Development, Validation and Use of a Questionnaire to Assess Students' Perceptions of Outcomes-Focused, Technology-Rich Learning Environments

Darrell L. Fisher, Jill M. Aldridge and Barry J. Fraser

Curtin University of Technology

David Wood

Sevenoaks Senior College, Western Australia

Abstract

This study involved the development and validation of a widely-applicable and distinctive questionnaire for assessing students' perceptions of their actual and preferred classroom learning environments in outcomes-focused, technology-rich learning settings. The development and validation of the questionnaire involved (1) interviews with students, teachers and ICT industry personnel to ensure that dimensions were salient, (2) ensuring consistency with Moos' scheme for classifying the dimensions of any human environment into 'relationship', 'personal development' and 'system maintenance and change' dimensions, (3) adopting and adapting scales and items from widely-used general classroom environment questionnaires, (4) field testing the instrument with students and interviewing them about their responses and (5) conducting various statistical analyses (e.g., exploratory and confirmatory factor analyses and item analysis) to refine the scales and furnish validity and reliability information. The data provided evidence for the validity and reliability of the questionnaire for use at the senior high school level across a number of different subjects. Also, the data were analysed to (a) determine whether associations exist between students' perceptions of the learning environment and their attitude towards the subject, attitudes toward computer usage and academic efficacy and (b) to determine whether differences exist between the learning environments perceived and preferred by boys and girls.

Introduction

In numerous countries around the world, there currently is a major shift in school education from what teachers do to an 'outcomes-focus' on what students achieve and an emphasis on catering for student individual differences in backgrounds, interests and learning styles. Although a true outcomes-focused system can be extremely difficult to achieve for practical reasons, integration of information communications technology (ICT) into the learning environment has considerable potential for providing teachers with the means to manage efficiently the diverse educational provisions needed to optimise each individual student's outcomes.

This paper reports research involving an innovative new senior high school that is committed to creating an outcomes-focused curriculum by integrating unique ICT infrastructure into the delivery of educational programs, online curricula, and management systems for both teachers and students. This paper reports the reliability and validity of a widely-applicable instrument that can be used to monitor the development of an outcomes-focused, technology-rich learning environment at Sevenoaks Senior College. Also, the study involved the investigation of how the learning environment created by teachers could influence students' attitudes and self-efficacy and whether girls and boys have different perceptions of the actual and preferred learning environment.

Aims of the Study

1. To develop and validate a widely-applicable questionnaire for monitoring outcomes-focused and ICT-rich classroom learning environments.
2. To investigate whether outcomes-focused and ICT-rich learning environments promote student attitudes towards the subject, attitudes to usage of ICT, and promotes academic efficacy.

3. To investigate whether differences exist between the learning environments that girls and boys perceive and would prefer.

Background to the Study

Field of Learning Environments

The study draws on and contributes to the field of learning environments (Fraser, 1994, 1998a). Contemporary research on school environments partly owes inspiration to Lewin's (1936) seminal work in non-educational settings, which recognised that both the environment and its interaction with characteristics of the individual are potent determinants of human behaviour. Since then, the notion of person-environment fit has been elucidated in education by Stern (1970), whereas Walberg (1981) has proposed a model of educational productivity in which the educational environment is one of nine determinants of student outcomes. Research specifically on classroom learning environments took off about 30 years ago with the work of Walberg (1979) and Moos (1974) which spawned many, diverse research programs around the world (Fraser, 1994, 1998a) and the creation of *Learning Environments Research: An International Journal* (Fraser, 1998c). Although earlier work often used questionnaires to assess learning environments, the productive combination of qualitative and quantitative methods is a hallmark of the field today (Tobin & Fraser, 1998).

Past research on learning environments provides numerous research traditions, conceptual models and research methods that are relevant to the study presented in this paper. This study draws on the rich resource of diverse, valid, economical and widely-applicable assessment instruments, available in the field of learning environments (Fraser, 1998b), as a starting point for developing a new questionnaire ideally suited to outcomes-focused, technology-rich learning environments. Also, the study draws on past evaluations of educational innovations (Fraser & Maor, 2000; Maor & Fraser, 1996; Teh & Fraser, 1994) from the field of learning environments to investigate success in creating effective outcomes-focused and ICT-rich classroom learning environments.

