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ABSTRACT

This paper outlines the development of a quantitative instrument designed to measure students' multiple achievement goals and key aspects of their cognitive engagement in Australian educational settings. The paper demonstrates the use of congeneric measurement models in assessing and improving the validity of the scales comprising the Goal Orientation and Learning Strategies Survey (GOALS-S), and it also illustrates the use of cross-validation as a way to assess the stability of the GOALS-S scales. Three academic goals, four social goals, three cognitive strategies, and three metacognitive strategies were defined and operationalized in the developed GOALS-S instrument. Preliminary factor analyses were used to refine the measure. Its 13 scales were tested with 380 Australian urban students. Once collected, data from a randomly chosen subsample (half the original sample) were subjected to confirmatory factor analysis using 13 separate one-factor congeneric models. Modified models that showed sufficient fit in the first half were tested with the second half of the sample. The initial modeling process supported the construct validity of only four of the original scales, but relatively minor modifications resulted in considerably better fit for the other nine scales. Results also demonstrate support for the reliability of at least eight of the GOALS-S scales. (Contains 6 tables and 88 references.) (SLD)

The development of the Goal Orientation and Learning Strategies Survey (GOALS-S): a quantitative instrument designed to measure students' achievement goals and learning strategies in Australian educational settings.

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This paper outlines the development of a quantitative instrument designed to measure students' multiple achievement goals, and key aspects of their cognitive engagement, in Australian educational settings. Specifically, the paper demonstrates the use of congeneric measurement models in assessing and improving the validity of scales comprising the Goal Orientation and Learning Strategies Survey (GOALS-S). The study also demonstrates the use of cross-validation as a means of assessing the stability of the GOALS-S scales.

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Most educators agree that effective learning involves the ability to self-regulate a variety of thoughts, feelings, and actions associated with learning processes (Bouffard, Boisvert, Vezeau, & Larouche, 1995; Hong, 1995; Meece, 1994; Schunk, 1991; Newman, 1991; Zimmerman, 1990). In particular, students' ability to activate prior knowledge, and to appropriately apply a variety of cognitive and metacognitive strategies in order to acquire and/or integrate new knowledge, influences the quality of their engagement in learning and their overall academic success (Meece, 1994; Derry, 1990; Bransford, Vye, Kizner & Risko, 1990). Recent research has particularly focused on the ways students' prior knowledge, and the cognitive and metacognitive strategies students use (or do not use), influence their ability to acquire, integrate, and retrieve information (Hong, 1995; Zimmerman & Martinez-Pons, 1988).

Various cognitive models of learning have proved useful for explaining the role that student's prior knowledge and strategy use plays in enhancing students' academic learning and performance (Alexander & Judy, 1988; Pintrich, Cross, Kozma, & McKeachie, 1986; Weinstein & Mayer, 1986). Specifically, research informed by these models has been able to explain the effect of students' prior knowledge and strategy use on their perception, selective attention, encoding, retrieval, and problem solving abilities (Alexander, Schallert, & Hare, 1991; Winne & Marx, 1989). Moreover, there is growing evidence that the use of *particular* cognitive and metacognitive strategies is associated with improved learning outcomes (Paris & Winograd, 1990; Weinstein, Ridley, Dahl, & Weber, 1989; Brown, Bransford, Ferrara, & Campione, 1983).

Cognitive models of learning have, however, proven less useful for explaining (a) why students may or may not, particularly in 'real life' classroom situations, activate their prior knowledge and strategies on given learning tasks, and (b) why students fail to transfer relevant prior knowledge and strategies from one task or situation to another (Pintrich & Scrauben, 1992; Schneider & Pressley, 1989). In other words, cognitive models are less adept at explaining why students may not expend *effort* to activate and/or transfer prior knowledge and strategies. This is particularly important because the activation and transfer of appropriate knowledge and strategies requires effort (Carr, Borkowski, & Maxwell, 1991). Thus, if students do not expend effort, any knowledge and strategies they do posses may remain inactive (O'Niell & Douglas, 1991).

This *selective* activation and transfer of prior knowledge and strategies may be attributed to purely cognitive factors e.g. routinisation, effective encoding, and the productive use of metacognitive and self-regulatory processes (Schneider & Pressley, 1989). However, recent research shows that the activation of prior knowledge and cognitive strategies is also dependent upon motivational variables (Graham & Golan, 1991; Garner, 1990; Meece, Blumenfeld, & Hoyle, 1988). Hence, students' level of *cognitive engagement* (the extent to which students appropriately activate, transfer, and apply their prior knowledge and strategies) is a function of *both* motivational *and* cognitive factors working together (Pintrich, 1989; Pintrich & Scrauben, 1992). This may be described as a 'hot' model of cognition (Brown et al., 1983; Giere, 1988).

