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A Structural Equation Modelling of the Academic Self-Concept Scale

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Abstract

The study aimed at validating the academic self-concept scale by Liu and Wang (2005) in measuring academic self-concept among university students. Structural equation modelling was used to validate the scale which was composed of two subscales; academic confidence and academic effort. The study was conducted on university students; males and females from different levels of study and faculties. In this study the influence of academic self-concept on academic achievement was assessed, tested whether the hypothesised model fitted the data, analysed the invariance of the path coefficients among the moderating variables, and also, highlighted whether academic confidence and academic effort measured academic self-concept. The results from the model revealed that academic self-concept influenced academic achievement and the hypothesised model fitted the data. The results also supported the model as the causal structure was not sensitive to gender, levels of study, and faculties of students; hence, applicable to all the groups taken as moderating variables. It was also noted that academic confidence and academic effort are a measure of academic self-concept. According to the results the academic self-concept scale by Liu and Wang (2005) was deemed adequate in collecting information about academic self-concept among university students.

Keywords: Academic Self-Concept Scale, Structural Equation Modelling, University Students, Malaysia.

Introduction

Academic self-concept is referred to as students' perceptions about their levels of competencies within the academic realm (Ferla et al., 2009; Lips, 2004; Wigfield & Eccles, 2000; Wigfield & Karpathian, 1991). Broadly academic self-concept is the way how students feel about themselves as learners (Guay et al., 2003). Specifically, academic self-concept is a composite view of oneself across various sets of specific academic domains, abilities, and perceptions (Trautwein et al., 2006). This is based on

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self-knowledge and evaluation of values formed through experiences with the interpretation of one's academic environment (Eccles, 2005; Bong & Skaalvik, 2003). Academic self-concept has been noted of its tendency to decline among students from early to mid adolescence, and also, it can extend to adulthood (Liu & Wang, 2005). Marsh (1989) explained that academic self-concept reaches its lowest point in middle adolescence, but, also found out that academic self-concept increased through early adulthood. In other findings it has been noted that as students grow older their academic self-concept becomes relatively stable (Guay et al., 2003). Academic self-concept has been noted to vary as students move through grades in which their academic self-concept tends to rise in the direction of their academic achievement (Liu & Wang, 2005; Jacob et al., 2002), while others studies found out that it tends to become weaker (Marsh & Yeung, 1997; Marsh et al., 2002). Generally, it has been highlighted that academic self-concept influences students' academic achievement (Awad, 2007; Marsh, 2006; Cokley, 2000; Marsh et al., 2002, 1999). However, although various researchers concur with the academic self-concept changes, only a few studies have tackled changes in the instruments of measure of academic self-concept across various groups of students they measure (Matovu, 2012).

In another issue, several studies have tested the validity of academic self-concept instruments across age (Marsh, 1990; Marsh et al., 1988), gender (Byrne & Shavelson, 1987; Marsh, 1993), and other groups. There are no documented studies that have validated the Liu and Wang (2005) academic self-concept scale across gender, levels of study, and faculties among university students using structural equation modelling. Validation of an instrument is one way of improving its performance over time. Academic self-concept instruments which have been validated over time have become better and more effective in measuring academic self-concept (Byrne, 2002; Marsh et al., 1999). The validation of the academic self-concept scale in this study was done because it had been noted that weak theoretical bases, poor quality of measurement instruments, methodological shortcomings, and lack of consistent findings had merged academic self-concept instruments (Byrne, 1984; Shavelson et al., 1976).

The third issues is that gender differences in academic self-concept have been reported in some studies; males and females possessing different conceptions about their competencies in academic abilities (Ireson et al., 2001; Wigfield et al., 2001; Marsh, 1989). Studies have postulated that males show higher academic self-concept than females (Kling et al., 1999). In other studies it has been posited that males tend to exhibit higher academic self-concept in science courses while females in non-science courses (Harter, 1999; Marsh, 1989). Jacob et al. (2002) articulated that gender differences start as early as elementary school and remains stable throughout adolescence to adulthood. With such existing differences this called for the validation of the academic self concept scale to find out whether it was invariant across the groups it was measuring. In another study it was highlighted that small stereotypic gender differences linearly declined in mean levels of academic self-concept with age, and modest differentiation between academic competencies among students (Marsh, 2006). This can also be the same situation in other groups defined by self-concept and academic achievement (Worrell et al., 1999).

