Cross-cultural Validation of Models of Approaches to Learning: an application of confirmatory factor analysis

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ABSTRACT *Six structural equation models were tested by analysing responses to the* Learning Process Questionnaire *of 10 samples of primary and secondary school students from Nigeria, Zimbabwe, Malaysia, Beijing, Hong Kong and Canada. Confirmatory factor analyses provided general support for the cross-cultural within-construct validity of the questionnaire. As predicted, the dimensions of deep and surface approaches to learning received cross-cultural support, but the positioning of the achieving dimension varied across cultures. This is in line with the notion that students who adopt an achieving approach will adopt different strategies which will be likely to maximise their achievement according to particular course and teacher characteristics.*

> Students undertake learning for a variety of reasons; those reasons determine how they go about their learning, and how they go about their learning will determine the quality of the outcome (Biggs, 1991, p. 14).

As conceptualised in the 3P model (Biggs, 1991), students' learning can generally be categorised in terms of input (**p**resage), approach (**p**rocess) and output (**p**roduct) stages.

In the process stage, the students utilise strategies consistent with their motives and this association of motive and strategy is called an approach to learning. Three approaches to learning (surface, deep and achieving) have been identified by factor analysis and replicated many times (Biggs, 1979, 1987a; Entwistle & Ramsden, 1983; Watkins, 1983). The basic approaches dimensions of surface and deep have been

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TABLE I. Prototypical approaches to learning (Biggs, 1991)

	Approach	
	Motive	Strategy
Surface	Extrinsic: avoid failure, but don't work too hard.	Focus on selected details and reproduce accurately.
Deep	Intrinsic: satisfy curiosity about topic.	Maximise understanding: read widely, discuss, reflect.
Achieving	Achievement: compete for highest grades.	Optimise organisation of time and effort ('study skills').

isolated in closely similar form, but through qualitative methodology, by Marton and Säljö (1976), amongst others.

A surface approach is based on extrinsic motivation or fear of failure. Those students using a surface approach would see school learning as a means towards some other ends, such as obtaining a job, pleasing parents, or just keeping out of trouble. The strategy arising from that is 'satisficing', but not satisfying. Minimal time and effort are invested merely to meet requirements. Thus, rote-learning of selected content without understanding is one of the commonest ways of doing this, but it is not the only way (Biggs, 1991, 1993).

In contrast, a deep approach is based on interest in the subject matter of the task. A student adopting a deep approach sees the task as interesting and is personally involved in it. Thus, the strategy is to maximise understanding. The particular strategies that are optimal in fact depend on the task in question, but as pointed out by Biggs (1991, p. 17), "a common feature would be to process data at a high level of generality, such as main ideas, themes, and principles rather than as conceptually unsupported specifics".

Biggs (1991, p. 17) described the notion of an achieving approach as based on "the ego-enhancement that comes out of visibly achieving, and in particular through high grades". Similar to the surface approach, the focus is not task-centred, but is, in this case, on top performance. The strategy is to do whatever the student believes is likely to get the highest marks in a particular course. Thus, the achieving approach is not associated with a fixed learning strategy. Students utilising such an approach may adopt either a surface or a deep approach, depending on the particular course and teacher requirements, and often utilise those popular 'study skills' such as cost-effective organisation of time, working space and syllabus coverage. The prototypical approaches to learning are shown in Table I.

Besides the identification of deep, surface and achieving approaches to learning, what is distinct in Biggs's conceptualisation is the congruence between motive and strategy in the process of learning. Biggs (1985) proposes that the first stage of meta-learning is to recognise the strategy consistent with the particular motive. The students would then be in a position to exercise control over their strategic options. The investigation of the motive-strategy model has attracted the interests of researchers and it was found that students tend to utilise learning strategies congruent with their motivation and that

congruent motive-strategy combinations are associated with higher academic achievement (Watkins, 1988; Watkins & Hattie, 1992).

Students' approaches to learning have been operationalised in the Study Process Questionnaire (SPQ) for tertiary level (Biggs, 1987c) and in the Learning Process Questionnaire (LPQ) for school level (Biggs, 1987b). The two instruments have been extensively used over the last decade in investigations of why and how students learn. They were also utilised in a great number of research investigating the relationships between the process of learning and learning outcomes (Biggs, 1991, 1992; Biggs & Watkins, 1993).