Until recently, however, the interaction between motivational and cognitive factors in explaining students' cognitive engagement and subsequent academic performance has been largely avoided or ignored (Corno & Mandinach, 1983; Pintrich, 1990). This is true despite a long history in psychology of researchers who have emphasised the motivated, purposive nature of human behaviour and cognition (e.g. Tolman, 1925, 1932). With some exceptions, it has generally been more common to explain students' cognitive engagement in terms of *either* motivational *or* cognitive factors rather than through a combination of both. Research acknowledging the interaction between motivational and cognitive factors, however, may explain more completely the functioning of students' cognitive processes (Borkowski, Carr, Rellinger, & Pressley, 1990; Pintrich & Schrauben, 1992).

Despite the above comments, researchers have begun to explain cognitive engagement and academic performance as a product of interacting motivational and cognitive constructs (factors) (e.g. Hong, 1995; Pintrich, Marx & Boyle, 1993; Graham & Golan, 1991; Corno, 1986). Although the resurgence of this type of research is still quite recent (Pervin, 1992), there is growing empirical evidence that cognitive engagement is the product of interacting motivational and cognitive constructs. Moreover, several constructs, which are known to influence students' motivation, also effect their cognitive engagement. Examples of these constructs include students' self-efficacy, control beliefs, task value beliefs, and goal orientation (Pintrich et al., 1993).

Research Orientation

Given the above, it is clearly of interest to researchers and practitioners to be able to accurately measure both motivational and cognitive constructs known to influence students' cognitive engagement. The present research outlines the development of a quantitative instrument designed to measure relations between students' goal orientations (motivational constructs) and students' cognitive and metacognitive strategy use (cognitive constructs).

Explanation and Justification

The decision to measure students' strategy use was made because, as outlined above, it appears to be a particularly salient indicator of students' cognitive engagement and subsequent academic achievement. The decision to measure students' goal orientation was made for reasons outlined below. These are preceded by a short explanation of students' goal orientations.

Explanation. Students' goal orientations are cognitive representations of the different purposes students may adopt in achievement situations (Urdan & Maehr, 1995; Pintrich et al., 1993; Wentzel, 1991; Ford and Nichols, 1991). In other words, students' *goals* (shorthand for their goal orientations) are the reasons students' have for wanting to achieve (or not) in achievement situations. Typically, the achievement situations of most interest to researchers have been academic achievement situations. For example, students may want to achieve in academic situations in order to demonstrate superior performance in comparison with other students (a performance goal orientation), to demonstrate understanding of academic work (a mastery goal orientation), to demonstrate a responsible attitude (social responsibility orientation), to feel part of a group (social affiliation orientation), etc. Several different types of goals have been identified in the literature. By far the most widely researched of these are performance and mastery goals (Ames, 1992. Blumenfeld, 1992). In addition to individual goals, two broader classes of goals have been identified in the literature. Academic goals are defined as the academic reasons students have for achieving in academic situations. Social goals are defined as the social reasons student have for achieving in academic situations. (Urdan & Maehr, 1995; Dowson & McInerney, 1997).

Justification. Students' goals have been chosen in the present study for the following reasons. Firstly, and most importantly, students' goal orientation has direct effects on significant aspects of their cognitive engagement (Graham & Golan, 1991; Garner, 1990; Dweck & Leggett, 1988; Nolen, 1988; Ames & Archer, 1988). Students adopting a mastery goal orientation, for example, are more likely to recall important information, use more and deeper cognitive strategies, and use more, and more adaptive, metacognitive strategies than those adopting a performance orientation. In addition, the entire process of academic self-regulation (of which strategy use is one aspect) is said to be a *goal directed* or *goal mediated* process (Newman, 1991; Kanfer & Kanfer, 1991). Other goals may also have an effect on specific aspects of students' cognitive engagement. For example, student's social goals have been shown to be related to their overall academic performance (Wentzel, 1991a, 1989). It is not unreasonable to hypothesise, therefore, that these goals have some effect on students' cognitive engagement in learning.

