The Development and Validation of the Contributive Role Scale (CRS) for Assessing Students' Individual Contribution to Group Coursework Tasks

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ABSTRACT

The aim of this study was to develop and validate the Contributive Role Scale (CRS) for assessing individual students' contribution toward completion of group coursework tasks. The construct of contributive role consists of two dimensions, namely, task-related contributive role, and group-related contributive role. Exploratory factor analysis was conducted to examine how each item of the CRS load into two dimensions initially hypothesised. Confirmatory factor analysis was conducted to confirm if the observed (indicator) variables reliably measured each of the latent variables. Using structural equation modeling (SEM) software called Amos 5 (Arbuckle, 2003), the measurement model was tested to examine if all observed variables reliably measure their respective latent variables. Intercorrelation between contributive role and three other latent variables namely, individualism, collectivism, and team role were examined. The strucutral model was tested for fit to establish nomological validity of the contributive role construct.

INTRODUCTION

Group coursework task assessment is increasingly emphasised at higher education institutions and teacher training colleges. Group tasks undertaken by students at teacher training colleges may take two major forms, namely written tasks and performance tasks. Written tasks involve completion of written products such as assignments, seminar papers, project reports (Magin, 2001), lab-reports, research proposal, or article critiques (Onwuegbuzie, Collins, & Elbedour, 2003). Performance tasks require students' preparation and involvement in practical tasks, such as oral presentations, experiments, fieldwork, or research or engineering projects (Lejk & Wyvill, 2002; Lejk & Wyvill, 2001a; Lejk & Wyvill, 2001b; Bourner, Hughes & Bourner, 2001; Li, 2001; Lejk & Wyvill, 1996; Rafiq & Fullerton, 1996; Goldfinch, 1994; Conway, Kember, Sivan & Wu, 1993; Falchikov, 1993; Falchikov, 1988). Assessment of group tasks at teacher training colleges has traditionally been carried out by course lecturers. The staff member will normally grade the final written group products or the performances and award each group product or performance a single score or grade. Although this procedure has generally been practiced, some lecturers, out of their own initiative, make attempts to produce different scores for individuals who are involved in group work. Unfortunately, the criteria employed to differentiate individuals vary significantly. This practice makes assessment of teacher trainees very difficult and inconsistent.

Studies that were conducted to measure individuals' contribution (Conway et al, 1993; Falchikov, 1993; Goldfinch, 1994; Rafiq & Fullerton, 1996; Lejk & Wyvill, 1996; Cheng & Warren, 2000; Magin, 2001; Li, 2001; Bourner, Hughes & Bourner, 2001; Lejk & Wyvill, 2001a; Lejk & Wyvill, 2001b; Lejk & Wyvill, 2002) reported only about the various assessment criteria

that were used to assess individual contributions toward completion of group coursework tasks. Lejk and Wyvil (2001a), and Lejk and Wyvill (2001b) in their respective studies, reported the employment of assessment criteria developed by Goldfinch (1994) for peer assessment of individual contribution to group coursework tasks. Due to lack of appropriate and adequate criteria to assess individual's contribution towards completion of group tasks, every member of a group is awarded a common grade based on assessment of their group's product or performance. This study was therefore, an attempt to develop and validate the Contributive Role Scales (CRS) that would enable teacher trainers discriminate contributing from non-contributing members of a group that has been working toward completing a group task. This may contribute to the existing efforts to assign each individual member who have been working in a group, a grade that is equivalent to his or her actual effort.

Statement of the Research Problem

Most of the courses conducted at teacher training colleges in Malaysia consist of group coursework task components (Teacher Education Division, Ministry of Education, 2003). This component is undertaken by students in almost all subject areas that are taught in the teacher training programme. It makes up a significant proportion of coursework assessment in each of the teacher education course subjects. Lecturers are made accountable for grading the group work (either products or practical tasks) that are generated collectively by several groups of students in various subject areas. Since a group product or performance is the only salient evidence of students' efforts in a collective setting, most lecturers mark or grade a group work and award a common mark to every group member who belongs to the group which produced the outcome. Assessing a group coursework task, and awarding a single, common grade to every group member who has been working collectively towards completing the group task regardless of their contributions is unacceptable and is a dilemma faced by many educators who encourage students to participate in collaborative learning activities (Cheng & Warren, 2000). Students have also been expressing their concerns and complaints regarding the practices among academic staff, of awarding a single mark to all group members (Rafiq & Fullerton, 1996).