The reliability and validity of the instruments have been extensively studied and established for both Australian (Biggs, 1987a) and Hong Kong students (Biggs, 1992). However, despite the extensive use of Western instruments like the Learning Process Questionnaire in various countries, researchers have long questioned the assumption that Western educational and psychological theories and measuring instruments are appropriate for non-Western subjects (Enriquez, 1977). Hui and Triandis (1985) and Watkins (1994) further argued that for many research purposes one needs to demonstrate that the construct being measured in one culture is embedded in the same network of constructs in the same way as it is in another culture. In Cronbach's (1977) terminology, this involves testing both within-construct and between-construct portions of the nomological network. The underlying rationale of the argument is that if a construct has the same meaning in different cultures, it should result in the same empirical relationships. In addition, if the networks in different cultures are similar, it can be claimed that instruments used in this validation process are cross-culturally applicable.

Some previous research has used exploratory factor analysis to provide support for the cross-cultural within-construct validity of the Learning Process Questionnaire (Watkins *et al.*, 1994; Watkins *et al.*, 1995). However, confirmatory factor analysis provides a much stronger test of such validity and allows tests of competing models (Hui & Triandis, 1985; Watkins, 1988). The paper by Andrews *et al.* (1994) seems to be one of the first attempts to apply confirmatory factor analysis to fit the underlying factors of these instruments. In their paper, orthogonality among the factors was assumed. However, as pointed out earlier, students taking up the achieving approach may employ surface and deep strategies according to different course requirements. Hence, correlations among the various factors should be expected.

In the present study, 10 sets of data from seven different cultures were utilised to investigate the within-construct validity of the surface-deep-achieving model and of the Learning Process Questionnaire. Various possible versions of the motive-strategy model were also tested with the help of confirmatory factor analysis. The goodness-of-fit indices of these competing models among these cultures were also compared.

Method

Instrument

The Learning Process Questionnaire has 36 items, with six items in each of the subscales Surface Motive, Surface Strategy, Deep Motive, Deep Strategy, Achieving Motive and Achieving Strategy (see Table I). Each item is answered on a five-point scale from (1) 'never or only rarely true of me' to (5) 'always or almost always true of

me'. The Learning Process Questionnaire has been shown to have adequate reliability and within-construct validity for students from Australia and a range of Asian countries (Biggs, 1992).

Procedure

The Learning Process Questionnaire was administered among primary and secondary school student samples typical of the educational systems of Nigeria, Zimbabwe, Malaysia, China and Hong Kong. The instrument was also administered to a Hong Kong international school (with expatriate children following the British system). In all but China, schooling was based originally on the British educational system. However, the countries vary considerably in religion and cultural values (see Hofstede, 1983). Various measurement models were fitted to these samples and these models were also fitted to the Canadian sample of Andrews *et al.* (1994) which consisted of 205 students (among which 98 were Grade 10, 66 were Grade 11 and 41 were Grade 12).

These samples represent a range of levels of educational and economic development and cultural heritages. Except for China, Hong Kong and Malaysia, the original English version of the Learning Process Questionnaire was used. As the instrument had been translated into Chinese (Biggs, 1992) and into Bahasa Malaysian (Watkins & Ismail, 1994) with validity established, the Chinese version of the Learning Process Questionnaire was used for the Chinese and Hong Kong samples (Chinese being their mother tongue), and the Malaysian version was used for the Malaysian sample.

Samples

Nigeria. A total of 200 Nigerian 14–15-year-old public secondary school students from the city of Ile-Ile participated in the study. They were of the Yoruba ethnic group. (See Watkins & Akande, 1994, for further information about their conceptions and approaches to learning.)

Zimbabwe. A total of 270 14–15-year-old students in Masvingo, a rural city, participated in the study, of which 133 were boys and 137 were girls. They were predominantly of the Shona ethnic group—a majority in Zimbabwe—and were of lower middle-class backgrounds.

Malaysia. A total of 301 14–15-year-old students studying at Malaysian high schools participated in the study. The sample was chosen at random from a database obtained by stratified random sampling of Malaysian students in terms of ability level, ethnicity and socioeconomic status.

China. A total of 621 children in Grades 3–6 at 24 ordinary Beijing public primary school were sampled. Their ages ranged from 8–12 years and 51% were female.

Hong Kong. A total of 356 Grade 9 students from nine secondary schools attended the study (168 were boys and 188 were girls). Their academic standards ranged from well above to below average. The data were collected in a longitudinal study (Wong, 1995), so the Learning Process Questionnaire was administered twice, once at the beginning of the academic year and once at the end. In this way, two sample pools were formed.

