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Validation of the Chinese Language Classroom Environment Inventory (CLCEI)

for use in Singapore Secondary Schools

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ABSTRACT

The Chinese Language Classroom Environment Inventory (CLCEI) is a classroom learning environment instrument for assessing students' and teachers' perceptions of their Chinese Language classroom environment in Singapore secondary schools. It is a bilingual instrument with 48 items presented in both English and Chinese. The English version of the CLCEI was customised from the original English version of the 'What is Happening in This Class?' (WIHIC) questionnaire (Fraser, McRobbie & Fisher, 1996) and its Chinese version was modified from the Taiwanese Chinese version of the WIHIC questionnaire (Huang & Fraser, 1997) for use in Singapore Chinese Language classrooms. The CLCEI was validated using 1460 secondary three (express) Chinese Language students in Singapore. Various statistical procedures were undertaken to examine validity, reliability and the factor structure of the six 8-item scales of the CLCEI. The purpose of this paper is to describe how the CLCEI was validated and to report on the validation results. The validation results obtained were compared with that of the original WIHIC questionnaire. The outcomes of the comparisons were analysed and discussed. (173 words)

Key Words: Chinese Language classroom, classroom environment.

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BACKGROUND

The classroom learning environment research has spanned a few decades with significant contributions to the educational field. Most of the recent classroom environment studies were conducted using the perceptual measures approach (Fraser, 1998). It is an approach where the investigation of the nature of classroom learning environment is undertaken by assessing students' and teachers' perceptions toward their classroom learning environment. These environment studies involving perceptual measures had produced a sizeable number of reliable environment instruments for use in different classroom contexts and in many different countries in the world (Fraser, 2000).

Among the various environment instruments developed, the ‘What is Happening in This Class?’ (WIHIC) questionnaire (Fraser, McRobbie & Fisher, 1996) is a recently developed environment instrument. It possesses some contemporary features, such as it includes some salient scales from the existing environment instruments and it allows the exclusion of irrelevant scale(s) to suit any classroom environment under study without affecting its reliability and validity. These features are the desirable features for developing an environment instrument, the Chinese Language Classroom Environment Inventory (CLCEI) for investigating the nature of the Chinese Language classroom learning environment in Singapore secondary schools. The reasons why the WIHIC questionnaire was chosen to develop the CLCEI and the detailed procedures of its development had been reported in another paper (Chua, Chen & Wong, 2000). The purpose of this paper is to describe how the CLCEI was validated and report the results of the validation.

OBJECTIVES

The three objectives of this paper are to:

1. describe the validation procedures of the CLCEI,
2. report the validation results obtained from various statistical procedures, and
3. compare and discuss the validation results with that of the original WIHIC questionnaire.

METHODOLOGY

The methodology of this study for validating the CLCEI is described under three sections: (1) The CLCEI questionnaire, (2) Sample and (3) Analyses Procedures.

The CLCEI questionnaire

The CLCEI is a bilingual environment instrument (in English and Chinese languages). It consists of six salient scales, namely ‘student cohesiveness’, ‘teacher support’, ‘involvement’, ‘task orientation’, ‘cooperation’ and ‘equity’, adapted from the ‘What Is Happening in This Class?’ (WIHIC) questionnaire (Fraser, McRobbie & Fisher, 1996). Each scale was designed to measure one dimension of the Chinese Language classroom learning environments. There are 8 items per scale, each item is scored on a five-point scale, ‘Almost never’, ‘Seldom’, ‘Sometimes’, ‘Often’ and ‘Almost always’, indicating the degree of agreement with each statement by the respondents. The 48 English items of the CLCEI were modified using the original WIHIC (Fraser, McRobbie & Fisher, 1996) and their Chinese versions were developed with some reference made to the Taiwanese Chinese version of the WIHIC (Huang & Fraser, 1997). The Taiwanese Chinese version of the WIHIC questionnaire could not be used for assessing classroom environment in Singapore context because the way of using the Chinese Language in Singapore is different from Taiwan. Table 1 below gives an overview of the seven scales and a sample item for each scale.