Secondly, there are substantial theoretical and practical links between students' goal orientations and other constructs associated with their motivation and cognition. Examples of these constructs include self-efficacy (Schunk, 1991, 1990); self-regulated learning (Meece, 1994); intrinsic interest (Butler, 1987); ability perceptions (Harter, 1982); attributional beliefs (Meece, 1994) subject matter attitudes (Meece et al., 1988); and affect (Jagacinski & Nicholls, 1987). Moreover, students' goal orientation is linked to other aspects of their academic behaviour other than their cognitive engagement *per se*. These include their task persistence (Stipek & Kowalski, 1989), their preference (or otherwise) for challenging or 'risky' learning activities (Ames & Archer, 1988; Nicholls, 1984), and their help-seeking behaviour (Meece, 1994; Newman, 1991). Hence, *goal theory* (the theoretical framework underlying students' goal orientations) is both a *comprehensive* and *complementary* theory of academic motivation.

Thirdly, goal theory has clear implications for classroom practice. Several reviews (Ames, 1992; Blumenfeld, 1992; Maehr & Midgley, 1991; Meece, 1991) have documented the ways in which classroom and school environments are implicated in the goals students are encouraged to adopt. Although empirical evidence is still restricted (see Nolen & Haladyna, 1990 for one example), it is, nevertheless, clear that goal theory may direct practitioners to the value of specific classroom practices designed to improve students' engagement in learning. These include providing learning opportunities that are meaningful and interesting (Corno & Rohrkemper, 1985), providing opportunities for student choice and decision-making (Ryan, Connell, & Deci, 1985), promoting beliefs in competence through effort (Stipek & Kowalski, 1989), increasing student's chances for success (Meece, 1994), rewarding and recognising personal improvement (Ames & Ames, 1991), and reducing the emphasis on social comparison and competition (Mac Iver, 1987). Thus, goal theory is not only theoretically integrated but practically applicable as well.

Existing Instruments

The literature contains several examples of instruments designed to measure students':

(a) *academic goals* eg. the Motivated Strategies for Learning Questionnaire (MLSQ) (Pintrich, Smith, Garcia, & McKeachie, 1991) and the Inventory of School Motivation (ISM) (McInereny, Roche, McInerney, & Marsh, 1997; McInerney & Sinclair, 1991).

(b) *social goals* eg. the Inventory of School Motivation and the Goal Questionnaire (Wentzel, 1989);

(c) use of *cognitive and metacognitive strategies* eg. the Inventory of Learning Processes (ILP) (Schmeck, Geisler-Brenstein, & Cercy, 1991), the Approaches to Study Inventory (ASI) (Entwistle & Ramsden 1983), the Study processes Questionnaire (SPQ) (Biggs, 1987), and the Strategic Flexibility Questionnaire (SFQ) (Cantwell, 1992).

Moreover, several of these instruments attempt to measure combinations of the above eg. academic goals with learning strategies or social goals with academic goals. However, as yet, an instrument designed to measure all three of the above (students' social goals, academic goals, and strategy use) is not available. This is the case despite the fact that recent research has emphasised that students can and do hold *multiple* social *and* academic goals in school settings and that the way students organise and coordinate these goals is substantially related to their cognitive engagement and academic performance (Seifert, 1995; Ainley, 1993; Pintrich & Garcia, 1991; Wentzel, 1991a, 1989; Meece, 1991). The theory underlying the instrument developed in this study explicitly assumes that students' will hold to multiple goals and strategies simultaneously.

In addition to the above, most of the instruments that have been designed to measure students' social and academic goals have been developed outside Australia. Thus, inferences made concerning Australian students using scores from these instruments may be invalid. There is a need, therefore, to develop an instrument specifically designed in and for the Australian context from which valid inferences may be drawn. This is particularly so given the cultural diversity of Australian schools where students hold diverse sets of goals which may differentially affect their motivation and learning (McInerney, 1989a, 1989b).

Measurement Models

In psychological research, *measurement models* attempt to assess the validity of instruments i.e. the degree to which an instrument measures what it supposed to. They, typically, do this by assessing the extent to which variations in and between observed indicators are 'caused' by underlying (or latent) constructs. For example, in the present study, variations in and between students' responses to the GOALS-S survey questions (the observed indicators) are assumed to be 'caused' by students' adherence to particular goals and strategies (the latent constructs the GOALS-S is attempting to measure). From a measurement point of view it is of most interest to know how much of the variation in and between the observed indicators is 'explained' by the latent construct(s) under consideration. If a substantial amount of the variation in and between a set of indicator variables can be 'explained' by the influence of a latent construct on these variables then the measurement model is 'good'. The reverse is true if less than substantial amounts of variance are 'explained' by the latent construct.

The degree to which variation in and between the indicator variables can be explained by a latent construct (or constructs) is known as the measurement model's 'fit'. The most common measure of a model's fit is the Chi-square (χ^2) test which compares the degrees of freedom associated with a given model with the Chi-square value for the model (Hu & Bentler, 1995; Tanaka, 1993). If the difference between these two is small then the model is deemed to 'fit' (which means that the data are not sufficient to reject the model). If the difference is large the model does not fit (the data are sufficient to reject the model). The probability associated with the Chi-square value (based on its degrees of freedom) acts as a standard by which the size of this difference is assessed (Hayduk, 1987; Cliff, 1987).