All of the subjects in the two samples pools were Chinese. The Hong Kong educational system receives great influence from the British one and the achievement orientation of the Chinese makes it 'examination-driven'. Great emphasis is laid in the preparation of in-school and public examinations. The Hong Kong sample, like all except the Malaysian, were not selected randomly, but were chosen to be representative of ordinary secondary school students in their respective country.

A Hong Kong International School. A total of 170 11–12-year-old students in a Hong Kong international primary school of expatriate children participated in the study. Most of the subjects in the sample are non-Chinese, many coming from families in which the parents are expatriate employees working in Hong Kong. The school follows the British educational system and its graduates will sit the British GCSE and A-level examinations.

Models Tested

Six structural equation models were tested with the help of confirmatory factor analysis for each sample. These six *a priori* factor models tested as underlying the responses to the Learning Process Questionnaire:

(1) a null model (there is no underlying factor);
(2) two factor model (a strategy and a motive factor);
(3) two factor model (a 'surface + achieving' factor and a deep factor);
(4) two factor model (a surface and an 'achieving + deep' factor);
(5) three factor model (a surface, a deep and an achieving factor which may be related to each other; see Fig. 1);
(6) three factor model (a surface, a deep and an achieving factor which are independent of each other; equal weights of the motive and strategy are indicators assumed).

Fig. 1 illustrates the three factor models tested.

To assess the goodness-of-fit of the six *a priori* models, the Tucker-Lewis Index (TLI) and the relative noncentrality index (RNI) were utilised. These appeared to be among the most useful goodness-of-fit indicators (see Marsh *et al.*, 1988; Bentler, 1990; McDonald & Marsh, 1990; Marsh *et al.*, 1994).

Results

The internal consistency reliability indices (Cronbach's alpha) of the Learning Process Questionnaire in various sample sets were estimated and listed in Table II. It can be seen that the reliability indices of each subscale were very much the same across samples except for the Hong Kong International School sample, for which the indices were exceptionally high. In addition, the alpha for Surface Strategy was also comparatively high for the Canadian sample. It is worthwhile noting that alphas that ranged from 0.35 to 0.52 for the subscale of Surface Strategy were reported in a large-scale study with a total of some 3,000 Hong Kong subjects (Biggs, 1992) and alphas that ranged from 0.51 to 0.55 for the same subscale were reported in studies on Australian samples (Edwards, 1986; Biggs, 1987a, 1989). The underlying motivation of the surface approach to learning is 'survival'. Student taking up such an approach will

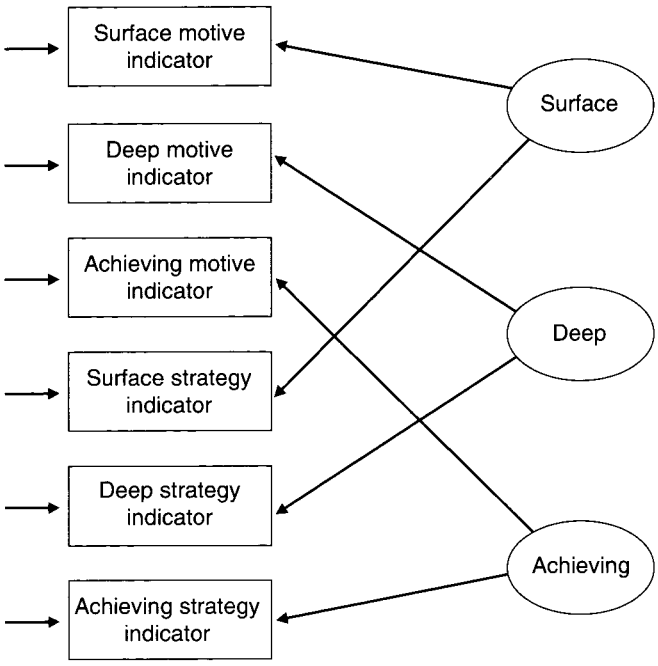

FIG. 1. A priori three factor model.

select a learning strategy which can allow them to meet the requirements with minimal invested effort. Thus, though rote-learning is the most common strategy utilised, such students just take up any means they think easiest (Biggs, 1993). As there is no definite surface strategy, the relatively low internal consistency of the subscale is not unexpected.