In addition, students at teacher training colleges are usually assigned to group coursework tasks involving various subject areas, with different requirements, and with various degrees of difficulties and complexities. There are various ways students approach group tasks that they are undertaking. These variations and uncertainties make it even more difficult to assess individual contributions to a collective task. Deeper understanding of the group work process and related theories, and identification of common criteria that defines and explains clearly what are the stable, consistent, and measurable behavioural indicators that individuals demonstrate in all group settings, is necessary. A generic set of behavioural criteria or standard measures would enable the Teacher Education Division to coordinate and monitor the implementation of teacher education curriculum and assessment of teacher trainees in all teacher training colleges in Malaysia (Ministry of Education, Malaysia, 1999). In view of these issues, this study was aimed at developing and validating a Contributive Role Scale (CRS) based mainly on theories related to functional role behaviours.

Purpose of the Study

The main purpose of the study was (a) to develop the CRS as a means to measure individuals' contribution to group coursework tasks, (b) to gather construct validity evidences for the CRS, by examining its reliability and dimensionality and, (c) to establish correlational and "causal"

relationship between the contributive role construct and individualism, collectivism, and team role, as evidence of nomological validity.

Hypothesised Model

When individuals work in groups towards accomplishing a collective tasks, they may contribute in two ways, firstly, to the task that is being undertaken, and secondly, to the group to maintain interpersonal (or social-emotional) relationships among the group members. Therefore, contributive role (CR) is hypothesized to be measured by task-related contributive role (TCR) and group-related contributive role (GCR). An individual's cultural inclination to, whether individualism (as idiocentric) or collectivism (as allocentric) (Triandis, 1996), is hypothesised to influence or to predict team role (Belbin, 1981) and contributibe role to a collective task. Individualism (INDV) is measured by vertical individualism (VIND) and horizontal individualism (HIND) variables. Collectivism (COLL) is measured using two observed variables, namely vertical collectivism (VCOLL) and horizontal collectivism (HCOLL). When working in groups, individuals contribute to the "productivity" of the group by taking up certain roles. Based on Belbin's long term study, it is suggested that individuals assume multiple roles in group settings. These roles are categorised into eight important roles individual play in teams by Belbin (1981). A further study by Fisher and colleague (1998) on the BTRSPI indicated that the eight dimensions of the team role construct can be grouped into task-related team role and group (relationship)-related team role. Therefore, team role (ROLE) construct is measured by two indicator variables, namely, task-oriented team role (TROLE) and group-oriented team role (GROLE).

Group members who approach group tasks in an individualistic manner may not contribute to the achievement of group goal (Johnson and Johnson, 2000). Individuals who are inclined to individualism also emphasise on the achievement of their personal goals and the group goals become secondary (Triandis et al, 1988; Triandis et al, 1990; Triandis, 1996). Therefore, group members who are inclined to individualism are predicted to obtain lower contributive role score if compared to individuals who are incline to collectivism. Negative relationship should be evident between individual's contributive role and their inclination toward individualism. Individuals with individualistic inclination also may have difficulty playing important roles in teams. Hence, individualism is less likely to predict team role. Indirect relationship is also hypothesised between individualism and contributive role. Collectivism should be able to positively predict contributive role. Since collectivist should not have any difficulty functioning in teams, team role is hypothesised to mediate the effect of collectivism on contributive role. The hypothesised relationships were illustrated in Figure 1.
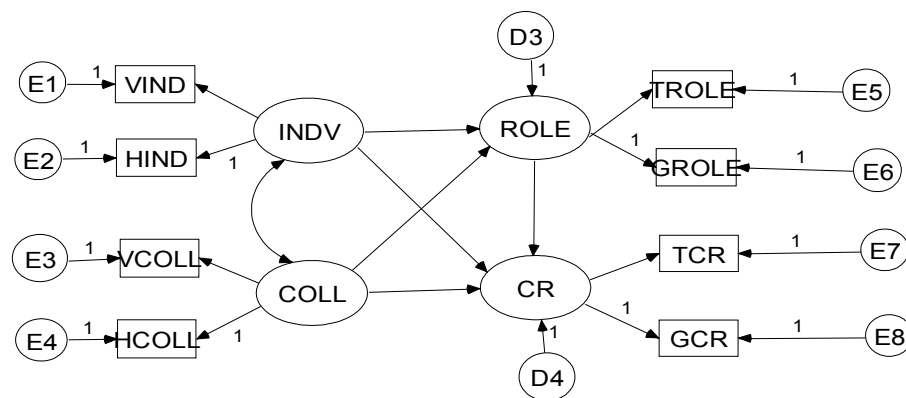
Figure 1. Hypothesised relationships between contributive role, individualism, collectivism, and team role