In addition to the Chi-square test, other methods for assessing model fit have been developed. There is considerable debate in the literature as to which of these methods (including the Chi-square test) are appropriate and in which situations (Tanaka, 1993; Hoyle & Panter, 1995, Marsh, Balla, & McDonald, 1988; Bentler & Bonett, 1980). Despite disagreement as to relative value of various measures of fit, however, there is a general consensus that more than one indicator of model fit should be used to evaluate a given model. In particular, an over-reliance on the Chi-square test alone may be misleading (Bentler & Bonett, 1980).

Congeneric Measurement Models

A common form of measurement model is the congeneric model. A congeneric model assumes the indicator variables used to measure the latent construct (or constructs) do so unequally well and with unequal variation (Joreskog, 1971). That is, the indicator variables are not all equally 'good' measures of the latent construct. A one-factor congeneric model is one that measures a single latent construct (although, theoretically, there is no limit on the number of indicator variables that may be used to measure that construct).

The present study uses a series of one factor congeneric models to assess how well variables attempting to measure each of the latent constructs (students' goals and strategies) actually do so. This is a critical step in assessing the validity of inferences drawn from the GOALS-S. If the indicator variables do not measure the latent constructs well then inferences drawn from the survey as to the relations between students' goals and strategies will be compromised.

Model Stability

In addition to the overall fit of a model, researchers are, typically, interested in how stable a fitted model is. This is known as the model's *reliability* (Cliff, 1987). A model, for example, may fit well in one sample but not in another. Obviously, unstable models (models that fit in one sample but not in others) are of limited value. A common measure of model reliability (stability) is Chronbach's alpha. However, for a variety of reasons this estimate is not universally appropriate, especially with congeneric models (Werts, Rock, Linn, Joreskog, 1978). Another particularly powerful measure of a model's reliability is its observed stability from one sample to another or from one portion of a sample to another (Browne & Cudec, 1989). Testing the fit of a model between samples or between independent portions of a single sample is known as *cross-validation*. The later type of cross-validation is used in the present study to test the stability of the one factor congeneric measurement models generated in the research.

Purpose of the Study

The purpose of the study was to develop an instrument capable of measuring students' multiple social and academic goals in Australian educational settings. Specifically, the paper outlines:

(a) in brief, the development of items and scales for the Goal Orientation and Learning Strategies Survey (GOALS-S) and,

(b) in more detail, the testing of the GOALS-S scales (using Confirmatory Factor Analysis with congeneric models and cross-validation strategies) in order to establish support for the validity of inferences drawn from them.

Participants

The data represent responses to the GOALS-S from students (n=386) from schools (n=4) in the Sydney metropolitan region. Approximately equal numbers of male (48.8%) and female (51.2%) students from a cross-section of cultural, socio-economic, and academic backgrounds are represented in the sample. The schools were chosen from various geographical regions in the Sydney metropolitan area in order to maximise the socio-economic and cultural diversity of the sample.

Method

A brief overview of the study follows. Elements of this overview are then discussed in more detail below.

A selection of academic goals (n=3), social goals (n=4), cognitive strategies (n=3), and metacognitive strategies (n=3) were defined and operationalised on the basis of a previous qualitative studies (Dowson & McInerney, 1997, 1996) and a review of the literature. Following this, an initial item selection representing each of the goals and strategies was constructed. This item selection was then reviewed by a sample of students (n=6) typical of the sample with which the GOALS-S was eventually piloted. This was done in order to establish support for the face validity of the items. Several items were reworded or deleted as a result of this process. Once support for the face validity of the items was established, the items were ordinally scaled and the survey was piloted with a sample of students (described above).

Once collected, the data from a randomly chosen sub-sample (comprising one-half of the original sample) were subjected to a Confirmatory Factor Analysis (CFA) process using thirteen separate one-factor congeneric models (discussed below). This was done in order to establish support for the *construct validity* of the scales hypothesised to be measuring particular goals and strategies and, hence, for the validity of inferences drawn from them. On the basis of this initial CFA, several models showed substantial fit with the data. However, several others did not. With reference to both data and substantive theoretical issues, several items were deleted from the scales which did not in the original sub-sample in order to improve their fit. These modified scales were then re-tested in the random first-half of the sample (the same sub-sample as before). When the modified models showed sufficient fit in the first half of the sample, they were tested in the remaining (second) half of the sample. The models which, on the basis of the first CFA process, did not require modification were also tested in the second half of the data. The fit of both the modified and the un-modified models in the second half of the data was then assessed.