Tables III and IV list the TLI and RNI for each of the samples, while Table V lists the chi-square of the samples. The goodness-of-fit indices obtained for the Canadian data differ from those reported by Andrews *et al.* (1994) as fewer assumptions were made in the testing of the models here. The analysis in Andrews *et al.*'s work had made some assumptions which were not clearly stated in the paper. Except that orthogonality and equal weights were assumed in Model 6, no other assumptions were made in other models.

The results obtained indicated that the first Nigerian sample, the two Hong Kong samples and the Canadian sample had the highest TLIs for the three factor model with orthogonality not assumed. For the second Zimbabwean sample, the Malaysian and Chinese samples and the sample taken from the Hong Kong international school, the highest TLIs were obtained for the two factor 'surface, achieving + deep' model; whereas for the second Nigerian and the first Zimbabwean samples, the highest TLIs were found for the two factor 'surface + achieving, deep' model.

The results obtained from the RNI were more consistent. All except two samples had the highest RNIs for the three factor model with orthogonality not assumed. The other two, the Chinese and the second Zimbabwean samples, had the same (up to the second decimal place) RNIs for both the three factor model with orthogonality and the two factor 'surface, achieving + deep' models. Thus, the three factor model seems to fit better.

TABLE II. The reliability indices (Cronbach alpha) of the Learning Process Questionnaire

	Samples									
Subscale	NIG1	NIG2	ZIM1	ZIM2	MALA	BEIJ	HK-1	HK-2	HK-I	CANA
SUR-MOT	0.45	0.57	0.47	0.41	0.56	0.53	0.55	0.56	0.81	0.47
DEP-MOT	0.55	0.34	0.48	0.63	0.54	0.43	0.59	0.67	0.85	0.70
ACH-MOT	0.62	0.54	0.50	0.62	0.69	0.36	0.66	0.64	0.83	0.75
SUR-STR	0.32	0.58	0.55	0.46	0.44	0.34	0.32	0.52	0.73	0.73
DEP-STR	0.58	0.49	0.54	0.65	0.67	0.56	0.66	0.66	0.84	0.55
ACH-STR	0.71	0.61	0.57	0.63	0.64	0.71	0.65	0.68	0.85	0.76

Key: NIG1: first Nigerian sample; NIG2: second Nigerian sample; ZIM1: first Zimbabwean sample; ZIM2: second Zimbabwean sample; MALA: Malaysia; BEIJ: Beijing; HK-1: Hong Kong sample taken at the beginning of the academic year; HK-2: Hong Kong sample taken at the end of the academic year; HK-I: Hong Kong international school; CANA: Canadian sample taken from Andrews *et al.*'s paper.

SUR-MOT: Surface Motive; DEP-MOT: Deep Motive; ACH-MOT: Achieving Motive; SUR-STR: Surface Strategy; DEP-STR: Deep Strategy; ACH-STR: Achieving Strategy.

TABLE III. The relative noncentrality indices of various measurement models

	Models					
Samples	NULL	MO-ST	S + A/D	S/A + D	3-NON	3EQWT
NIG1	NA	0.86	0.86	0.90	0.92	0.32
NIG2	NA	0.70	0.73	0.67	0.66	0.66
ZIM1	NA	0.76	0.84	0.78	0.82	0.37
ZIM2	NA	0.82	0.81	0.88	0.86	0.37
MALA	NA	0.65	0.66	0.77	0.72	0.41
BEIJ	NA	0.55	0.58	0.81	0.75	0.39
HK-1	NA	0.24	0.52	0.67	0.79	0.31
HK-2	NA	0.56	0.73	0.71	0.85	0.35
HK-I	NA	0.84	0.86	0.95	0.94	0.43
CANA	NA	0.43	0.45	0.64	0.72	0.50

Key: NULL: null model; MO-ST: the two factor model of motive, strategy; S + A/D: the two factor model of (surface + achieving), deep; S/A + D: the two factor model of surface, (achieving + deep); 3-NON: the three factor model with orthogonality not assumed; EQWT: the three factor model with equal weight assumed.

NIG1: first Nigerian sample; NIG2: second Nigerian sample; ZIM1: first Zimbabwean sample; ZIM2: second Zimbabwean sample; MALA: Malaysia; BEIJ: Beijing; HK-1: Hong Kong sample taken at the beginning of the academic year; HK-2: Hong Kong sample taken at the end of the academic year; HK-I: Hong Kong international school; CANA: Canadian sample taken from Andrews *et al.*'s paper.