METHODOLOGY

The sample for the study consisted of 192 Postgraduate Diploma in Education (KPLI) students enrolled at a teacher training college in Malaysia and have been involved in completing written group coursework tasks in Educational Studies course. Of the total, 59 were male (30.7%) and 133 are female (69.3%). Average age of the participants was 27.22 years (minimum age = 23, maximum age = 34). Participants voluntarily responded to three instruments that measured four variables. The CRS measured contributive role (CR), the adapted version of BTRSPI (Belbin, 1981) measured team role (ROLE), and the adapted version of ICQ (Singelis, Triandis, Bhawuk, and Gelfand, in Triandis, 1996) measured the constructs of individualism (INDV) and collectivism (COLL).

Development of the CRS

Task- and group-related contributive role are two important components of contributive role that influence the functioning of group members in producing a collective outcome (Stech & Ratliffe, 1988; Bligh, 2000; Falchikov, 1993; 1988; Benne & Sheats, 1970). The items for the CRS were constructed based mainly on these two components.

Task-related Contributive Role

Task-related contributive role (TCR) concern with how individuals contribute toward pooling and sharing of ideas through interaction among group members. Individuals may also be involved in initiating tasks (Bligh, 2000; Falchikov, 1993; 1988; Benne & Sheat, 1970), providing and asking for information, ideas, and opinions. Individuals may contribute by clarifying, evaluating, combining ideas and resources, selecting relevant information and materials, and synthesising

them into an integrated product (Stech & Ratliffe, 1988). Exchange of ideas, suggestions or opinions may occur among group members.

Group-related Contributive Role

Group-related contributive role (GCR) involves maintenance of interpersonal relationships among group members (Bligh, 2000; Falchikov, 1993; 1988; Benne & Sheat, 1970). It is as equally important as the task-related (ideational) contributions whenever individuals engage in a group task. This dimension involves maintenance of socio-emotional "harmony" (Fisher et al, 1998) among individuals in a group.

Data Analysis

Internal reliability of the CRS, ICQ, and BTRSPI was determined using Cronbach's coefficient-alpha. Responses to the CRS were factor analysed using the principal component analysis to examine correlation between items (subscales). Dimensionality of the CRS was determined using the equamax rotation. Loadings of subscales into different components were also examined to find out if they load into their original dimensions as hypothesised. The scree plot (Cattell, 1966) and the Kaiser-Guttman Rule (1954) were used as criteria to determine number of factors to be accepted. Using structural equation modeling (SEM) software program called Amos5 (Arbuckle, 2003), reliability of observed (indicator) variables in measuring each of the latent variables were examined using factor loadings (standardised regression weights). Maximum likelihood estimation method was use for examining the measurement model and structural model. The measurement model fit was examined before the structural model is tested for fit (Schumacker & Lomax, 1996). Correlational and "causal" relationships among CR, INDV, COLL, and ROLE were established by examining the hypothesised structural model. The goodness of fit measures and parameter estimates were examined to determine if the model can be accepted as fitting the sample data.

RESULTS

Cronbach's coefficient alpha value of the CRS, ICQ, and BTRSPI are .954, .839, and .932 respectively. Exploratory factor analysis of the CRS indicated Kaise-Meyer-Olkin (KMO) Measure of Sampling Adequacy equals to .918; well above the minimum requirement of .60. Chi-square of Bartlett's Test of Sphericity equals to 4479.420 (df = 780) and significant at .001.