Constructs Measures by the GOALS-S

Table 1 below describes the goals and strategies assessed by the GOALS-S, provides a sample item for each, and indicates the number of items related to each goal or strategy contained in the original scales.

Table 1
Goals and Strategies measured by the GOALS-S

Construct (Goal or Strategy)	Sample Item	Number of items in original scales
<u>*Academic goals*</u>		
Mastery Wanting to achieve in order to demonstrate understanding, academic competence, or improved performance relative to self-established standards.	I like school work that challenges me to learn new things.	5
Performance Wanting to achieve in order to out perform other students, attain certain grades /marks, or obtain tangible rewards associated with academic performance.	I want to get better marks than other people at school.	6
Work avoidance Wanting to achieve with as little effort as possible. Conversely, avoiding demanding achievement situations.	I choose easy work at school so that I don't have too much trouble with it.	5

Construct (Goal or Strategy)	Sample Item	Number of items in original scales
<u>*Social goals*</u> *Social affiliation* Wanting to achieve in order to enhance a sense of belonging to a group or groups and/or to build or maintain inter-personal relationships. Conversely, wanting to achieve in order to avoiding feelings of separateness or isolation.	I try to work with my friends as much as possible at school	5
Social approval Wanting to achieve in order to gain the approval of peers, teachers, and/or parents. Conversely, wanting to achieve in order to avoid social disapproval or rejection.	Getting praise from my teachers for my school work is important to me	5
Social responsibility Wanting to achieve in order to maintain interpersonal commitments, meet social role obligations, or follow social and moral 'rules'. Conversely, wanting to achieve in order to avoiding social transgressions and/or unethical conduct.	It is important for students to help each other at school.	5
Social status Wanting to achieve in order to attain wealth and/or position in school and/or later life. Conversely, wanting to achieve in order to avoid low status positions in either school or later life.	I want to do well at school for the good of my family's reputation.	5
<u>*Cognitive strategies*</u> *Elaboration* Making connections between present and previously learned information. May involve paraphrasing, generating analogies, reviewing previous work, etc.	When I want to learn new things I try to recall what I know about similar things.	4
Organisation Selecting, sequencing, outlining, re-ordering or summarising important information.	I make summaries of the things I want to learn at school.	5
Rehearsal Listing, memorising, reciting, and/or naming facts/items to be learned.	When I want to learn something for school I practice saying it over and over.	5
<u>*Metacognitive strategies*</u> *Monitoring* Involves self-checking for understanding, self-testing, organised review of learned material, etc. Implies systematic attempt to evaluate the assimilation and organisation of learned material.	I ask myself questions to see if I understand what I am learning	4
Planning Involves prioritising, time management, scheduling, setting realistic goals, arranging work environments appropriately, etc. Implies thoughtful preparation for completing work.	When I want to learn things for school I try to pick out the most important parts first.	5
Regulating The strategies put in place to rectify deficits identified whilst monitoring. Specific strategies include attempting different ways to learn material, seeking explanations from teachers, identifying mistakes in reasoning, etc.	If I don't understand something I will try a different way to learn it.	5

Initial Factor Analyses

After listwise deletion there were 380 cases available for analysis. Initially, the original one-factor congeneric models were tested with a randomly chosen sub-sample of the data comprising one-half of the original sample (n=190). That is, each of the goals and strategies outlined above were the latent factor in a series of models where the survey items supposedly measuring those constructs were the indicator variables. There were thirteen models in total. PRELIS (version 2.1) and LISREL (version 7) (Joreskog & Sorbom, 1987) embedded in SPSS-X (version 6.1) were used to complete the analyses.

As a result of these analyses, several models were deemed not to fit the data sufficiently. In order to improve the fit of these models, items which did not appear to measure the latent construct well were deleted from the original scales. The rationale for these deletions was as follows. Firstly, the absolute fit of the models was assessed on the basis of their Chi-square/degrees of freedom ratio and associated probabilities. Secondly, the relative fit of the models was assessed on the basis of other fit indices provided by LISREL i.e. the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI) and the Root Mean Square Residual (RMSR). The GFI and AGFI should be as close as possible to one (1). The RMSR should, ideally, be less than .05.