Table 1 Description of the six scales of the CLCEI using a Sample Item in Student-Actual Form in both English and Chinese versions

| Scale | Description | Sample Item |
|----------------------|--|--|
| Student Cohesiveness | Extent to which students know, help and are supportive of one another. | I am friendly to members of this Chinese Language class. ???????????????? |
| Teacher Support | Extent to which the teacher helps, befriends, trusts and is interested in students. | The Chinese Language teacher goes out of his/her way to help me. ???????????????? |
| Involvement | Extent to which students have attentive interest, participate in discussions, do additional work and | I give my opinions during Chinese Language class discussions. |

| | | |
|------------------|---|---|
| | enjoy the class. | ?????????, ?????????? |
| Task Orientation | Extent to which it is important to complete activities planned and to stay solving and investigation. | I know what I am trying to accomplish in this Chinese Language class. ?????????, ???????????? |
| Cooperation | Extent to which students cooperate rather than compete with one another on learning tasks. | I cooperate with other students on Chinese Language class activities. ???????????????????? |
| Equity | Extent to which students are treated equally by the teacher. | I am treated the same as other students in this Chinese Language class as other students ???????, ???????????????? |

Adapted from Chionh & Fraser (1998)

The CLCEI, like the WIHIC questionnaire, is presented in 4 different forms. In the WIHIC questionnaire, the four forms are named personal-actual, personal-preferred, class-actual and class-preferred forms. For easy identification of the respondents of each form, the four forms of the CLCEI were renamed as student-actual, student-preferred, teacher-actual and teacher-preferred forms respectively. The student-actual and student-preferred forms were used to assess students' perceptions toward their actual and preferred Chinese Language classroom learning environment, whereas, the teacher-actual and teacher-preferred forms were used to assess teachers' perceptions toward their actual and preferred Chinese Language classroom learning environment. Table 2 gives an example of an item in its four different forms.

Table 2 A sample item of the CLCEI in its four different forms

| Forms | Sample item |
|----------------|---|
| Student actual | I pay attention during this Chinese Language class. ??????????????? |
| preferred | I would pay attention during this Chinese Language class. ????????????????? |
| Teacher actual | Students pay attention during this Chinese Language class. ????????????????? |
| preferred | Students would pay attention during this Chinese Language class. ????????????????? |

Sample

The student-actual and student-preferred forms of the CLCEI were validated using 1460 secondary three (grade 9) students from 50 randomly selected Chinese Language classes with almost equal number of male and female students (688 male and 772 female students). The student sample was selected from 25 government secondary schools in Singapore. Such schools were selected for the participation in this study because 75% of the secondary schools in Singapore are government secondary schools. Therefore, a sample drawn from the government secondary schools would be the most suitable representatives of the population for this study.

Analyses Procedures

The data collection was carried out in the period of July-August (i.e. the third school term). Perception scores of the 1460 students were captured using OMR (Optical Mark Recognition) forms. The data obtained was then stored in various SPSS files to perform all the statistical analyses on the internal consistency reliability, discriminant validity, the scales' ability to differentiate between students' perceptions in different classrooms and the factorial validity of the CLCEI.

The Cronbach alpha reliability coefficient was calculated for each of the six scales as a measure of internal consistency reliability for each scale, using two units of analysis (the individual and the class mean). In addition, the discriminant validity for each CLCEI scale was also obtained by computing the mean correlation of that scale with the other five scales of the CLCEI using the individual student as the unit of analysis.

The ability of the CLCEI scales (student-actual) to differentiate between perceptions of students in different classes was also examined using a series of one-way analyses of variance (ANOVA). For this ANOVA, class membership was used as the independent variable and the set of the six scales of the CLCEI in the student-actual form was used as the dependent

variable. The results of this analysis were presented in terms of the η^2 statistics which is the ratio of 'between' to 'total' sums of squares.

Furthermore, principal components factor analysis with varimax rotation was conducted using the perception scores obtained from the student-actual form of the CLCEI (i.e. analyzed based on students' perceptions of the actual classroom learning environments). Individual student's score was used as the unit of analysis. The purpose of this factor analysis was to confirm whether the 48 items of the CLCEI would load into six *a priori* scales for assessing six different dimensions of the Chinese Language classroom learning environment. Only items with factor loadings greater than 0.40 (the minimum value conventionally accepted as meaningful in factor analysis) were considered in deciding the factor structure of each scale of the CLCEI. The factor structure that evolved was then compared with that reported previously for the original WIHIC questionnaire, to examine the extent it was replicated. The validation results of the CLCEI are reported and discussed in the next section.

RESULTS AND DISCUSSION

Table 3 presents a summary of the alpha reliability and discriminant validity obtained separately for the actual and preferred versions of the CLCEI using two units of analysis (individual student's mean and class mean). The ability of the CLCEI to differentiate students' perceptions between classes as measured by the η^2 statistics was also presented in Table 3. On the whole, the statistics obtained were acceptable.

