

Rasch Psychometric Analysis of Composite Achievement and Social Goal Orientation Instrument

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Abstract: Learning quality of higher education students continue to be an issue for stakeholders in the higher educational sector. There is inadequate psychometric testing with respect to the assessment of both achievement and social goal orientation in a composite form using Item Response Theory. This study, presents the test development process measures students' achievement and social goal orientation towards academic attainment. Rasch Measurement Model was used for the data analysis. Reliability and validity exhibited a satisfactory measure of students' goals orientation but eventually with the empirical omission of performance goals. Implication of these tests can be used for placement, diagnostic and predictive assessment purposes.

Key words: Higher education, goal orientation, Item Response Theory, Rasch Measurement Model

INTRODUCTION

Accountability and graduate on time valued the importance of achievement-driven research. Consequently, there were intensified achievement-driven interventions aimed at improving higher education's students' academic achievement and academic attainment. The twenty first century employability trend lends itself towards acquisition of generic skills such as problem solving, communication and information gathering skills to mention a few; in addition to academic qualification as the former instills attributes such as team working, networking, self-confidence and coping with unexpected challenges. These farfetched attributes are mostly derived from non-academic/psychological variables. Examples of such variables are motivational orientations, behavioral or emotional traits, belief systems such as self-efficacy, self-esteem, self-confidence and locus of control (Beck and Davidson, 2001; Caprara *et al.*, 2011; Diseth *et al.*, 2010; Richardson *et al.*, 2012). Robbins *et al.* (2004) found out that academic self-efficacy and students' sense of academic skills were related to academic attainment. This was further buttressed by Brown *et al.* (2008) as strong positive relationships exist between self-efficacy, educational goals and college persistence.

Moreover, when compared with the traditional academic measures used in the admission process (that is, standardized test scores and high school academic performance) with respect to its ability to

increase minority admissions; predict academic problems and performance and reduce attrition of all students, the non-academic predictors alone resulted in higher hit rates (Le Deist and Winterton, 2005; Oswald *et al.*, 2004; Robbins *et al.*, 2004; Sedlacek, 2004). The clamour for psychological variables can only be widely accepted by all stakeholders when the impacts of their long term interventions are attestable. For these interventions to meet its mark, a careful measuring and testing procedure of these psychological variables must be delineated. Though few validation of goal orientation measures have been investigated (Conroy *et al.*, 2003; Elliot and Murayama, 2008; Fryer and Elliot, 2007; King and Watkins, 2011b) but the novelty in this study is the validation of both achievement and social goals in a composite form among multi-ethnic higher education student's population within the Asian race. An exemption to the Asian perspective is observed in an investigation that noted how the profile of the students' achievement goals differs somewhat from those found in studies among North American-based students (Dela Rosa and Bernardo, 2013; Luo *et al.*, 2011). However, this study corroborates achievement goals with a multiple goal dimension and excluded social goal dimension. Moreover, the population understudy was secondary school students.

With the importance of social goals in mind and the inadequate quest especially within cross-cultural settings (Chang and Wong, 2008; King, 2011; King and Watkins,

2011a, b) amid the varied conceptualization, the objective of this study is to develop and psychometrically test a composite instrument comprising both achievement and social goals using Rasch Measurement Model.

Goal theory: Goals increase an individual's motivation which will ultimately aid their academic achievement (Koch and Nafziger, 2011). There are numerous concepts that contribute to motivation but goal orientation is unique as it is a form of psychologically based motivation which greatly influences student's achievement (Kellaghan, 2001; Kellaghan and Greaney, 2001). Goal orientation refers to an individual's fundamental motives, purpose or disposition to pursue certain goals in academic settings (Anderman and Maehr, 1994; Dweck and Leggette, 1988; Pieterse *et al.*, 2011; Payne *et al.*, 2011). At the onset, goal orientation was for task-based research and aimed towards increased academic achievement but the concept is now be applied to academic attainment in which other non-intellective factors such as help-seeking and problem solving capabilities have been proven to be influenced by this trait.

Goal orientation conceptualization: Theorists over the past few decades have proposed a two-factor (Dweck, 1986; Dweck and Leggette, 1988), three-factor (Elliot and Harackiewicz, 1996; Pintrich and Zusho, 2002; VandeWalle, 1997) and later fully expanded to the 2×2 achievement goal orientation framework in which each of the mastery and performance goals have both approach and avoidance valences (Elliot and McGregor, 2001). Recently, a 3×2 framework was introduced (Elliot *et al.*, 2011) that defines its dimensions as self-oriented, task-oriented and other-oriented (meaning externally influenced) and each of the three possessing approach and avoidance valences. Students with performance goal orientation portray competence demonstration as focus is on the end result and are apprehensive of their poor performance or failure and its consequences. These feared outcomes make such students (where possible) choose unchallenging tasks (Dweck, 1986; Elliott and Dweck, 1988; Payne *et al.*, 2011). Mastery goal orientation students seek challenging tasks that provide them the opportunities to develop their competencies and perceive feedback and errors as part of the natural, instructive learning process. The outcome instigates an increase in self-efficacy (Bandura, 1986).

