

PERSONAL AND CLASS FORMS OF A NEW CLASSROOM ENVIRONMENT QUESTIONNAIRE

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ABSTRACT

This study involved the development of separate personal and class forms of a new classroom environment instrument which synthesises salient dimensions from existing instruments as well as including relevant new dimensions. Personal forms are more appropriate for identifying differences between subgroups of students within a class and in the construction of case studies of individuals. Quantitative methods and qualitative methods were combined both in the validation phase and in several research applications. Following a pilot study, the questionnaire was administered to a sample of approximately 800 high school science students in 30 science classes. The study resulted in a new widely-applicable classroom environment questionnaire with similar statistical characteristics for the personal and class forms. It was found that: student perceptions on the 'personal' form were systematically less positive than their perceptions of the same class using the conventional 'class' form; gender differences in classroom environment perceptions were greater for the 'personal' form than for the 'class' form; and attitude-environment associations were of comparable magnitudes for the 'personal' and 'class' forms, although each form accounted for unique variance in attitude scores.

Introduction

In the early days of the study of human environments, Murray (1938)

introduced the term alpha press to describe the environment as assessed by a detached observer and beta press to describe the environment as observed by those within that environment. These ideas were extended by Stern, Stein and Bloom (1956) to include perceptions of the environment unique to the individual (called private beta press) and perceptions of the environment shared among the group (called consensual beta press). Hence, even in these early studies of human environments, it was recognised that the perceptions of persons from different perspectives could lead to different interpretations of that environment.

Interest in the study of learning environments in classrooms was rekindled during an evaluation of Harvard Project Physics which

required the development of an instrument to assess learning environments in physics classrooms. This instrument, the Learning Environment Inventory (LEI, Walberg, 1968), asked students for their perceptions of the whole-class environment. At about the same time, Moos and Trickett (1974) had been developing a series of environment measures which concluded with the Classroom Environment Scale (CES), which also asked students for their perceptions of the learning environment of the class as a whole. These two questionnaires provided considerable impetus for the study of classroom learning environments, were used extensively for a variety of research purposes, and provided models for the development of a range of instruments over the next two decades or so (see Fraser, 1994). Most of these instruments are available in an actual version, which asks respondents questions about the experienced learning environment, and a preferred version, which focuses on the learning environment ideally preferred by students.

Inherent in this approach is the assumption that there is a unique learning environment in the classroom that all students in a class more or less experience. Variations in scores on learning environment instruments were considered as error variance, with the class mean representing a good measure of the learning environment in the classroom. However, the assumption of a common learning environment experienced by all students within a classroom was challenged in the latter half of the 1980s. For example, in interpretive studies employing classroom learning environment instruments, classroom observations and interviews involving teachers and students suggested that there were groups of students (termed "target" students) who were involved more extensively in classroom discussions than the other students. These target students were found to have more favourable perceptions of the learning environment than those students less involved, suggesting that there could be discrete and differently-perceived learning environments within the one classroom (Tobin, 1987; Tobin & Gallagher, 1987; Tobin & Malone, 1989). One implication of these studies is that there is potentially a problem with using the traditional class form of learning environment

instruments when studying differences between groups of students in a classroom (e.g., boys and girls) because these instruments elicited the student's perceptions of the class as a whole rather than the student's personal perception of his or her role in that classroom (Fraser & Tobin, 1991). Although classroom environment scales have been used to advantage in case study research (Tobin & Fraser, 1987; Tobin, Kahle, & Fraser, 1990), these studies suggested the desirability of having a new form of an instrument available which is better suited than is the conventional Class Form for assessing differences in perceptions that might be held by different students within the same class.

Around the time when these studies were being carried out, the traditional teachers' role of transmitting the logical structures of knowledge to students was being questioned in favour of a view that meaningful learning is a personal cognitive process that actively involves the learner in making sense of world experiences in terms of the existing knowledge of the individual, and a social process in which this sense-making process involves negotiation and consensus building with others (Tobin, 1993; von Glasersfeld, 1989).

These studies and influences led Fraser, Giddings and McRobbie (1992) to propose a different form of a learning environment instrument which asked students for their personal perception of their role in the environment of the classroom rather than their perception of the learning environment in the class as a whole; these two forms are called the Personal Form and the Class Form, respectively. Initially, this paper summarises some previous research using these two forms of

the Science Laboratory Environment Inventory (SLEI, Fraser, Giddings & McRobbie, 1992) and then reports current research involving the Personal and Class Forms of a new classroom environment questionnaire (Fraser, Fisher & McRobbie, 1996).

