr>
<td>3. Receiving sufficient feedback from lecturers and tutors</td>
<td>.84</td>
</tr>
<tr>
<td>4. Satisfaction with standard of lecturing and tutoring</td>
<td>.87</td>
</tr>
<tr>
<td>5. My social life at university is good</td>
<td>0a</td>
</tr>
<tr>
<td>6. I get on well with other students</td>
<td>0a</td>
</tr>
<tr>
<td>7. I have regular contact with lecturers/tutors outside of class hours</td>
<td>0a</td>
</tr>
</tbody>
</table>

*Note.* P = pattern coefficient; S = structure coefficient. N = 148. Factor correlations were free to be estimated. All pattern coefficients are statistically different from zero.

a. Parameters fixed at reported levels to identify the model.
Discussion

For tertiary students studying technical and further education courses, the three-factor independent cluster measurement model comprising latent variables for teaching, motivation and social integration was found to fit the data well. In particular, the three constructs displayed discriminant validity and further studies are now warranted to determine whether these constructs are significant predictors of course completion or course withdrawal.

In contrast, the three-factor model was not a valid representation of the responses from university psychology undergraduate students. However a two-factor model comprising only the items for teaching and social integration was an adequate fit to the model. The lack of congruence between the results of the factor analyses for the two samples of students was unexpected. It could be expected that the items related to task value, a construct of motivation, for TAFE students would also be a measure of motivation for higher education students. Items related to the importance of completing the degree and the vocational relevance of the course would be expected to have as much relevance for students in higher education as for TAFE students. However, psychology undergraduate students expressed high levels of motivation and to such an extent that responses on items relating to motivation were negatively skewed. In addition, the item relating to the “use of the course as a stepping stone” may not resonate in the same way with higher education students as many TAFE students, whether it is realistic or not, harbour aspirations to articulate to higher education. In contrast, psychology undergraduate students who want to continue their studies so that they might be psychologists are aware of the degree of competition currently surrounding entry to the Honours year, a necessary ‘stepping stone’ to their dreams of pursuing a career as a psychologist. Alternate entry into a 4th-year postgraduate course is only possible for full fee-paying students. Nevertheless, it seems unlikely that the slight changes in the wording of some items to render them more suitable for students in higher education would have influenced the findings to such an extent in relation to this sample of students. Further research involving undergraduates from other disciplines and universities would be required before any firm conclusions regarding the generalisability of the findings for the three-factor model can be made. A further consideration may be that the students
from TAFE were, on average, older than the undergraduate university students and this may be a further factor that future studies confirming or disconfirming the measurement model proposed in this study should examine more closely.

In summary, a measurement model was established that was a valid representation of the three key constructs of motivation, quality of teaching and social integration that previous studies have suggested as instrumental in predicting whether or not tertiary TAFE students complete their selected courses. Furthermore, the study also demonstrated that two of the three factors, namely quality of teaching and social integration, may be factors that play a key role in determining course outcomes for undergraduate students at tertiary institutions.

References