Social goals (Dowson and McInerney, 2001; Ryan and Deci, 2000) are another form of goal orientation perceived as social purposes aimed towards academic attainment (King and Watkins, 2011b; Pintrich and

Schunk, 2002; Urdan and Maehr, 1995) and is also explaining students' motivation (Horst *et al.*, 2007). The need for affiliation, approval, concern, responsibility and status from self, peers, academia and or familial have been generally delineated as social purposes students maintain at the onset and during their learning experience (Dowson and McInerney, 2004; Wentzel, 2000).

Cooperative learning necessitates the inclusion of social goals within higher learning as students' exerting more effort on their studies, may not necessarily be for academic achievement and attainment but could also be for social reasons for instance, making friends, proving their worth to their friends and fulfilling friends and parental expectations. Diversification and Inclusion within higher education sector also warrants the investigation of social goals as educational research has dissipated to developing, multicultural and cross cultural collectivist societies. However, research findings still portray inadequate investigation of the social goal construct (Covington, 2000) especially its conceptualization (Horst *et al.*, 2007; Urdan and Maehr, 1995) and psychometric analysis (Horst *et al.*, 2007; King and Watkins, 2011b).

Empirical studies regarding achievement and social goal orientation: Goal orientation theory is an age long theory for both theoretical and evidence based research in educational research. Controversies are apparent in the empirical goal orientation research across educational levels' and tasks' findings (Fryer and Elliot, 2007; Muis *et al.*, 2009). For instance, though positive relationships have generally been found between mastery goal orientation, performance outcomes, self-efficacy and knowledge; however performance orientation has had inconsistent findings with various outcomes. A tabulated summary of some research findings based on both achievement and social goals is presented in Table 1.

Item Response Theory (IRT): Item response theory consists of measurement models that permit the analyses of test development not only at the dimension/composite level but more importantly at the item level for self report survey instruments. It is also a form of measurement model that is both item and sample independent. The derived measures are truly outcomes reflecting respondents' values adjudged from the better measurement characteristics hence making it more reliable, valid and meaningful. With IRT measurement models, precise and user-friendly analysis and interpretation can be achieved whilst still requiring minimal sample size to achieve adequate statistical power.

Table 1: Summary of positive factors associated with achievement and social goals orientation

Goal orientation sub-constructs	Positive effects
Mastery-approach goal orientation	Cognitive engagement Self-reported self-regulatory strategies Self-efficacy Interest Value Help seeking Achievement outcomes Metacognitive learning strategies Belenky and Nokes-Malach (2013), Bergsman <i>et al.</i> (2013), Harackiewicz <i>et al.</i> (2000), Pintrich (2000), Ryan and Pintrich (1998) and Senko <i>et al.</i> (2013)
Goal orientation sub constructs	Positive effects
Mastery-avoid goal orientation	Self-determination Self-reported surface processing strategies Conroy and Elliot (2004) and Elliot and McGregor (2001)
Performance-approach goal orientation	Persistence Increment in grades Elliot (1999) and Harackiewicz <i>et al.</i> (2002)
Performance-avoid goal orientation	Self-efficacy Achievement Metacognition Deep processing Intrinsic motivation Help seeking Self-determination Self-reports of surface processing Conroy and Elliot (2004), Elliot (1999), Elliot and McGregor (2001), Karabenick (2003), Middleton and Midgley (1997), Shih (2005) and VandeWalle <i>et al.</i> (2001)
Social goal orientation	Parent approval goal is related to mastery goals Social status goals were positive predictors of deep learning Social responsibility and social status goals were both shown to be strongly related to emotional and behavioural engagement Social affiliation and social concern goals were positively related to positive self-beliefs Social affiliation, concern and status goals are the best predictors of quality learning General social goals still had significant effects after controlling both mastery and performance goals Elliot and McGregor (2001), King and Watkins (2011a, b) and Watkins <i>et al.</i> (2002)

Rasch Measurement Model (RMM) is parameter models within the IRT Models. The probability of the correct response is a logistic function of both the person and item parameters. Some of the analyses obtained through RMM are dimensionality, fit statistics, item polarity, response category function analysis, internal consistency reliability estimates and differential item functioning. Its unit of measure is based on the log odds (called logits) of respondents' agreeing with the items. The items are ordered along the zero calibrated scale from easiest to agree with to hardest to agree with. Items at the easiest end of the scale (those with negative logit values) are answered in agreement by most students and those items at the hardest end of the scale (those with positive logit values) are most likely to be answered only by students with high perception of the investigated trait.