Previous Research with Science Laboratory Environment Inventory

The Personal Form of the SLEI was developed by rewording items of the Class Form. For example, the item, 'In our laboratory sessions, different students do different experiments' became 'In my laboratory sessions, I do different experiments than some of the other students'. Similar transformations of preferred version items of the Class Form were made in developing a preferred version of the Personal Form.

The Personal Form of the SLEI had satisfactory validity and reliability on both the actual and preferred versions, which was comparable to that of the Class Form. For the actual version of the SLEI, the alpha reliability figures ranged from 0.71 to 0.86 when the individual student was used as the unit of analysis, and from 0.74 to 0.91 when the class mean was used as the unit of analysis. The alpha reliability figures for the preferred version of the Personal Form of the SLEI

ranged from 0.64 to 0.84 when the individual student was used as the unit of analysis and from 0.70 to 0.85 when the class mean was used as the unit of analysis. Principal components factor analysis followed by varimax rotation for the actual and preferred versions of the Personal Form yielded the same five-factor structure for each form. Further, analysis of variance showed that each scale of the actual version of the Personal Form of the instrument differentiated between the perceptions of students in different classes. The eta² values, which are the ratios of between to total sums of squares and represent the proportion of variance explained by class membership, ranged from 0.23 to 0.28 and indicated that each scale of the Personal Form of the SLEI differentiated significantly ($p < 0.1$) between the perceptions of students in different classes.

One of the common lines of research with Class Forms of learning environment instruments in the last 25 years has been investigation of associations between characteristics of the learning environment and various student outcome measures (Fraser, 1994). The administration of the Class and Personal Forms of the SLEI along with an attitude outcome survey to 516 students in 56 grade 11 chemistry classes in Queensland allowed a comparison to be made of the magnitude of attitude-environment associations for the Class and Personal Forms. Attitudes were assessed with a Likert scale covering a range of chemistry-related attitudes associated with the goals of laboratory teaching, namely, Attitude to Laboratory Learning, Nature of Chemistry Knowledge (testability and changing nature of science knowledge), Cooperative Learning and Adoption of Laboratory Attitudes (e.g., working safely, repeating observations, following instructions). Generally, the strengths of outcome-attitude associations were similar for the Class Form and the Personal Form.

Nevertheless, although the total variance explained is comparable for each form of the instrument, this does not imply that they account for the same variance in the outcome measures. A commonality analysis (Pedhazur 1982) based on the squared multiple correlation for the five Class Form and five Personal Form scales in the actual version as predictors was performed separately for the same four attitude scales (Fraser & McRobbie 1995) using the class mean as the unit of statistical analysis. The Class Form and the Personal Form each accounted for a sizeable proportion of the outcome variance which was unique to that form when compared to the other form. Further, the

unique variance accounted for in the outcome measures was comparable to the common variance. Except for the Cooperative Learning outcome, both forms of the SLEI (Personal and Class) made a statistically significant unique contribution to the variance in the outcome measures. Similar results also were reported by Fraser, Giddings and McRobbie (1995) for other attitude outcome measures and an inquiry skills test thus vindicating the development of separate forms of the questionnaire.

Current Research with a New Instrument

In the last 25 years, instruments have been developed for a range of classroom contexts, such as individualised classrooms (Fraser, 1990), constructivist classrooms (Taylor, Dawson & Fraser, 1995) and computer-assisted instructional settings (Teh & Fraser, 1995), and for the primary school level (Fraser & O'Brien, 1985) and for higher education (Fraser & Treagust, 1986). These instruments have been employed in a range of studies, with different instruments and scales used in particular studies. Recently, Fraser, Fisher and McRobbie (1996) began the development of a new learning environment instrument which incorporates scales that had been shown in previous studies to be significant predictors of outcomes (Fraser, 1994) and additional scales to accommodate recent developments and concerns in classroom learning, such as equity issues.. The first version of the new instrument contained the following 9 scales, each scale containing 10 items: Student Cohesiveness, Teacher Support, Involvement, Autonomy/Independence, Investigation, Task Orientation, Cooperation, Equity and Understanding. The new instrument employs the same five-point Likert response scale (Almost Never, Seldom, Sometimes, Often, Almost Always) as used in some previous instruments. Actual versions of the Class and Personal Forms were developed and administered to 355 students in 17 grade 9/10 mathematics and science classrooms in five Australian schools. Principal components factor analysis followed by varimax rotation, along with item analysis and estimation of internal consistency (Cronbach alpha coefficient) and discriminant validity (mean correlation of each scale with the other scales), resulted in the acceptance of a revised version of the instrument comprising 54 items in seven of the original scales (with the Autonomy/Independence and Understanding scales not holding up). In the second trial version of the new instrument, these 54 items in seven are imbedded in an 80-item version with 10 items in each of 8 scales (with Autonomy/ Independence being reinstated). Table 1 clarifies further the nature of the new questionnaire by providing a scale description and sample item from the Personal Form for each scale and shows each scale's classification according to Moos's scheme. As well, Table 1 provides information about the method and direction of scoring of the items.