Further examination showed that cumulative percentage of total explained variance of 53% was achieved with a four component model. But scree plot indicated that a two factor model was more viable. A confirmatory factor analysis (CFA) of a two factor component model was run to confirm this result. The CFA of 40 items of the CRS confirmed existence of two distinct dimensions with items 1, 3, 5, 7, 9, 13, 17, 21, 23, 25, 29, 33, and 35, loading into dimension 1 (task-oriented CR) with factor loadings between .456 and .760, while items 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 36, 38, and 40 loading into dimension 2 (group-oriented CR) with factor loadings between .350 and .737. Hence, task-oriented CR (TCR) and group-oriented CR (GCR) were hypothesised to measure latent variable (construct) of contributive role (CR). Only items with factor loadings above .50 were selected to represent each dimension for measurement model testing.

Measurement Model

Testing of the measurement model (see Figure 2) confirmed that TCR and GCR reliably measure the latent variable of CR with factor loadings (standardised regression weights) of .92 and .79 respectively. Seven vertical individualism (VIND) items and 6 horizontal individualism (HIND) items were selected to represent the individualism (INDV) construct. Testing of the measurement model resulted in standardised regression weights of .50 and .66 for VIND and HIND respectively, indicating a reasonable representation of INDV latent variable by VIND and HIND. Seven vertical collectivism (VCOLL) items loaded well (standardized regression weight = .66) into collectivism (COLL) construct, while another 6 horizontal collectivism (HCOLL) items indicated standardized regression weight of .73 on collectivism (COLL) latent variable. This showed VCOLL and HCOLL both reliably measure the COLL construct.

Task-related team role (TROLE) did not measure the team role construct well with a low standardized regression weight of .21. But, group-related team role (GROLE) measured the team role (ROLE) construct very well with standardised regression weights .92.

Squared multiple correlations (R^2) of TCR is .84, indicating lower bound estimate of the reliability of the measure is above .84. This also indicated that 84% of variance of CR is accounted for by variance in TCR. Another 16% of variance is attributed to the error variance (Arbuckle & Wothke, 1999). The subscales of GCR also measure the CR construct with reliability estimate of .62. Hence, only 38% of the variance of CR cannot be explained by the model. Except for TROLE and VIND, the other indicator variables reasonably reliably measure their respective latent variables, with reliability ranging from .43 to .85.

Measurement model (see Figure 2) of the hypothesised (default) model showed good fit of the sample data (χ^2 = 21.351, df = 14, probability level = .093). Absolute fit measures were satisfactory (GFI = .973; RMSEA = .052). Incremental fit measures shows good fit compared to the independence (the most restricted) model with χ^2 = 512.014, df = 28. Other satisfactory goodness of fit indices include, adjusted GFI = .973 (above .95); normed fit index, NFI = .958 (above .90), Tucker-Lewis Index (TLI) = .970, which was above .95, and IFI = .985, (above .90). Parsimonious fit measures indicating normed chi-square, Cmin/df = 1.525, 1<cmin/df<2; Akaike Information Criterion (AIC) = 65.351; which was not very distant from the value of 72.000 for the saturated (the least restricted) model; and the comparative fit index (CFI) is .985 (above .90). Since the measurement model was adequate, the structural model was then tested based on the measurement model (Anderson & Gerbing, 1988).