If the overall fit of the model was questionable on the *combined* basis of these absolute and relative indicators, then, particularly, the factor loadings (the degree to which indicator variables are associated with the latent constructs) for each item constituting the original scales were more closely examined. Items which had low factor loadings were considered candidates for deletion from a scale. *However*, a low factor loading *per se* did not mean that an item was automatically deleted from a scale. On some occasions, for example, an item was considered central to the scale being constructed and was retained despite its apparently low factor loading. Conversely, items with moderate factor loadings were not necessarily 'safe' from deletion. Again, on several occasions, items with moderate factor loadings were removed from scales because they appeared to be negatively influencing the theoretical integrity of the scale. Thus, the decision to delete or not or delete was based upon substantive theoretical grounds as well as data considerations.

Subsequent Factor Analyses

Once 'suspect' items had been deleted from the original scales the modified scales were retested in the same random sub-sample as before. Again, the absolute and relative fit of these models as well as the factor loadings for each item in the scales were assessed.

It should be noted, however, that despite the best intentions of the researcher, the process above does 'capitalise on chance'. That is, by testing and retesting models in a given sample the researcher increases the chances of finding model that fits the data regardless of the considerations that informed the model modification process (MacCallum, Roznowski, Necowitz, 1992; Cliff, 1983). Thus, it is important to test any modified model once and once only in an independent sample or sub-sample. In the present research, once the modified models demonstrated sufficient fit, they were tested in the remaining (as yet untested) half of the original sample. This was done *once* only. The fit of the models in the second half of the data was then examined.

Results

The results of the first series of analyses (testing the original thirteen models in the random first-half of the data) are reported in Table 2. The results in Table 2 indicate the following. First, four (4) of the original scales (Mastery, Rehearsal, Elaboration, and Monitoring) model the data well. That is, both the absolute (Chi-square) and relative (GFI, AGFI, RMSR) fit indices do not suggest that the data are sufficient to reject these models. These models, thus, were left unaltered and were tested later in the second half of the data (described below).

Second, seven (7) of the models (Performance, Work Avoidance, Social Affiliation, Social Status, Social Approval, Social Responsibility, and Regulation) appear to model the data poorly. That is, the Chi-square test and relative fit indices indicate that the data are sufficient to reject these models. Third, two (2) of the models (Organisation, Planning) demonstrate appropriate fit according to the Chi-square test, but inappropriate fit according to, at least, the RMSR. These models also have one or more items that 'load' weakly on the underlying factor measured by the models. Thus, although these models fit according to the Chi-square test there is reason to suspect that the models do

Table 2
Thirteen Original One Factor Congeneric Models of Students' Goals and Strategies (Random First-Half of Data)

Factor	Number of Indicators	Factor Loadings	Chi-square	Degrees Freedom	Probability	GFI	AGFI	RMSR
Mastery	5	.682 .576 .816 .846 .772	7.71	5	.173	.984	.953	.028
Performance	6	.812 .741 .596 .882 .574 .594	37.32	9	.000	.934	.845	.061
Work Avoidance	5	.719 .811 .443 .400 .210	10.89	5	.054	.978	.934	.052
Social Affiliation	5	.789 .615 .878 .239 .662	13.51	5	.019	.972	.917	.040
Social Approval	5	.658 .722 .722 .510 .481	16.14	5	.006	.965	.895	.048
Social Responsibility	5	.132 .323 .894 .747 .785	34.10	5	.000	.938	.815	.093
Social Status	5	.780 .373 .708 .892 .685	17.80	5	.003	.965	.895	.050
Elaboration	4	.592 .445 .958 .449	.98	2	.612	.997	.987	.016
Organisation	5	.029 .617 .747 .153 .277	10.27	5	.068	.979	.937	.054
Rehearsal	5	.495 .338 .571 .598 .176	7.07	5	.216	.985	.956	.041
Monitoring	4	.582 .562 .433 .414	.75	2	.688	.998	.990	.015
Planning	5	.161 .178 .512 .970 .428	10.11	5	.072	.980	.939	.050
Regulation	5	.156 .341 .644 .498 -.006	17.23	5	.004	.962	.887	.074

not, in fact, fit the data well (especially given the relatively small sample size which may artificially reduce the Chi-square value relative to its degrees of freedom).

Given the above, several indicator variables in the seven poorly fitting and two indifferently fitting models were removed from the models according to the process outlined previously. These nine (9) modified models were then re-analysed in the same half of the data as the original models. Results of these analyses are reported in Table 3.