Table 1
Description of Scales in New Questionnaire and Sample Items of Each Form

Table 2 reports statistical data relevant to the internal consistency reliability (Cronbach alpha coefficient) and discriminant validity (mean correlation of a scale with the other scales) for the Class and Personal Forms of the 54-item version of the new questionnaire. Appendix A shows the corrected item-scale correlations for the items in

the new version that were retained from the previous trial version. Further, the factor analysis reported in Appendix B shows that these revised forms of the instrument each had a similar factor structure.

Table 2

Number of Items, Internal Consistency (Cronbach Alpha Coefficient), Discriminant Validity (Mean and Correlation with Other Scales), Ability to Differentiate Between Classes and Difference in Scale Means for Class and Personal Forms

Difference Between Scores on Class and Personal Forms

A multivariate analysis of variance (MANOVA) with repeated measures was used to explore differences between Class and Personal Forms on the set of seven environment dimensions. For the 355 students who completed both Class and Personal Forms, the multivariate test was statistically significant (Wilks' lambda, $p < .01$). Therefore, separate t-tests for dependent samples were conducted for each scale as reported in Table 2.

This analysis showed that there were statistically significant differences ($p < .01$) between mean scores on the Class and Personal Forms of the new instrument. However, as some of these differences (e.g. Student Cohesiveness, Investigation and Cooperation) were smaller than 0.3 standard deviations, they should be considered as small effects only. Unlike the SLEI, for which each scale's mean score on the Personal Form was lower than the corresponding mean score on the Class Form, analyses for the new instrument showed that, for some scales (Student Cohesiveness, Task Orientation and Equity), the Personal Form mean scores were higher than the corresponding mean scores on the Class Form. It is particularly interesting to note that, for the Student Cohesiveness scale in the SLEI, the mean scores for the Personal Form were less than those for the Class Form, although differences were not statistically significant. For the same scale on the new revised instrument, the difference between the mean scores for the Personal and Class Forms was statistically significant, with the Personal Form mean being higher than the Class Form mean. However, the scales in these two instruments contained different items.

Interview Responses

Interviews were held with 45 selected students who had responded to the new questionnaire in order to obtain student views about the wording and salience of items as part of the instrument development and refinement procedures. Also student interviews were used to ascertain

reasons why students gave different responses to the Personal and Class Forms of items. Preliminary analysis of survey responses to the initial 90-item instrument was used to identify students for interview. Interviewees were selected from those for whom scale total scores (out of a maximum scale score of 50 points) on the Personal and Class Forms on one or more scales differed by 5 points or greater. In the interviews, the students were asked first to comment generally on the learning environment of their science or mathematics class in open-response form, including how they personally perceived and how the class perceived the science or mathematics class learning environment. They then were asked to comment in a similar way on the particular constructs assessed by the new instrument for those scales for which a student's total Personal and Class scale score differed by at least 5 points. Finally, students commented on their responses for each individual item in those scales. Where particular items on other scales in a student's survey differed by 2 or more points (out of a maximum item score of 5 points), that student also was asked to comment on his/her responses to those items. This three-level approach provided a rich description of how the students perceived their personal role in

the learning environment of the classroom, their perceptions of the learning environment for the class as a whole, and the differences between those perceptions. As part of instrument development procedures, these students also were asked to comment on any difficulties which they experienced in interpreting or understanding the items in the questionnaires and whether there were any additional items or issues that should have been included in the instrument as concerns for improving the learning environment in their classroom.

Below are some examples of responses given by students to explain differences in their perceptions of the whole-class learning environment and their personal perceptions of their role in that learning environment in response to the initial open-ended question or questions relating to the specific dimensions. These responses illustrate a case for which the Personal perception was both more and less favourable than that for the Class as a whole:

There are parts of science I really like but other parts are boring. Some people in the class are like me in that they like some lessons but some people just don't care at all. They just muck around. (About the science class)

I would say that it is a friendly class, but some of the students are smarter than me and can understand everything better. So the way I see the class will be different to what they see. They have fun in practical work because they know what to do. Not understanding it spoils it for me. (Student Cohesiveness)

I know that we have to do all of our work and have it in on time. I

always do my work and the homework. Sometimes, if I don't finish my work in class, I take it home and do it. The class? There are fools in the class and they don't want to do their work. They want to muck up and play around. (Task Orientation)

Table 3 provides student comments for selected items in Teacher Support, Involvement and Task Orientation, which all are scales for which the differences in the means of the Class and Personal Forms were both statistically significant and of a magnitude to warrant further investigation. The item wording in Table 3 is for the Personal Form, and the student's response to the Class Form and the Personal Form are shown.