TABLE IV. The Tucker-Lewis indices of various measurement models

	Models					
Samples	NULL	MO-ST	S + A/D	S/A + D	3-NON	3EQWT
NIG1	NA	0.93	0.92	0.95	0.97	0.46
NIG2	NA	0.84	0.86	0.83	0.87	0.40
ZIM1	NA	0.87	0.86	0.88	0.93	0.50
ZIM2	NA	0.90	0.90	0.94	0.94	0.51
MALA	NA	0.82	0.82	0.88	0.89	0.54
BEIJ	NA	0.76	0.77	0.90	0.90	0.52
HK-1	NA	0.60	0.74	0.82	0.91	0.46
HK-2	NA	0.76	0.85	0.85	0.91	0.49
HK-I	NA	0.91	0.92	0.97	0.98	0.54
CANA	NA	0.70	0.71	0.81	0.89	0.60

Key: NULL: null model; MO-ST: the two factor model of motive, strategy; S + A/D: the two factor model of (surface + achieving), deep; S/A + D: the two factor model of surface, (achieving + deep); 3-NON: the three factor model with orthogonality not assumed; EQWT: the three factor model with equal weight assumed.

NIG1: first Nigerian sample; NIG2: second Nigerian sample; ZIM1: first Zimbabwean sample; ZIM2: second Zimbabwean sample; MALA: Malaysia; BEIJ: Beijing; HK-1: Hong Kong sample taken at the beginning of the academic year; HK-2: Hong Kong sample taken at the end of the academic year; HK-I: Hong Kong international school; CANA: Canadian sample taken from Andrews *et al.*'s paper.

Discussion

The basic dimensions of deep and surface approaches to learning were established across the 10 samples in various cultures in the present study. Judging from the TLIs,

TABLE V. Chi-squares of various measurement models

Samples	Models (degree of freedom)					
	NULL (15)	MO-ST (8)	S + A/D (8)	S/A + D (8)	3-NON (6)	3EQWT (12)
NIG1	816.14	67.51	69.23	49.75	31.91	446.32
NIG2	409.49	71.80	64.62	77.19	59.93	252.67
ZIM1	483.96	68.15	49.03	62.57	40.58	249.54
ZIM2	625.68	66.80	70.75	47.79	40.82	317.64
MALA	502.46	98.24	97.06	67.39	60.19	240.88
BEIJ	316.29	80.15	76.10	37.88	36.56	169.78
HK-1	461.92	188.21	122.24	86.49	44.34	257.75
HK-2	541.26	132.15	85.13	88.40	37.52	286.11
HK-I	1779.05	161.42	144.01	57.22	45.78	820.52
CANA	507.18	156.63	152.29	103.88	61.70	212.34

Key: NULL: null model; MO-ST: the two factor model of motive, strategy; S + A/D: the two factor model of (surface + achieving), deep; S/A + D: the two factor model of surface, (achieving + deep); 3-NON: the three factor model with orthogonality not assumed; EQWT: the three factor model with equal weight assumed.

NIG1: first Nigerian sample; NIG2: second Nigerian sample; ZIM1: first Zimbabwean sample; ZIM2: second Zimbabwean sample; MALA: Malaysia; BEIJ: Beijing; HK-1: Hong Kong sample taken at the beginning of the academic year; HK-2: Hong Kong sample taken at the end of the academic year; HK-I: Hong Kong international school; CANA: Canadian sample taken from Andrews *et al.*'s paper.

some samples seemed to fit the 'surface + achieving, deep' model better, some fitted the 'surface, achieving + deep' model better, while others got a better fit for the 'surface, deep, achieving' three factor model. This is expected as the achieving approach is not associated with a specific strategy of learning; it depends on the nature of different courses and requirements of the teacher. When a teacher stresses understanding and tends to set 'non-routine' questions to tap authentic abilities, achievement-orientated students will adjust to such requirements and opt for learning for understanding. On the other hand, if a teacher sets questions which require mere memorisation, the students, particularly those adopting for an achieving approach, will see rote-learning as adequate to score high marks. Thus, it is not surprising that the achieving approach is associated with surface approach in some cultures, but with deep approach in others.

In conclusion, the results obtained here provide support for the cross-cultural within-construct validity of the Learning Process Questionnaire and the underlying surface-deep approach model. Therefore it seems likely that the now voluminous literature on student learning in Western countries may well have relevance to non-Western countries too. Further research will be needed to determine the extent to which variations in the placement of the achieving approach in the overall learning motive and strategy model is due to local educational factors or to more enduring cross-cultural dimensions.

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