Gender Differences

Today, problems of under-representation and under-achievement in science and mathematics education among women continue internationally (Parker, Rennie, & Fraser, 1996) and low female enrolments in physical science at the upper secondary school in Australia persist. Furthermore, both at educational institutions and at home, males are more likely than females to access online technologies and online use varies with socioeconomic status (White, 1999). The research reported in this paper investigates whether differences exist in the types of learning environments that male and female students perceive and those which they would prefer.

Information and Communications Technology (ICT) and Education

Education and training are fundamental to achieving priorities for the economy in the twenty-first century. All citizens need to be "enterprising, innovative, adaptable and socially responsible participants in the information economy" (National Office of the Information Economy, 1999, p. 11). These national views also are reflected in state curriculum frameworks (e.g., Curriculum Council, 1997). Although education has a poor history of successfully meeting the challenges of major shifts in information technology (Trinidad, 1998), there has been far too little research into the implementation and educational benefits of technology-rich school learning environments. Therefore, this study investigated how teachers and students integrate ICT effectively into the learning environment and, importantly, student outcomes directly associated with using ICT.

Student Self-Efficacy and the Learning Environment

Self-efficacy represents a core aspect of Bandura's (1997) social-cognitive theory. Self-efficacy beliefs are concerned with the judgements that people make about what they can do with their skills, rather than the skills themselves, and refer to the extent to which an individual is confident in his or her ability (Bandura, 1986). Self-efficacy differs from other expectancy constructs in as much as it is goal specific. Therefore, high self-efficacy in one setting does not guarantee high self-efficacy in another (Bandura, 1986, 1989; Pintrich & Schunk, 1995).

A student's sense of self-efficacy can influence several aspects of behaviour that are important to learning. Past research has found that high self-efficacy positively affects the behaviours of engagement, effort, persistence, goal setting and performance (Bandura, 1982, 1989; Schunk, 1989; Zimmerman, Bandura, & Martinez-Pons, 1992). That is, increased self-efficacy will often result in an increase in willingness to engage and persist in challenging tasks (Pajares, 1996). Furthermore, increased self-efficacy directly increases academic performance by increasing the quality of information processing as well as the quantity. Reviews of research indicate that high-efficacy students are more likely to use a broader array of strategies, use them more flexibly and process information at a deeper level (Pajares, 1996; Schunk, 1989).

This study was based on the premise that student self-efficacy beliefs regarding competence can have important implications for improving learning environments and, therefore, student outcomes (Lorsbach & Jinks, 1999). The present study examined students' beliefs about their academic competence and whether associations exist between students' perceptions of their competence and their perceptions of the learning environment. To do this, a scale was adapted from the *Morgan-Jinks Student Efficacy Scale* (MJSES; Jinks & Morgan, 1999).

Research Methods

Combining Quantitative and Qualitative Methods

Although the study reported in this paper is largely quantitative, it did include some important qualitative information to provide richer insights into the learning environments created at the new school. Past studies have successfully combined qualitative and quantitative research methods in studying the classroom learning environment at different 'grain sizes' (Fraser, 1999) to show how individual students and the teacher can be investigated not only at the smallest grain size, but also at the class level, school level or system level to clarify whether particular teachers or students were typical of larger groups (Aldridge, Fraser & Huang, 1999; Tobin & Fraser, 1998). Multiple research methods (e.g., surveys, interviews) and various grain sizes (student, gender group, and class; see Fraser, 1999) were used in the present study.

Sample

The sample for the quantitative data collection (learning environment and attitude) included Grade 11 students from across all learning areas at the innovative new school. The total sample available for the analyses reported in this paper consisted of 386 student responses from 33 classes.

Sevenoaks Senior College is an innovative new school located in a lower socioeconomic suburb of Perth, Western Australia. The unique ICT infrastructure built into Sevenoaks is aimed at facilitating a truly outcomes-focused curriculum that allows the integration of ICT into the delivery of programs, and it provides online curriculum and electronic information management systems to

teachers and students. Therefore, Sevenoaks is an ideal setting for this study of the educational benefits of outcomes-focused, technology-rich learning environments.