Table 3 Internal Consistency Reliability, Discriminant Validity for the CLCEI (student-actual form) and ANOVA Results for Class Membership Differences (η^2 statistics) for two units of analysis

| Environment Scale | Unit of Analysis | Alpha Reliability (a) | | Mean Correlation with Other Scales | ANOVA Results (η^2) |
|----------------------|------------------|--------------------------|-----------|------------------------------------|----------------------------|
| | | Actual | Preferred | | |
| Student Cohesiveness | Individual | .90 | .90 | .44 | .13** |
| | Class Mean | .94 | .96 | | |
| | | | | | .12** |
| Teacher Support | Individual | .82 | .93 | .52 | |
| | Class Mean | .94 | .96 | | |
| | | | | | |
| Involvement | Individual | .87 | .91 | .51 | .08** |
| | Class Mean | .87 | .96 | | |
| | | | | | |
| Task Orientation | Individual | .89 | .93 | .45 | .13** |
| | Class Mean | .96 | .97 | | |
| | | | | | |
| Cooperation | Individual | .88 | .93 | .51 | .11** |
| | Class Mean | .94 | .97 | | |
| | | | | | |
| Equity | Individual | .91 | .93 | .50 | .11** |
| | Class Mean | .96 | .97 | | |

**
 $p < .001$

Sample Size: 1460 students from 50 Chinese Language classes.

The η^2 statistic (which is the ratio of 'between' to 'total' sums of squares) represents the proportion of variance explained by class membership.

The statistics of the Cronbach alpha reliability coefficient and the mean correlation of each scale with the other five scales were generated as indices of scale internal consistency reliability and discriminant validity respectively. Results in Table 3 showed that the internal

consistency of each of the six scales of the CLCEI for both the actual form and the preferred form was high.

For the student-actual form of the CLCEI, the Cronbach alpha coefficients ranged from .82 to .91 when the individual student's score was used as the unit of analysis and from .87 to .96 when the class mean was used as the unit of analysis. For the student-preferred form, the Cronbach alpha coefficients ranged from .90 to .93 when the individual student's score was used as the unit of analysis and from .96 to .97 when the class mean was used as the unit of analysis.

The results also indicated that when the class mean was used as the unit of analysis, the values of the Cronbach alpha were higher than when the individual student was used as the unit of analysis for all the six scales for both the actual and preferred forms. In general, the internal consistency of the CLCEI in student-actual form was found higher than that for the WIHIC questionnaire. When the original WIHIC was validated (Fraser, McRobbie & Fisher, 1996), the Cronbach alpha coefficients ranged from .77 to .89 when the individual student's score was used as the unit of analysis and from .67 to .88 when the class mean was used as the unit of analysis.

The discriminant validity is described as the extent to which a scale measures a unique dimension not covered by the other scales of the instrument. Table 3 indicated that the mean correlation of a scale with the other five scales ranged from .44 to .52 for the student-actual form of the CLCEI when using the individual student as the unit of analysis. These results were comparable to the validation results when the original WIHIC was validated using the Australian sample (Fraser, McRobbie & Fisher, 1996). The reported mean correlations for the Australian study for five out of the six scales namely, 'Student Cohesiveness', 'Teacher Support', 'Involvement', 'Task Orientation', and 'Cooperation' were

in the range of .42 to .45. The 'Equity' scale had an extremely low value of .06 for its mean correlation with the other five scales. Whereas, when the CLCEI was validated using the Singaporean sample, the mean correlation of the 'Equity' scale with the other five scales was .50. The higher value for the 'Equity' scale of the CLCEI could be related to cultural factors. For instance, when the 'Equity' scale of the original WIHIC was validated using the Taiwanese sample, its mean correlation with the other five scales was .59 (Huang & Fraser, 1997) whereas, it was .27 when validated using Indonesian sample (Margianti & Fraser, 2000). These results indicated that the way 'Equity' is interpreted seems to vary depending on the cultural context the students are from. A more accurate interpretation of such a finding would require further exploration by related future studies.

In general, the overall results showed that the six scales of the CLCEI have adequate discriminant validity although the scales assess somewhat overlapping aspects of the Chinese Language classroom learning environments.

The ability of the CLCEI to differentiate between the perceptions of students in different classes was investigated using a one-way ANOVA. The findings of the one-way ANOVA showed that each scale of the CLCEI in the student form was able to differentiate significantly between the perceptions of students from 50 different Chinese Language classrooms at $p < .001$. The η^2 statistics, which represents the proportion of variance accounted for by class membership, ranged from .08 to .13 for the student-actual form when the individual student's score was used as the unit of analysis. The results are favourable because the ability of the CLCEI to differentiate students' perceptions between classes is one of the important characteristics that a classroom learning environment instrument should possess.