Dimensionality: Within Rasch Measurement Analysis (RMA), dimensionality assumes that the items making up the test when summed together should form a unidimensional scale. The reported principal components analysis of the residuals tests the local independence of the items suggesting that there is no further association

between the items other than random associations, once the Rasch factor has been accounted for. This should lead to no meaningful pattern in the residuals. In addition, raw variance explained by measures and the unexplnd variance in 1st contrast indices should have satisfactory indices.

Fit statistics: Both weighted and unweighted mean squares are termed fit statistics and when normalized using Wilson-Hilferty transformation, it results in Infit t and outfit t with a mean close to 0 and its standard deviation close to 1 (Bond and Fox, 2007). Below or above the expected mean portrays less or more variation between the observed and predicted response patterns. Its implication signifies that the data conform to the measurement model.

Response category: Each response category summated scores are calculated in logits and termed threshold values. They must be ordered from the least endorsement to the most endorsement which is, "Strongly Disagree" to "Strongly Agree". Any item that those not follow suit is investigated further and may be discarded (Wright, 1985).

Reliability: Reliability refers to the consistency of achieving true measures irrespective of varied conditions. Reliability estimates can be calculated in three ways. These are:

- Item separation index and person separation index: separation indices connotes the ability of the items to separate persons to different levels of the construct measured implying that the proportion of observed variance can be considered to be true. A value of 1 represents high reliability and vice versa
- Reliability estimates for both the items as well as the respondents (persons): the latter reports on the consistency of a respondent’s answers to the items in the scale
- Cronbach alpha’s calculation: this is a measure of internal consistency and estimates reliability of the scale by computing the variance between all possible pairs of items. A value of <0.80 is regarded as high and satisfactory

MATERIALS AND METHODS

The study aims to test the psychometric properties of the newly developed ASGOT instrument using RMA. This will ascertain the Asian HE students’ Goal Orientation with respect to their academic attainment. As this is an exploratory study within the population of an Asian University HE awarding baccalaureate degree, a multistage stratified random sampling at which three streams of representative disciplines (Engineering, Sciences and Humanities) was first selected before selection of respondents based on ethnicity. In all, eighty two respondents completed the 19 statements based on the students’ Achievement and Social Goal Orientation.

Instrumentation: The ASGOT instrument is made up of two sections. Section A entails the introduction and seeks socio-demographic information such as faculty, gender, ethnicity and current cumulative grade point average. Section B had 10 items comprising mastery goals orientation with 3 items; social status goal; social approval goal; social concern goals having 2 items each while social affiliation goals had only 1 items. The unequal distribution of items is due to an initial total item inter-correlation where indices <0.4 were omitted.

Test administration and data analysis: Permission was sought from the lecturers in charge of the classes where the test was administered and the students were adequately briefed on the objective of the test. Ethical issues regarding the confidentiality of their responses, optional participation and no incurred risks were also addressed before the test administration. The face to face

administration taking approximately 20 min per session in a class <30 students enabled the researcher to ensure high response and completion rates.

The RMA bases its evaluation on the dimensionality; item fit analysis, response category analysis to determine the validity of the test while the calculated Cronbach alpha, item and person reliability and separation indices depicts the reliability estimates of the test. Response category analysis investigates the suitability of the 4 point rating scale which ranges from “Strongly not typical of me” as 1 to “Strongly typical of me” as 4.

RESULTS AND DISCUSSION

The test was analyzed by using Winsteps Version 3.68.2 in order to examine the items’ validity and reliability with the results summarized as:

Dimensionality analysis: Within RMA, the raw variance explained by measures is 40.4 while the unexplained variance in 1st contrast is calculated as 15.8, both indices are categorized as poor based on classification (Table 2).

Item fit analysis: The validity of the ASGOT items within the RMA framework is detected by the Mean Square (MNSQ) and Standard Deviation (ZSTD) indices. The MNSQ easily identifies the misfit items which are basically the outliers. The discerning yardstick for satisfactory MNSQ adequacy should be $0.4 < x < 1$ and $-2 < x < +2$ for the ZSTD. Table 3 illustrates ASGOT’s item fit analysis.