Instrument Development and Validation

A major contribution of the study was the development and validation of a widely-applicable questionnaire for assessing students' perceptions of their actual and preferred classroom learning environments in technology-rich, outcomes-focused learning settings (known as the *Technology-Rich, Outcomes-Focused Learning Environment Inventory*, TROFI). The development and validation of the questionnaire involved (1) interviews with students, teachers and ICT industry personnel to ensure that dimensions were salient (Fraser, 1994), (2) ensuring consistency with Moos' (1974) scheme for classifying the dimensions of any human environment, (3) adopting and adapting scales and items from widely-used general classroom environment questionnaires such as the What is Happening in this Class? questionnaire (Aldridge & Fraser, 2000), (4) field testing the instrument with students and interviewing them and (5) conducting various statistical analyses with data from the sample of 386 student responses (e.g., factor analysis and item analysis) to refine the scales and furnish validity and reliability information (see Fraser, 1998a).

The *What is Happening in this Class?* (WIHIC) questionnaire was drawn on especially during the development of the Technology-Rich, Outcomes-Focused Learning Environment Inventory (TROFI). The WIHIC was originally developed by Fraser, McRobbie and Fisher (1996) and attempted to incorporate those scales that previous studies had shown to be predictors of student outcomes. A personal form in conjunction with the class form was developed for the first time. The personal form uses the same scales and comparable items as the class form, but is worded to elicit the student's perception of his/her individual role within the classroom, as opposed to the student's perception of the class as a whole (Fraser, 1994, 1998a, 1998b; Fraser, Giddings & McRobbie, 1995; Fraser & McRobbie, 1995; Fraser, McRobbie & Fisher, 1996). The personal form is concordant with the constructivist theory of learning (Bruner, 1986; Tobin, 1993; von Glasersfeld, 1989). Based on the assumption that individuals construct their own meaning and knowledge of the world, rather than attaining it from external sources, the personal form enables students to provide individual interpretations of their environment. As such, the personal form is well suited for assessing the perceptions of subgroups within a class.

The robust nature of the What is Happening in this Class? (WIHIC) questionnaire, in terms of reliability and validity, has been widely reported in studies that have used the instrument in different subject areas, at different age levels and in eight different countries. Since the initial development of the WIHIC, the questionnaire has been used successfully in studies to assess the learning environment in Singapore (Chionh & Fraser, 1998; Fraser & Chionh, 2000), Australia and Taiwan (Aldridge & Fraser, 2000; Aldridge, Fraser, & Huang, 1999), Brunei (Riah & Fraser, 1998), Canada (Zandvliet & Fraser, 1998), Australia (Dorman, in press), Indonesia (Margianti, Fraser, & Aldridge, 2001), the United States (Moss & Fraser, 2001) and Canada, Britain and the US (Dorman, Adams & Ferguson, in press). Within these countries, the WIHIC has been used to assess a range of subjects including high school science (Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999; Moss & Fraser, 2001; Riah & Fraser, 1998), mathematics (Margianti, Fraser & Aldridge, 2001) and mathematics and geography (Chionh & Fraser, 1998; Fraser & Chionh, 2000). The robust nature of the WIHIC made it a sensible choice for the present study that involved a sample from a range of subjects.

Six WIHIC scales were included in the new instrument, namely, the Student Cohesiveness, Involvement, Investigation, Task Orientation, Cooperation and Equity scales. Three new scales were also developed for the purpose of this study, namely, the Differentiation, Computer Usage and Young Adult Ethos scales. These scales, which were considered especially relevant to outcomes-focused and ICT-rich learning environments, are defined later in Table 1.

To investigate students' attitudes, a second instrument was developed. The instrument consists of 18 items in three scales, namely, Attitudes Towards Subject, Attitude Towards Computer Usage and Student Academic-Efficacy. The first scale, Attitude Towards Subject, was based on a scale from the *Test of Science-Related Attitudes*(TOSRA; Fraser, 1981). The second scale was adapted from the Computer Attitude Scale (CAS) developed by Newhouse (in press). The third scale, Academic Efficacy, was modified from a scale developed by Jinks and Morgan (1999).