The 1460 students' responses to the 48 items of the student-actual form and 48 items of the student-preferred form of the CLCEI were subjected to separate principal components factor analyses (with varimax rotation) involving the individual student's score as the unit of analysis. The factor loadings for all the six scales are presented in Table 4, in which factor loadings with values less than 0.40 were omitted (it is the minimum value conventionally accepted as meaningful loadings in factor analysis). The factor structure of the CLCEI which evolved showed that 48 items of the student-actual form and 48 items of the student-preferred form loaded neatly into their six *a priori* scales with all items having factor loadings greater than 0.40 on their respective scale. The factor structure for the six scales of the CLCEI was similar to that of the 56-item version of the WIHIC questionnaire (Chionh & Fraser, 1998).

Table 4 shows that item 8 which reads 'In this Chinese Language class, I get help from other students' loaded into two scales, the 'Student Cohesiveness' scale and the 'Task Orientation' scale with equal factor loadings of 0.40 each. In the original WIHIC questionnaire, item 8 was an item in the 'Student Cohesiveness' scale. Whereas, in this factor analysis, it also loaded in the 'Task Orientation' scale. In addition, the item 23 which reads 'Students discuss with me how to go about solving problems' in the 'Involvement' scale also loaded in the 'Cooperation' scale with factor loadings .46 and .42 for the actual form and preferred form respectively.

In summary, besides the double-loading pattern for the items 8 and 23 on two different scales explained above, all the other items loaded neatly into its six original *a priori* scales, and hence, the results lend support to the factorial validity of the CLCEI.

Table 4 Factor Loadings for six CLCEI scales using individual student as the unit of analysis

| Item No. | Student Cohesiveness | | Teacher Support | | Involvement | | Task Orientation | | Cooperation | | Equity | |
|---------------|----------------------|-------|-----------------|-------|-------------|-------|------------------|-------|-------------|-------|--------|-------|
| | Act | Pref | Act | Pref | Act | Pref | Act | Pref | Act | Pref | Act | Pref |
| 1 | .67 | .77 | | | | | | | | | | |
| 2 | .67 | .79 | | | | | | | | | | |
| 3 | .69 | .77 | | | | | | | | | | |
| 4 | .74 | .77 | | | | | | | | | | |
| 5 | .69 | .71 | | | | | | | | | | |
| 6 | --- | .42 | | | | | | | | | | |
| 7 | .63 | .58 | | | | | | | | | | |
| 8 | .40 | .49 | | | | | .40 | | | | | |
| 9 | | | .68 | .71 | | | | | | | | |
| 10 | | | .74 | .71 | | | | | | | | |
| 11 | | | .74 | .67 | | | | | | | | |
| 12 | | | .69 | .65 | | | | | | | | |
| 13 | | | .67 | .68 | | | | | | | | |
| 14 | | | .71 | .72 | | | | | | | | |
| 15 | | | .61 | .70 | | | | | | | | |
| 16 | | | .47 | .49 | | | | | | | | |
| 17 | | | | | .68 | .72 | | | | | | |
| 18 | | | | | .77 | .74 | | | | | | |
| 19 | | | | | .47 | .64 | | | | | | |
| 20 | | | | | .72 | .69 | | | | | | |
| 21 | | | | | .61 | .63 | | | | | | |
| 22 | | | | | .66 | .72 | | | | | | |
| 23 | | | | | .49 | .51 | | | .46 | .42 | | |
| 24 | | | | | .60 | .65 | | | | | | |
| 25 | | | | | | | .67 | .72 | | | | |
| 26 | | | | | | | .74 | .74 | | | | |
| 27 | | | | | | | .70 | .74 | | | | |
| 28 | | | | | | | .69 | .68 | | | | |
| 29 | | | | | | | .75 | .73 | | | | |
| 30 | | | | | | | .69 | .69 | | | | |
| 31 | | | | | | | .70 | .69 | | | | |
| 32 | | | | | | | .66 | .67 | | | | |
| 33 | | | | | | | | | .62 | .65 | | |
| 34 | | | | | | | | | .60 | .66 | | |
| 35 | | | | | | | | | .64 | .67 | | |
| 36 | | | | | | | | | .68 | .69 | | |
| 37 | | | | | | | | | .67 | .67 | | |
| 38 | | | | | | | | | .73 | .71 | | |
| 39 | | | | | | | | | .65 | .66 | | |
| 40 | | | | | | | | | .56 | .61 | | |
| 41 | | | | | | | | | | | .62 | .66 |
| 42 | | | | | | | | | | | .70 | .68 |
| 43 | | | | | | | | | | | .73 | .73 |
| 44 | | | | | | | | | | | .73 | .71 |
| 45 | | | | | | | | | | | .75 | .71 |
| 46 | | | | | | | | | | | .73 | .71 |
| 47 | | | | | | | | | | | .59 | .60 |
| 48 | | | | | | | | | | | .70 | .60 |
| % of Variance | 7.78 | 10.37 | 9.56 | 10.65 | 9.01 | 10.70 | 5.10 | 11.87 | 9.60 | 11.48 | 10.16 | 11.87 |