Fourth, Byrne (1996) and Hattie (1992) cited two major issues in which any research concerning the self-concept should focus; (a) the development of instruments affording to collect valid and reliable scores and (b) attention to cross-cutting concerns in the development of academic self-concept measures which have also been addressed in this study. Specifically, lack of the above cited issues reported in the literature have led to the validation of the academic self-concept scale and further studies on academic self-concept (Marsh, 1990; Marsh et al., 1988; Marsh et al., 1991).

According to developed theories and models that explain academic self-concept and academic achievement, there has been no much proof on whether prior academic self-concept influences academic achievement or, prior academic achievement causes subsequent academic self-concept (Marsh et al., 2002; Matovu, 2012). In the self-enhancement model academic achievement is due to the consequence of academic self-concept (Bong, 2001; Skaalvik & Skaalvik, 2005). Secondly, the skill-development model highlights that academic achievement determines academic self-concept (Marsh, 2006; Marsh et al., 2005, 2002, 1999). Third, academic self-concept and academic achievement are reciprocal (Guay et al., 2003). The extensive debate among researchers concerning whether prior academic self-concept influences academic achievement, or, prior academic achievement causes subsequent academic self-concept has been considered an egg-chicken question (Marsh et al., 2002). This also calls for more understanding of the influence of academic self-concept on academic achievement, and to validate further the instruments that measure academic self concept (Byrne, 1996; Shavelson et al., 1976).

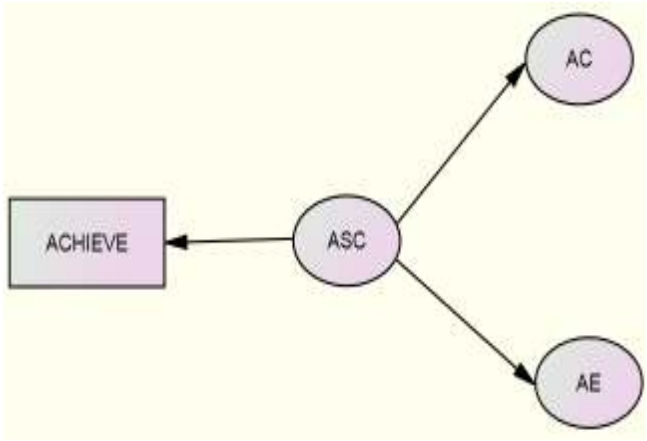

Figure 1. Academic self-concept - Academic achievement hypothesised model

ACHIEVE = Academic Achievement, ASC = Academic Self-Concept, AC = Academic Confidence, AE = Academic Effort

Measure

The aim of the study was to validate the academic self-concept scale developed by Liu and Wang (2005) to test for its variability and reliability in measuring academic self-concept among university students. The academic self-concept scale was developed in reference to the general academic status scale (Piers & Harris, 1964), the academic esteem subscale (Battle, 1981), and the school subjects self-concept (Marsh et al., 1983). The original academic self-concept scale by Liu and Wang (2005) had to two sub scales; (a) academic confidence, and (b) academic effort each with 10 items. The 20 item questionnaire which utilised a 7 point likert scale with designated end points of strongly agree and strongly disagree was used in this study. The items included both negatively and positively worded items to avoid the same answers from the students. Both academic confidence and academic effort items were mixed in the scale; academic confidence items taking odd numbers (1, 3, 5, 7, 9, 11, 13, 15, 17, 19), while academic effort items taking even numbers (2, 4, 6, 8, 10, 12, 14, 16, 18, 20). For the first validation the Liu and Wang (2005) academic self-concept scale item 13 was removed, and in the second validation by Tan and Yates (2007) using Rasch modelling three items (4, 13, and 18) were removed because of their poor in-fit statistics (see the

instrument in Appendix A). These studies were done in secondary schools and primary schools respectively in Singapore.

Research Questions

This study was based on two research questions; (a) whether the Liu and Wang (2005) academic self-concept scale was appropriate to measure academic self-concept among university students, and (b) whether university students' academic self-concept influenced their academic achievement.