MEASUREMENT MODEL
cmin=21.351, df=14, p=.093
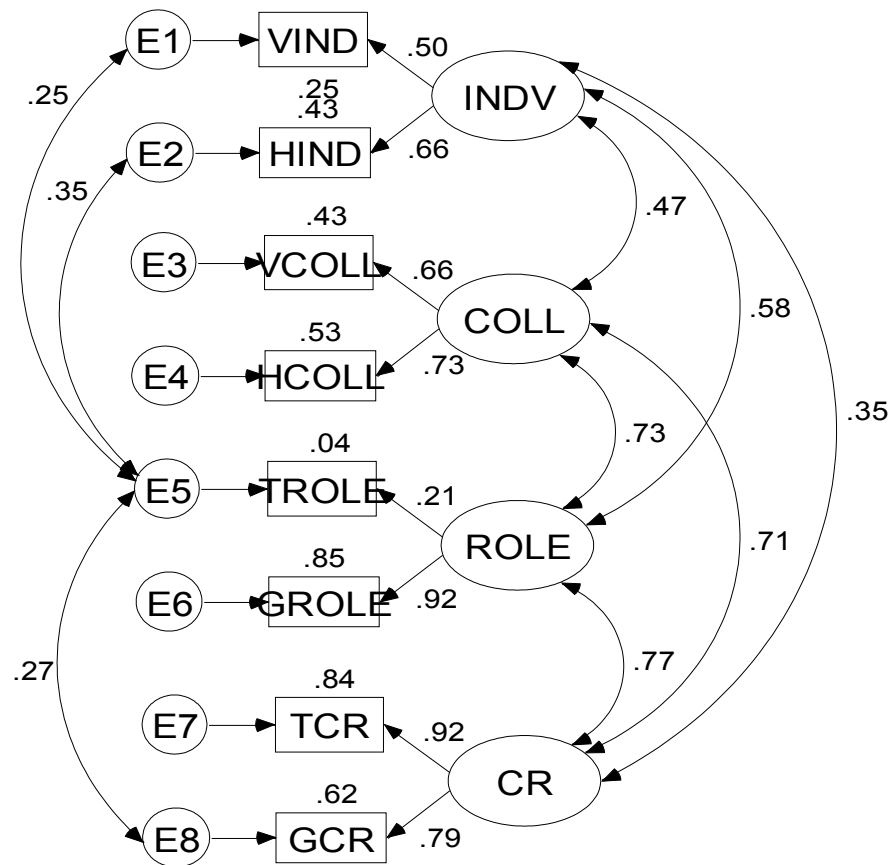cmin/df=1.525
Standardized estimates

Figure 2. Measurement model for contributive role, individualism, collectivism, and team role

Structural Model

Solution of the structural model was achieved with only 8 iterations. The structural model showed good fit with the sample data (Cmin, χ^2 = 21.352, df = 16, probability level = .165). Non-significant probability level indicates failure to reject null hypothesis. This means implied

covariance is not different from sample covariance. Therefore, the hypothesised model fit the sample data.

In addition, results of the fit analysis of the structural model showed satisfactory absolute fit measures with GFI = .973 (above .95); RMSEA = .042 (less than .06). Incremental or comparative fit measures also satisfactory with AGFI = .940 (above .90); NFI = .958 (above . 90); TLI = .981 (above .95); and IFI = .989 (above .90). Parsimonious fit measures also indicated good fit of the hypothesised model to the sample, with Cmin/df = 1.335 (1< Cmin/df <2); AIC = 61.352 (not too distant from AIC of saturated model (72.000); and comparative fit index, CFI = .989 (above .90).

The results (see Figure 3) indicated that except for the effect of INDV on CR (standardised regression weight = -.17), all other effects are positive (standardised regression weight ranging from .31 to .61). Individualism (INDV) has the lowest negative direct effect on contributive role (CR). Individualism also indirectly influence contributive behaviour with team role (ROLE) mediating the relationship. Individualism positively influence team role, but the effect is not very strong (path coefficient = .31), while team role "causes" higher positive effect on contributive role (path coefficient = .61). Contributive role is predicted by team role, but team role is also influenced by collectivism. Collectivism (COLL) is indicated of having direct positive influence on contributive role (path coefficient = .34). Collectivism also influences team role (path coefficient = .58). Intercorrelations among latent variables can also be indicated by the structural model. As explain by theory, correlation between individualism and collectivism was reasonably low (INDV $\leftrightarrow$ COLL = .47). Squared multiple correlation (R^2) of contributive role was .65, indicating that 65% of the variance of contributive role is accounted for by individualism, collectivism, and team role.