Table 3

Nine Modified One Factor Congeneric Models of Students' Goals and Strategies (Random First-Half of Data)

Factor	Number of Indicators	Factor Loadings	Chi-square	Degrees Freedom	Probability	GFI	AGFI	RMSR
Performance	4	.818	.46	2	.795	.999	.994	.008
		.818						
		.467						
		.876						
Work Avoidance	4	.786	5.15	2	.054	.987	.933	.041
		.747						
		.465						
		.342						
Social Affiliation	4	.654	1.15	2	.563	.997	.985	.016
		.690						
		.284						
		.733						
Social Approval	4	.655	5.27	2	.072	.986	.929	.031
		.691						
		.804						
		.568						
Social Responsibility	4	.314	2.44	2	.295	.994	.968	.020
		.855						
		.769						
		.811						
Social Status	4	.744	4.65	2	.098	.988	.941	.024
		.657						
		.895						
		.677						
Organisation	4	.561	4.25	2	.119	.989	.946	.042
		.807						
		.190						
		.248						
Planning	4	.189	.70	2	.703	.998	.991	.018
		.408						
		.600						
		.213						
Regulation	4	.333	.87	2	.646	.998	.988	.019
		.876						
		.299						
		.220						

The results in Table 3 indicate that the data in the random first-half of the sample are insufficient to reject the nine modified models. However, as above, several of the indicator variables retain low factor loadings. This suggests that, although the nine modified models fit in the first half of the data, they may be unreliable (unstable). Whatever the case, the next step was to test the nine modified and four original un-modified models in the second half of the data. The results of these analyses are reported in Table 4.

The analyses in Table 4 indicate that all nine of the modified models as well as the four original (unaltered) models fit the data in the second half of the sample. Thus, the data in the second half of the sample are insufficient to reject these models. However, again, low factor loadings are retained by some indicator variables. This may compromise the reliability of the scales despite their apparent construct validity.

Table 4

Nine Modified and Four Un-modified One Factor Congeneric Models of Students' Goals and Strategies (Random Second Half of Sample)

Factor	Number of Indicators	Factor Loadings	Chi-square	Degrees of Freedom	Probability	GFI	AGFI	RMSR
Mastery	5	.630	5.15	5	.398	.990	.970	.020
		.699						
		784						
		805						
		.750						
Performance	4	.836	4.52	2	.104	.989	.944	.021
		.755						
		.599						
		.844						
Work Avoidance	4	.831	4.51	2	.105	.988	.942	.035
		.731						
		.516						
		.390						
Social Affiliation	4	.610	1.23	2	.542	.997	.984	.018
		.722						
		.288						
		.690						
Social Approval	4	.655	3.69	2	.158	.990	.951	.028
		.682						
		.755						
		.510						
Social Responsibility	4	.319	4.34	2	.114	.988	.942	.027
		.882						
		.799						
		.719						
Social Status	4	.762	.26	2	.876	.999	.997	.005
		.701						
		.872						
		.722						
Elaboration	4	.642	.96	2	.708	.998	.991	.013
		.261						
		.891						
		.423						
Organisation	4	.550	2.10	2	.351	.994	972	.026
		.798						
		.179						
		.200						
Rehearsal	4	.317	1.75	2	.417	.996	.978	.023
		.503						
		.730						
		.423						
Planning	4	.238	1.04	2	.594	.997	.986	.022
		.400						
		.609						
		.260						
Monitoring	4	.662	2.39	2	.303	.994	.969	.030
		.526						
		.274						
		.380						
Regulation	4	.337	.46	2	.794	.999	.994	.014
		.938						
		.297						
		.230						

The final step in the analyses was to assess the fit of the thirteen models (above) in the entire data set. This was done in order to establish final parameter estimates and measures of fit for all the available data in the sample. Results of these analyses are reported in Table 5. The results in Table 5 indicate that all the models fit with the entire data set. However, according to the Chi-square test, the work avoidance model only 'just' fits the data. That is, the data according to this test are almost sufficient to reject this model. Also, consistent with the previous analyses, several of the models display items with weak factor loadings. In order to better quantify the effect that these low factor

Table 5

Nine Modified and Four Un-modified One Factor Congeneric Models of Students' Goals and Strategies (Complete Sample)