Hypotheses

The study was conducted on four hypotheses which included; (a) academic self-concept directly influences academic achievement, (b) the hypothesised model will fit the data collected using the Liu and Wang (2005) academic self-concept scale, (c) the path coefficients of the hypothesised model vary significantly among groups (gender, levels of study, and faculties) as moderating variables, and (d) academic confidence and academic effort are a measure of academic self-concept.

Methods

Sample

The data was collected from a total of 280 students in a public university in Malaysia. The sample composition was of males (50.4%) and females (49.6%) for gender, non science (61.8%) and science (38.2%) for faculties, and undergraduates (50.7%) and postgraduates (49.3%) for levels of study. All the students were randomly selected from their respective groups. For science and non science faculties, the students were selected from the different departments in their respective faculties. The sample was appropriate because it considered the proportions of the different groups in its selection.

Instrument

The data was collected using the original academic self-concept scale by Liu &Wang (2005) which measured academic confidence and academic effort on the general academic self-concept. Academic confidence and academic effort served as endogenous variables to the general academic self-concept. The instrument had 20 items on a 7 point scale on which students responded to indicate their agreement or disagreement with the items. The 20 item original Liu and Wang (2005) academic self-concept scale was validated because there was no literature that it had ever been validated on measuring academic self concept among university students using structural equation modelling.

Structural Equation Modelling

The study applied four stages structural equation modelling using AMOS 18 to test the hypotheses. The study validated the measurement model, confirmatory factor analysis was done to the hypothesised model, metric invariance were calculated, and then later, good fit of the fully fledged academic self-concept and academic achievement model was tested. All these processes allowed the relation to be tested only after ensuring that the latent variables were measured adequately (Barry & Stewart, 1997). In cross validation of the model, moderating effects of gender, levels of study, and faculties were considered. In estimating the hypothesised model using covariance matrix the estimations satisfied the underlying statistical distribution theory by giving appropriate estimates for the properties. This was due to having adopted a maximum likelihood in estimating the full-fledged model. After the model had been estimated a set of criteria were applied to evaluate the model goodness-of-fit. The measures were based on the

conventionally accepted criteria for deciding what constitutes a good fit model, that is, (a) reasonableness of the estimates, (b) consistence of the model that collected data, and (c) proportions of variance of the dependent variables that accounted for by the exogenous variables.

Table 1. *Measurement of the variables of the hypothesised model*

Construct	Items	Measure	M	SD	CR
Academic Confidence	C1	I can follow the lectures easily.	4.35	1.81	.853
	C2	I am able to help my course mates in their school work.	4.66	1.73	
	C3	If I work hard, I think I can get better grades.	5.31	1.64	
	C10	I am able to do better than my friends in most courses.	4.58	1.77	
Academic Effort	E2	I often do my course work without thinking.	5.67	1.36	.861
	E3	I pay attention to the lecturers during lectures.	6.39	1.12	
	E4	I study hard for my tests.	6.49	.97	
	E5	I am usually interested in my course work.	6.48	1.03	
	E6	I will do my best to pass all the courses this semester.	6.84	.46	
	E9	I do not give up easily when I am faced with a difficult question in my course work.	5.80	1.22	

Note: M = Mean, SD = Standard Deviation, CR = Composite Reliability

Results

In this section, the results of the structural equation modelling that addressed the hypotheses of the study are presented.

Measurement model

Confirmatory Factor Analysis using AMOS 18 was used to determine the psychometric properties of the academic self-concept scale and the academic achievement among university students. The results got using the maximum likelihood estimation of confirmatory factor analysis tested the validity of the model which indicated that the hypothesised model fitted the data. In the first run of the data some items had poor loading on their respective factors. The items with poor fit were removed from the model. In the subsequent run, the overall fit of the measurement model was adequate with Relative Chi- Square = 2.386, CFI = .943, RMSEA = .070, SRMR = .048, and p = .000 (see figure 2). All measures were within acceptable values indicating good model