DISCUSSION

The current study was conducted to develop the CRS and to establish evidences for its construct validity. Analysis of the internal reliability of the CRS indicated Cronbach's coefficient alpha value of .952. Exploratory factor analysis of the CRS showed evidence that subscales (items) of the CRS loading into two main dimensions, namely the task- and group-oriented dimension as hypothesised. Confirmatory factor analysis of a twp factor model confirmed that 13 task-related items load onto task dimension and 13 group-related items load onto group dimension. Testing of the measurement model, upon re-specification, indicated that the model fit well with the sample data (chi-square = 21.351, df = 14, p = .093). Both task-related contributive role (TCR) and group-related contributive role (GCR) variables measured the contributive role (CR) very reliably. This was evident from their respective standardised regression weights of .92 and .79. High standardised regression weights provide evidence of convergent validity of the CRS (Anderson & Gerbing, 1988). Squared multiple correlation value of TCR (.84) and GCR (.62) indicate lower bound value of their respective reliability. This means that TCR measures CR with reliability no less than .84, while GCR measures CR with reliability exceeding .62. These results provide evidence that the CRS can be employed to reliably and validly measure the construct of contributive role of individuals in group settings. Correlations among latent variables were less than .90, indicating no evidence of multivariate collinearity.

STRUCTURAL MODEL
cmin=21.352, df=16, p=.165
cmin/df=1.335
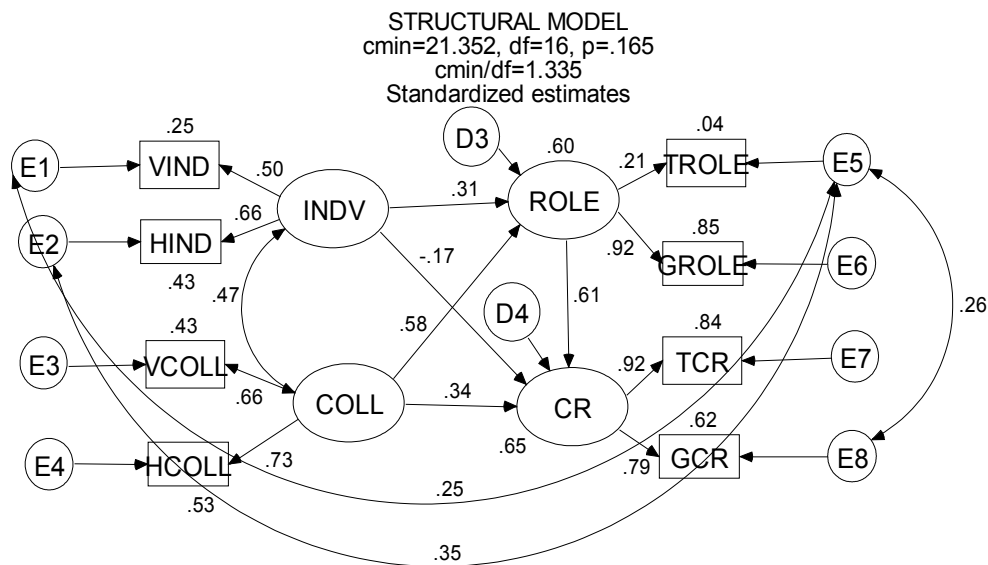Standardized estimates

Figure 3. Structural Model of Contributive role, individualism,
collectivism, and team role

Nomological validity of the CRS can be established by examining evidences of interrelationships (correlation and/or "causal") of CR with other latent variables, which in this case were individualism, collectivism, and team role. Testing of the measurement model indicated that all these constructs were reliably measured by their respective indicator (observed) variables (standardised regression weights ranging from .50 to .92). Only task-related role (TROLE) did not reliably (factor loading = .21) measure the team role construct. As hypothesised, structural model indicated that correlation between individualism and collectivism was below .50 (standardised estimate = .47), suggesting that individualism and collectivism are two different constructs. Individualistic individuals (idiocentrics) are more concern about achieving personal goals. Having a relationship or working with others is thought of as stopping them from achieving excellence. Individualistic individuals (idiocentrics) have preference for competitions or for outdoing others. Individuals who are inclined toward individualism prefer to work alone and may find it difficult to work in group or team environment, and therefore, failed to function appropriately in a team and could not contribute to their groups. This is evident from the low negative path coefficient (-.17) between individualism and contributive role. The result is consistent with Johnson and Johnson's (2000) explanation of behaviours of individualistic individuals in cooperative learning environment. As a result, the higher the inclination toward individualism, the lower would be the contribution to group work. Low path coefficient (.31) between individualism and team role indicates that individuals' increasing inclination toward individualism does not change much the assumption of team roles by individuals in group settings.