Table 3
Student Comments about Their Response to Class and Personal Forms of Some Items

These student responses provide examples for which the Class Form response was more favourable than the Personal Form response, as well as other cases for which the Personal Form was more favourable. Explanations of student responses to the Class Form often were predicated on the identification of events or actions of small groups in the class rather than on the class as a whole, and this raises questions about the validity of Class Form responses representing the whole class learning environment. Underlying many of the responses for which the Class Form response was more favourable than the Personal Form response was the idea that the individual student is only part of the class and therefore interactions with that individual student are necessarily less than the interactions with the whole class. Also, responses frequently reflected a desire on the part of the student not

to become involved in the classroom actions for a variety of reasons. A further observation was that, on each of the scales, there was a large proportion of both negative and positive differences in scores between the Class Form and the Personal Form. For example, for the Task Organisation scale, this difference (Class Form minus Personal Form) was positive for 25.9% of students, and negative for 65.9% of students, with 34.8% of students having difference scores which were equivalent to one or more points on the response scale. These ranges in scale score differences between the Class and Personal Forms of the instruments provide further support for the contention that there are groups of students within a classroom with perceptions of the learning environment which differ from these perspectives.

The size of the scale score ranges raises the question of how well the mean score on either form can represent the learning environment in a

classroom. Fraser and Hoffman (1995) used qualitative and quantitative data to show how Personal Forms could be utilised in studying the classroom learning environment at different "grain sizes". They showed how individual students and the teacher could be investigated at the smallest grain size and how these environment scores can be aggregated to the class level. When appropriate, such aggregation also could be extended to the system level. However, where classes are composed of heterogeneous groups of students with respect to their perceptions of the learning environment, the aggregation of learning environment perception scores inevitably obscures differences between students and groups within that classroom.

The student responses for the Personal Form also showed that some students were responding in terms of their perceptions of their personal involvement in the classroom and, depending on the scale, were identifying factors that personally could influence their learning. Recent approaches to learning increasingly have recognised the role of social factors in knowledge construction. The responses to the Personal Form also show the extent to which students perceived themselves as participating in the construction of knowledge from a social perspective (e.g., Student Cohesiveness, Cooperation and Involvement scales) in the classroom, both with the whole class as a whole and with their closer working groups. Accordingly, the Personal Form of the instrument has the potential to characterise the learning environment in a classroom from the perspective of recent views of learning. Taylor, Dawson and Fraser (1995) have constructed a Personal Form of a learning environment instrument, specifically for the purpose of assessing constructivist emphases within classroom learning environments, and McRobbie and Tobin (in press) have utilised Personal Forms of learning environment instruments to characterise the learning environment in a chemistry classroom from a social constructivist perspective. Relative to earlier periods of research on environments, currently the Personal Form of instruments is being used increasingly in research on classroom environments.

Conclusion

The paper reports the use of a Personal Form of a new classroom learning environment instrument which synthesises existing instruments and adds some dimensions of contemporary educational relevance. The Personal Forms assess a student's perception of his or her role within a classroom environment, whereas traditional class forms ask students to provide perceptions of the class as a whole. According to Fraser and Tobin (1991), Personal Forms of classroom environment scales are more valid, especially in research which involves case studies of individual students or which investigates differences in the perceptions of within-classroom subgroups of students (e.g. males and females).

The Personal Forms of scales displayed satisfactory factorial validity, internal consistency reliability and discriminant validity, and they were capable of differentiating between the perceptions of students in different classrooms. Interesting differences were found between mean scores on the Class and Personal forms for particular scales, and interviews with students helped to illuminate some of the reasons for these differences.

Overall, the findings reported in this paper provide convincing evidence that many respondents have differing perceptions of the learning environment in classrooms from the perspective of the whole class relative to their perceptions of their personal role in that class. However, the research on the characteristics and associations of Personal Forms of learning environment instruments is still in its infancy and much further research will be required before the implications associated with Personal Forms of instruments are understood fully. Meanwhile, the development of this instruments now makes the study of individuals or groups of students within a classroom more valid. It also open the way for the utilisation of qualitative and quantitative data together to paint a more compelling picture of the learning environments of individual and small groups of students.

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APPENDIX A

Scale Alpha Reliability and Corrected Item-Scale Correlations for
54-Item Version of Personal and Class Forms

APPENDIX B

Factor Loadings for Items in 54-Item Version of Personal (P) and Class
(C) Forms