fit (Byrne, 2001, 2006, 2010; Arbuckle & Wothke, 1999; Masrom & Hussein, 2008; Brown, 2006). In other words, measuring academic self-concept did generate the observed covariance matrix; that is to say, there was no evidence to reject the measurement model at this level. From the measurement model the factor loading were substantial and statistically significant at p = .000, and the model was free from offending estimates. The composite reliability for the first order factors was .85 for academic confidence and .86 for academic effort (see table 1). A composite reliability above .70 for a model is adequate (Hair et al., 1998). Also, both convergent and discriminant validity were examined. The convergent validity which is the extent to which indicators of a specific construct converge or share proportion of variance in common was examined using composite reliability and Average Variance Extracted (AVE). Discriminant validity which is the extent to which a construct is truly distinct from other constructs (Bagozzi & Lee, 2002; Shen et al., 2009) was examined as well. The data supported the measurement adequacy with the Average Variance Extracted (AVE) of .68 to academic confidence and .62 to academic effort which were above the threshold (.50) and an evidence of convergent validity (Fornell & larker, 1981; Shittu et al., 2011). Also the AVE for both academic confidence and academic effort were greater than the squared correlation (.42) which was an evidence for discriminant validity that is, supporting the evidence of construct validity of the model. This indicated that the measured variables were more in common with the construct they were associated with than they did with the other constructs (Byrne, 2010).

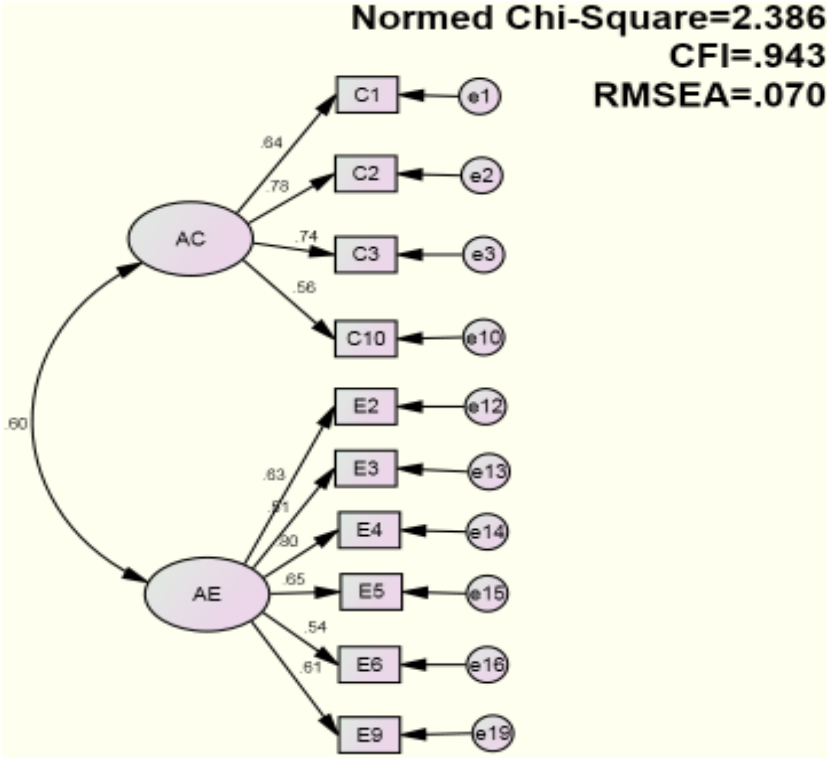

Figure 2. Measurement model of Academic Self-Concept

AC = Academic Confidence, AE = Academic Effort

From the measurement model in figure 2, six items (7, 9, 11, 13, 15 and 17) were removed from the academic confidence subscale, while four items (2, 14, 16 and 20) were also removed from the academic effort subscale (see items in appendix A). This was because the items had poor loadings onto their factors.

Full- fledge model of academic self-concept and academic achievement

Figure 3 shows results of structural equation modelling of the influence of academic self-concept on academic achievement in the full-fledged model. According to the goodness-of-fit statistics, confirmatory modelling yielded consistence in the causal relationship with the data, with Relative Chi-Square = 2.272; CFI = .937, RMSEA = .068, SRMR = .050, and p = .000. All the results got indicated that the indices satisfied their critical cut off scores; that is, the model fitted the data.