Collectivism describes cultural inclination of individuals in group settings. Collectivistic individuals (allocentrics) concern about achievement of group goals and have preference for continuous relationships with others including peers, neighbours and family members. As hypothesised, reasonably high path coefficient (.58) was indicated between collectivism and team role. Inclination toward collectivism does influence individuals' readiness or ability to assume important team roles in accomplishing group tasks. Team role also evidently influence contributive role. The more relevant team roles individuals assume in team or group settings, the higher the contribution of individuals. It is evident, as hypothesised, that individuals who are inclined toward collectivism are more likely to demonstrate contributive role (CR) if compared to individuals who are inclined to individualism. This provides discriminant validity evidence for the CRS.

CONCLUSION

Evidences obtained from this study have so far been able to establish reasonable construct validity of the CRS. The CRS may reliably and validly measure the construct of contributive role. It is hoped that more research is conducted to further validate the CRS by either examining how it relates to other constructs or by establishing other methods to measure the construct. A multitrait-multimethod (MTMM, Campbell & Fiske, 1970) design may be able to establish convergent and discriminant validity of the construct of contributive role (CR).

The contention of this study has been that individual members may have contributed differently to the group tasks, and therefore deserve a better or lesser grade than the group grade (i.e. group product or performance score). By using the CRS, an individual member's contributive role to a group task can be proportioned. Several studies have suggested various means to determine individual proportion of a group coursework score by calculating his or her "Individual Weight Factor (IWF)" (Conway et al, 1993; Falchikov, 1993; Goldfinch, 1994; Rafiq & Fullerton, 1996; Lejk & Wyvill, 1996; Lopez-Real & Chan, 1999; Cheng & Warren, 2000; Li, 2001). Individual score can be obtained by multiplying the IWF with the group score. Therefore, the development and validation of the CRS will enable implementation of multiple peer rating procedures that may complement the present group coursework task assessment procedures by enabling individual performance in group work to be differentiated, while at the same time, producing wider mark distributions to discriminate students' abilities.

The current study developed and validated the CRS to measure contributive role to group coursework tasks at teacher training colleges. It is hoped that this effort will stimulate further research to explore the possibilities of implementing the CRS at other higher learning institutions, such as the public and private universities. This study used samples from teacher education population for validating purposes. It is suggested that other researchers will validate the CRS for the purpose of usage at public and private universities, by employing samples from the university population. Further research is also recommended to be conducted to explore the ways how the CRS can be utilised to quantify individual contributions to group coursework tasks across various tasks over different course subjects.

REFERENCES

Arbuckle, J. L., & Wothke, W. (1995-1999). *Amos 4.0 user's guide*. Chicago: SmallWaters Corp.
Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103* (3), 411-423.

Barker, L. L., Wahlers, K. J. & Watson, K. W. (2001). *Groups in process: An introduction to small group communication*. Boston: Allyn & Bacon.

Belbin, R. M. (1981). *Management teams: Why they succeed or fail*. Heinemann: London.

Benne, K. D., & Sheat, P. (1970). Functional roles of group members. In C. G. Kemp (Ed.), *Perspectives on the group process: A foundation for counseling with groups* (2nd.ed) (pp. 270-275). Boston: Houghton Mifflin.

Bligh, D. (2000). *What's the point in discussion?* Exeter: Intellect.

Bourner, J., Hughes, M., & Bourner, T. (2001). First-year undergraduate experiences of group project work. *Assessment & Evaluation in Higher Education, 26*, 19-39.

Campbell, D.T., & Fiske, D. W. (1970). Convergent and discriminant validation by the multitrait-multimethod matrix. In G. F. Summers (Ed.), *Attitude measurement* (pp. 100-122). London: Kershaw.

Cheng, W., & Warren, M. (2000). Making a difference: Using peers to assess individual students' contributions to a group project. *Teaching in Higher Education, 5*, 243-255.

Conway, R., Kember, D., Sivan, A., Wu, M. (1993). Peer assessment of an individual's contribution to a group project. *Assessment & Evaluation in Higher Education, 18*, 45-56.

Cronbach, L. J., & Meehl, P. E. (1967). Construct validity in psychological tests. In W. A. Mehrens, & Ebel, R. L. (Eds.), *Principles of educational and psychological measurement* (pp. 243-270). Chicago, Illinois: Rand McNally.