The amount of variance extracted was 56.72% (actual form) and 66.13% (preferred form).

CONCLUSION

The goal of developing an instrument, the Chinese Language Classroom Environment Inventory (CLCEI), for assessing students' perceptions toward their Chinese Language classroom learning environment in Singapore secondary schools had been achieved in this study. The CLCEI consists of six 8-item scales which were adapted from the WIHIC questionnaire (Fraser, McRobbie & Fisher, 1996). The six scales are, 'student cohesiveness', 'teacher support', 'involvement', 'task orientation', 'cooperation' and 'equity' and were designed to measure six dimensions of a classroom learning environment. In addition, the CLCEI is a bilingual instrument with 48 items presented in both English and Chinese Language. The Chinese version was modified using the Taiwanese Chinese version for use in the Singapore context.

The six scales of the CLCEI were validated with 1460 secondary three students from 25 Singapore government secondary schools. The validation results showed that all the six scales of the CLCEI have high internal consistency reliability and adequate discriminant validity. Though the analysis on the discriminant validity showed that the six scales of the CLCEI assessed somewhat overlapping aspects of the Chinese Language classroom learning environments, the results were consistent with the validation results of the original WIHIC instrument. Like the original WIHIC questionnaire, the CLCEI also had the ability to differentiate students' perceptions between classes, which is one of the desirable characteristics of an environment instrument.

The results of the principal components factor analyses (with varimax rotation) showed clearly that 48 items of the CLCEI loaded neatly into six scales which replicated the factor structure of the original WIHIC questionnaire. The loading pattern is appropriate and therefore, the factorial validity of the CLCEI is comparable to that of the original WIHIC questionnaire.

In conclusion, the validation results obtained and the factor structure which emerged showed that the CLCEI is a reliable bilingual instrument that is ready for use to assess the nature of the Chinese Language classroom learning environment in Singapore secondary schools. In addition, the validation results indicated that the adaptation of the six scales from the original WIHIC questionnaire and the omission of the 'Investigation' scale in the WIHIC for developing the CLCEI were appropriately carried out (Chua, Chen & Wong, 2000). It also further supported the claim made by the developers of the WIHIC questionnaire that the instrument allowed the exclusion of irrelevant scale(s) to suit any classroom environment under study without affecting the reliability and validity of the instrument (Fraser, Fisher & McRobbie, 1996).

REFERENCES

- Chionh, Y. H., & Fraser, B. J. (1998). *Validation and use of the 'What is Happening In This Class? (WIHIC)' questionnaire in Singapore*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, April, 1998.
- Chua, Chen & Wong (2000). *The Development of a Variation to the Chinese "What Is Happening in This Class" (WIHIC) for Use in Cross-Cultural Studies*. Paper presented at the Second Conference on Science, Mathematics and Technology Education, Taiwan, January 2000.
- Fraser, B. J. (1998). Science learning environments: Assessment, effects and determinants. *International Handbook of Science Education*, 527-564.
- Fraser, B. J. (2000). Improving Research on Learning Environments through International Cooperation.

Keynote address presented at the Second Conference on Science, Mathematics and Technology Education, Taiwan, January 2000.

Fraser, B. J., McRobbie, C. J. & Fisher, D. L., (1996, April). *Development, validation and use of personal and class forms of a new classroom environment instrument*. Paper presented at the annual meeting of the American Educational Research Association, New York.

Huang, I. T. C. & Fraser, B. J. (1997). *The development of a questionnaire for assessing student perception of teaching environments in Taiwan and Australia*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, Chicago.

Margianti & Fraser, D.L. (2000). Learning Environment, Mathematical Ability and Students' Outcomes in University Computing Courses in Indonesia. Paper presented at the Second Conference on Science, Mathematics and Technology Education, Taiwan.

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