Factor	Number of Indicators	Factor Loadings	Chi-square	Degrees Freedom	Probability	GFI	AGFI	RMSR
Mastery	5	.649	4.49	5	.481	.991	.973	.021
		.582						
		.754						
		.817						
		.722						
Performance	4	.803	.71	2	.701	.998	.991	.009
		.763						
		.508						
		.861						
Work Avoidance	4	.785	5.97	2	.051	.992	.961	.029
		.825						
		.482						
		.447						
Social Affiliation	4	.620	2.18	2	.337	.997	.986	.016
		.715						
		.266						
		.710						
Social Approval	4	.536	5.46	2	.065	.993	.964	.023
		.708						
		.751						
		.599						
Social Responsibility	5	.228	3.59	2	.122	990	.952	.025
		.789						
		.812						
		.806						
Social Status	4	.742	1.46	2	.482	.998	.991	.009
		.676						
		.904						
		.718						
Elaboration	4	.540	.92	2	.932	.998	.991	.017
		.349						
		.949						
		.468						
Organisation	4	.327	1.76	2	.415	998	988	.020
		.709						
		.173						
		.183						
Rehearsal	4	.320	4.53	2	.104	.994	.970	.028
		.424						
		.692						
		.517						
Monitoring	4	.602	3.99	2	.136	.995	.974	.025
		.523						
		.295						
		.478						
Planning	4	.171	1.89	2	.390	.998	.988	.021
		.648						
		.747						
		.208						
Regulation	5	.248	.65	2	.724	.999	.996	.012
		.989						
		.228						
		.189						

loadings may have on the reliability of each of the scales, the coefficients of determination (maximised reliabilities) for each of the scales are reported in Table 6 below.

Table 6
Maximised Reliabilities for the GOALS-S Scales

Construct	Maximised Reliability
Mastery	.850
Performance	.865
Work Avoidance	.811
Social Affiliation	.735
Social Approval	.766
Social Responsibility	.846
Social Status	.884
Elaboration	.908
Organisation	.545
Rehearsal	.620
Monitoring	.572
Planning	.673
Regulation	.979

These results indicate that four of the scales (Organisation, Rehearsal, Monitoring, and Planning) have relatively low maximised reliabilities.

Discussion

The process outlined above provides some support for the construct validity of the GOALS-S scales. The initial modeling process supported the construct validity of only four of the original thirteen scales. This result was not totally unexpected given that the GOALS-S scales were previously untested. However, the fact that relatively minor modifications to the nine non-fitting scales resulted in considerably better fit for these scales suggests that their fit was not as 'bad' as might be suggested from the initial analyses. Whatever the case, these modified scales did fit the random first-half of the data sufficiently. This was true despite the fact that, as noted previously, some of the factor loadings on some of the scales did not appear substantial. (One of the deficiencies in using one factor congeneric models is that the possibility that one item might 'load' on more than one factor is not assessable. Therefore there is no way of testing whether items with low (or high or moderate) factor loadings may 'load' on other factors or not).

Despite this, the nine modified models, as well as the four unaltered models, fitted the data in the second half of the sample adequately. This cross-validation is a substantial test of the stability of the models, despite some low factor loadings. Furthermore, confirmation of the construct validity and (to some extent) the reliability of the scales comes from the test of the modified and unmodified models in the entire data set. All the models continued to display adequate fit within the complete data set.

Although not an exception to the above, it is interesting to examine the fit of the Work Avoidance model in the complete data set. As indicated above, this model, according to the Chi-square test, fails only marginally to be rejected by the complete data set. This may be indicate that the model only marginally fits the data. Alternatively, it may indicate a well noted deficiency of the Chi-square test i.e. that it is sample size dependent. Typically, as the sample size increases the Chi-square value relative to its degrees of freedom increases. This means that, in large sample sizes, the Chi-square/degrees of freedom ratio may be statistically significant even though the model substantially fits the data. While the 'excuse' that sample size has contributed to a statistically significant Chi-square value is overused (Hayduk, 1987), it is, nevertheless, possible that the Chi-square value associated with the Work Avoidance model has been inflated relative to its degrees of freedom as a result of the increase in sample size from one-half to the complete sample. Whatever the case, none of the fit indices (GFI, AGFI, RMSR) suggest that the fit of this model is as marginal as the Chi-square probability indicates.

Finally, the reliability estimates in Table 6 suggest that four of the GOALS-S scales may be unstable. It should be noted that the reliability coefficients are estimates only and that, in the present study, the cross validation strategy used confirmed that the scales were stable from one-half of the data to the other and in the complete data set. Nevertheless, the relatively low reliability estimates suggest that, in other samples, these models may not be stable. Further testing in other sample will be necessary to confirm whether all the scales, but particularly the scales with low reliabilities, are unstable.

Conclusion

This study has demonstrated the use of one-factor congeneric models and cross-validation techniques in the development of the GOALS-S, a quantitative instrument designed to measure students' social and academic goals and cognitive and metacognitive strategy use. The analyses above support the construct validity of the GOALS-S scales. Moreover, they demonstrate support for the reliability of at least eight of the GOALS-S scales. Given these results, the study provides initial support for inferences which may be drawn from GOALS-S. However, there is clearly the need to re-test the GOALS-S scales with other samples to further establish (or not) their construct validity and reliability and, hence, the validity of inferences drawn from them.

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