Falchikov, N. (1988). Self and peer assessment of a group project designed to promote the skills of capability. *Programmed Learning and Educational Technology, 25*, 327-339.

Falchikov, N. (1993). Peer feedback marking: developing peer assessment. *Innovation in Education & Training International, 32*, 175-187.

Falchikov, N., & Magin, D. (1997). Detecting gender bias in peer marking of students' group process work. *Assessment and Evaluation in Higher Education, 22,* 385-396.

Fisher, S.G., Hunter, T. A., & Macrosson, D. K. (1998). The structure of Belbin's team roles. *Journal of Occupational and Organizational Psychology, 71*, 283-288.

Forsyth, D. R. (1999). *Group dynamics* (3rd.ed). California: Wadsworth Publishing.

Goldfinch, J. (1994). Further developments in peer assessment of group projects. *Assessment & Evaluation in Higher Education, 19*, 29-35.

Johnson, D. W., & Johnson, F. P. (2000). *Joining together: group theory and group skills.* (7th.ed). Boston: Allyn & Bacon.

Lejk, M., & Wyvill, M. (1996). A survey of methods of deriving individual grades from group assessments. *Assessment & Evaluation in Higher Education, 21*, 267- 280.

Lejk, M., & Wyvill, M. (2001a). Peer assessment of contribution to a group project: A comparison of holistic and category-based approaches. *Assessment & Evaluation in Higher Education, 26*, 61- 72.

Lejk, M., & Wyvill, M. (2001b). Secret and Open-Peer assessment of contribution to a group project: A comparison of holistic and category-based approaches. *Assessment & Evaluation in Higher Education, 26*, 61- 72.

Li, L. (2001). Some refinements on peer assessment of group projects. *Assessment & Evaluation in Higher Education, 26*, 5-18.

Lord, F. M, & Novick, M. R. (1968). *Statistical theories of mental test scores.* Massachusetts: Addison-Wesley.

Lopez-Real, F., & Chan, Y. R. (1999). Peer assessment of a group project in a primary Mathematics Education. *Assessment & Evaluation in Higher Education, 24*, 67-80.

Magin, D. J. (2001). A novel technique for comparing the reliability of multiple peer assessment with that of single teacher assessments of group process work. *Assessment & Evaluation in Higher Education, 26*, 139-152.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed.) (pp.13-103). New York: Macmillan.

Ministry of Education, Malaysia (1999). *Current trends and issues in training practices (pre-service and in-service) for educators in the area of information and communication technologies*. APEC Project: Country Report Malaysia.

Ministry of Education, Malaysia. (2003). *Malaysian teaching diploma: Education studies-Professional knowledge and skills.* Kuala Lumpur: Author.

Onwuegbuzie, A. J., Collins, K. M. T., & Elbedour, S. (2003). Aptitude by treatment interactions and Matthew Effects in graduate-level cooperative-learning groups. *Journal of Educational Research, 96*, 217-230.

Rafiq, Y., & Fullerton, H. (1996). Peer assessment of group projects in Civil Engineering. *Assessment & Evaluation in Higher Education, 21*, 69-83.

Schumacker, R. E., & Lomax, R. G. (1996). *A beginner's guide to structural equation modeling.* New Jersey: Lawrence Erlbaum.

Stech, E. L., & Ratliffe, S. (1988). *Working in groups: A communication manual for leaders and participants in task-oriented groups.* Lincolnwood: National Textbook Co.

Triandis, H. C., Bontempo, R., Villareal, M. J., Asai, M., & Lucca, N. (1988). Individualism and collectivism: Cross-cultural perspectives on self-ingroup relationships. *Journal of Personality and Social Psychology, 54*, 323-338.

Triandis, H. C., McCusker, C., & Hui, C. H. (1990). Multimethod probes of individualism and collectivism. *Journal of Personality and Social Psychology, 59,* 1006-1020.

Triandis, H. C. (1996). The psychological measurement of cultural syndromes. *American Psychologist, 51,* 407-415.

Wisker, G. (1994). Innovative assessment: peer group and oral assessment. *Education & Training Technology International, 31*, 104-114.