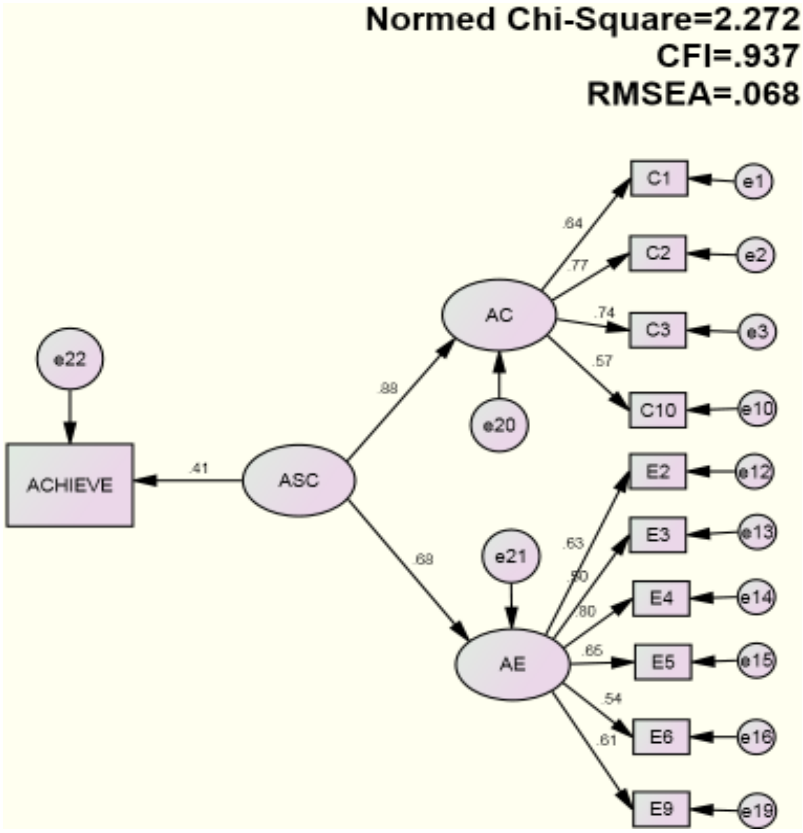

Figure 3. Standardised coefficients of the Academic Self-concept - Academic Achievement hypothesised Model

According to the model in figure 3, the parameter estimates of the derived model were good and free from offending values. According to the coefficients of the causal structure, all path coefficients were statistically significant at .005 levels, showing the practical importance of the model. From the model in figure 3 it can be highlighted that students' academic confidence (β = .88, p < .05) and academic effort (β = .68, p < .05) contributed to their academic self-concept. Also, academic self-concept was influential to the students' academic achievement (β = .41, p < .001). The two endogenous variables explained 61% of the variability in academic self-concept. From the findings, the four hypotheses were supported by the results got in the study.

Gender, levels of study, and faculties' invariance of the model

It was also in the interest of the research to examine the structure invariance of the model among the moderating variables. The model had three moderating variables which included gender (males and females), levels of study (Postgraduate or undergraduate), and faculties (science or non-science). In testing the invariance simultaneous analysis was done on the males (n^1= 141) and females (n^2 =139). Later,

an analysis of the constrained model for the males and females was done whose Chi-Square values were tested against the baseline Chi-Square values for the statistical significance difference. The same procedure was done to test for the invariance in the levels of study (undergraduates; n^1 = 142 and postgraduates; n^2 = 138), and faculties (science; n^1 = 107 and non-science; n^2 = 173) of the university students (see table 2).

The invariance tests across male and female groups resulted in a statistically insignificant change in the Chi-Square value, χ^2 (df = 8) = 16.84, p > .005. Also for undergraduates and postgraduates, χ^2 (df = 8) = 8.76, p > .005, and non science and science faculties, χ^2 (df = 8) = 5.918, p > .005 had also a statistically insignificant change in the Chi-Square value. According to the results, the difference in the Chi-Square values of the constrained and unrestricted model did not produce poor fit. It can be concluded from the results of the invariance tests, that is; gender, levels of study, and faculties in which the students study did not interact with the students' academic achievement. It can also be drawn from the results that the path coefficients did not vary significantly across the three groups (gender, levels of study and faculties). Hence gender, levels of study, and faculties of the students were not invariant on the academic self concept scale among university students.