Reliability analysis: Reliability indices of >0.5 and a separation index >2 is regarded as adequate (Bond and Fox, 2007) in RMA. The 10 item ASGOT instrument resulted in satisfactory reliability estimates. The item reliability was 0.83>0.5 and item separation was

Table 2: Dimensionality indices of ASGOT

Variance	Percentage
Raw variance explained by measures	40.4
Raw variance explained by persons	15.9
Raw variance explained by items	24.5
Unexplained variance in 1st contrast	15.8

Table 3: Item fit and item polarity indices

Items	Construct	Measure	Infit		Outfit		PTMEA
			MNSQ	ZSTD	MNSQ	ZSTD	
G1	MG	-0.88	1.30	0.9	1.14	0.4	0.46
G2	MG	-0.61	0.93	-0.1	0.78	-0.4	0.56
G3	MG	0.82	0.96	-0.2	0.90	-0.2	0.72
G4	SS	0.16	0.91	-0.4	0.81	-0.5	0.66
G5	SS	0.96	1.24	1.3	1.29	0.8	0.69
G6	SC	-1.19	0.95	-0.1	1.00	0.1	0.68
G7	SC	-1.39	0.95	-0.1	0.82	-0.4	0.62
G8	SAP	3.32	0.93	0.1	0.58	-0.1	0.91
G9	SAP	-0.14	0.86	-0.4	0.97	0.0	0.70
G10	SAF	-1.05	0.98	0.0	0.99	0.1	0.72

Table 4: Item and person reliability and separation indices

Parameters	Index
ITEM	
Reliability	0.830
Separation	2.190
Person	
Reliability	0.800
Separation	1.993
Cronbach alpha	0.920
Person raw score to measure correlation	0.920

Table 5: Response category indices

Category	Count	Percentage count	Observed average	Structure calibration	Category measure
1	1	1	2.18	-	-3.05
2	6	4	1.51	-1.45	-1.35
3	53	34	1.73	-0.64	0.56
4	95	61	2.95	2.09	2.97

2.19>2. Table 3 shows the person and item reliability, person and item separation for the ASGOT instrument. The results of person and item reliability and separation indices indicate good reliability property Table 4. In addition as the item and person indices are fairly close together, it is indicative that there is not a lot of noise in the data.

Calibration scaling analysis: Response category inspection determines the usability of the rating scales by first making a zero setting calibration. With respect to the ASGOT instrument, Table 5 shows a summary of the category structure on a scale gradation and size structure of the intersection. In the column arrangement observation (observed count) shows the respondents' answers given to ranking scale. As shown in the Table 5, the most frequent response scale used was "Strongly Typical of Me (4)" with 95 counts. The least selected response category was "Strongly Not Typical of Me (1)" with only one count.

The observed averages show the pattern of respondents. Fairly normal pattern warrants the category measure to increase systematically from negative to positive. As illustrated in Table 5, the response pattern obtained starting from -3.05 logit and moves up monotonously to +2.97 logit implying that the pattern of respondents' answers are fairly normal.

CONCLUSION

This study uses RMA to evaluate the usefulness of ASGOT as a measurement scale to tap into students' learning orientation. The sub-constructs of mastery goals and performance goals for achievement goals were defined. Within social goals, social affiliation, approval, responsibility, concern and status goals were identified

according to theory and literature review. The Rasch Measurement Model using Winsteps Software resulted in the omission of performance goals and social responsibility goals. Based on the results of the RMA, satisfactory psychometric properties bordering both validity and reliability of the instrument was achieved. However, the dimensionality of the ASGOT instrument is low signifying that more items will need to be developed and validated to adequately depict the learning orientation of the HE students.

Further, scrutiny of the 10 item ASGOT instrument portrays social approval goals being the most contributory item as its item measure as 3.32 was the highest. The statement read "I want to get blessings." while the least contributory item is "I wish to use knowledge to serve society" of social concern goals. A possible explanation to the why "I want to get blessings" resonated well with the students may be due to the fact that the context of the study is a collectivist context where which support and reliance on the family and society is enshrined. In addition, aside being a collectivist setting, the major ideological belief in this context which are Islam, Buddhism and Hinduism preach reward for virtuous behaviour.

Summation of the sub construct item measures led to social approval goals (2.88) still being the most important sub construct followed by social status goals (1.12); mastery goals (-0.67); social affiliation goals (-1.05) and lastly by social concern goals at -2.58. Also, interesting is the fact that the only sub-construct with all positive measures is social status goals.

The implication of these findings warrants further investigation (perhaps qualitative studies) as to the reasons why students support social goals particularly social approval and social status goals. Similarly, these items could be used as indicators for successful academic attainment within Malaysian HE students.

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