Table 2. *Results of multiple groups modelling of the hypothesised model*

		Chi-Square	*df*	Critical value	Chi-Square Change
Gender	Unrestricted	150.18	86	21.95	16.84
	Constrained	167.02	94		
Level	Unrestricted	142.67	86	21.95	8.76
	Constrained	151.43	94		
Faculty	Unrestricted	150.88	86	21.95	5.92
	Constrained	156.80	94		

df = degrees of freedom

Discussion

In this study, several findings have been got and have expanded on the knowledge in the area of academic self-concept and academic achievement at large. The results got can explain related issues on students' achievement in relation to their academic self-concept with the studied moderating variables. The results showed that academic self-concept directly influenced academic achievement. These results are similar to those found by Awad (2007), Cokley (2000), Cokley (2002) & Lent et al. (1997) who highlighted that academic self-concept had a relationship with academic achievement. It can also be derived from the results of this study that the higher the academic self-concept the students have the more they will achieve academically. Or, the avoidance of repeated failure can produce good academic achievement (Martin et al., 2004).

It can also be highlighted that academic self-concept through gender, levels of study, and faculties does not influence academic achievement. So, in the current situation where studies are being done on academic self-concept as an influencer to academic achievement, gender, levels of study, and faculties do not moderate

academic achievement. This refutes the findings of Ireson et al. (2001), Wigfield et al. (2001), Marsh & Yeung (1998), Pajares & Miller (1994) who articulated that males and females possess different conceptions about their competence in academic abilities. This was by males having a higher academic self-concept than females (Kling et al., 1999). Basing this on gender this may discourage a particular gender from certain academic choices view themselves as poorly fitting into certain academic areas (Eagly, 1987; Eccles, 1987). This was evidenced in male dominated course where females reported higher levels of academic discrimination than females in female dominated course (Steele et al., 2002). Also the results reject that there is a difference in self-concept of students offering either science based or non-science courses (Harter, 1999; Marsh, 1989). Again the results of this study have differed from the findings of Trautwein et al. (2006) who suggested that academic self-concept may differ as a function of the students' achievement on their reference group. At the same time findings of this study are similar to those of Bong and Skaalvik (2003) that revealed that academic self concept directly influences how students perform at academic tasks.

Conclusion

In analysis of the findings of the study they have applicable implications in the teaching and learning process among university students. In the teaching and learning situation targeted on academic self-concept instructors should be aware that students' academic confidence and academic effort are great contributors to their academic self-concept which determines their academic achievement. Teaching instructors should go an extra mile to develop students' academic confidence and also encourage them to put in more effort in order to achieve highly academically. Secondly, researchers to us the academic self-concept scale by Liu and Wang (2005) in future to find out the academic self concept of university students they should know that it is valid and invariant across students' gender, levels of study and faculties.

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APPENDIX A

1= strongly Disagree, **2** = Disagree, **3** = Disagree some-what, **4** = neither agree nor disagree, **5** = Agree some-what, **6** = Agree, **7** = Strongly Agree

1.	I can follow the lectures easily.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2.	I day-dream a lot in lectures.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3.	I am able to help my course mates in their school work.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4.	I often do my course work without thinking.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5.	If I work hard, I think I can get better grades.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6.	I pay attention to the lecturers during lectures.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7.	Most of my course mates are smarter than I am.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8.	I study hard for my tests.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9.	My lecturers feel that I am poor in my studies.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10.	I am usually interested in my course work.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11.	I often forget what I have learned.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12.	I will do my best to pass all the courses this semester.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13.	I get frightened when I am asked a question by the lecturers.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14.	I often feel like quitting the degree course.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15.	I am good in most of my courses.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16.	I am always waiting for the lecture to end and go home.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
17.	I always do poorly in course works and tests.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18.	I do not give up easily when I am faced with a difficult question in my course work.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19.	I am able to do better than my friends in most courses.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20.	I am not willing to put in more effort in my course work.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

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