Associations between Students' Perceptions of the Learning Environment and Student Outcomes

A central question of the study was whether the creation of outcomes-focused and ICT-rich classroom learning environments improves student attitudes. Using data collected for the sample of 386 student responses, students' attitudes to learning and ICT and self-efficacy were investigated. Simple, multiple and canonical correlation analyses with two units of analysis (the student and the class mean) were used to estimate the strength of outcome-environment associations.

Male and Female Students' Perceptions of the Actual and Preferred Learning Environment

A further aim of the present study was to determine whether differences exist between (a) the learning environment that students perceive as being present and (b) the learning environment that they would prefer. A multivariate analysis of variance (MANOVA) was performed to investigate whether differences exist between male and female perceptions of their actual and preferred learning environments.

Findings and Results

Description of the Technology-Rich, Outcomes-Focused Learning Environment Inventory (TROFI)

The initial version of the Technology-Rich, Outcomes-Focused Learning Environment Inventory (TROFI) contained 80 items altogether with 8 items belonging to each of 10 scales. Extensive field-testing and instrument validation procedures led to a refined version of the TROFI consisting of 69 items in 9 scales. Table 1 provides each scale's classification according to Moos' (1974) scheme, scale descriptions and sample items. Items are responded to on a five-point scale with the alternatives of Almost Never, Seldom, Sometimes, Often and Almost Always. (See Appendix 1 for a copy of the TROFI used in the present study.)

All items were written to have a positive scoring direction in order to minimise confusion to students and were grouped together in scales to provide contextual cues to readers (Aldridge, Fraser, Taylor, & Chen, 2000). Historically, researchers have administered a separate actual and preferred version of questionnaires. To provide a more economical format, however, the TROFI pioneered the inclusion of two adjacent response scales on the one sheet (one to record what students perceived as actually happening in their class and the other to record what students would prefer to happen in their class).

Table 1. Descriptive Information for Each Scale in the TROFI

Scale	Moos Category	Description	Sample Item
		The extent to which …	
Student Cohesiveness	R	students know, help and are supportive of one another.	Students in this class like me.
Involvement	P	students have attentive interest, participate in discussions, do additional work and enjoy the class.	I explain my ideas to other students.
Investigation	P	emphasis is placed on the skills and processes of inquiry and their use in problem solving and investigation.	I know the goals for this class.
Task Orientation	S	it is important to complete activities planned and to stay on the subject matter.	I find out answers to questions by doing investigations.
Cooperation	R	students cooperate rather than compete with one another on learning tasks.	I work with other students on projects in this class.
Equity	R	students are treated equally by the teacher.	I am treated the same as other students in this class.
Differentiation	S	teachers cater for students differently on the basis of ability, rates of learning and interests.	I work at my own speed.
Computer Usage	S	students use their computers as a tool, to communicate with others and to access information.	I use the computer to obtain information from the Internet.
Young Adult Ethos	P	teachers give students responsibility and treat them as young adults.	I am dealt with as a grown up.

R: Relationship Dimension; P: Personal Development Dimension; S: System Maintenance and Change Dimension

Reliability and Validity of the New Learning Environment Instrument

A major contribution of the present study was the development of a widely-applicable instrument for monitoring outcomes-focused and ICT-rich classroom learning environments. Data collected from the 386 students in 33 classes were analysed in various ways to investigate the reliability and validity of the TROFI. Principal components factor analysis followed by varimax rotation confirmed a refined structure of the instrument comprising 69 items in nine scales. Nearly all items have a loading of at least 0.4 on their *a priori* scale and no other scale (see Table 2). The percentage of the total variance extracted with each factor is also recorded at the bottom of Table 1. The percentage of variance varies from 5.04 to 9.81 for different scales, with the total variance accounted for being 60.19%.

For the revised 69-item version of the TROFI, three further indices of scale reliability and validity were generated. The Cronbach alpha reliability coefficient was used as an index of scale internal consistency. Analysis of variance (ANOVA) results were used as evidence of the ability of each scale to differentiate between the perceptions of students in different classrooms. A convenient discriminant validity index (namely, the mean correlation of a scale with other scales) was used as evidence that each TROFI scale measures a separate dimension that is distinct from the other scales in this questionnaire.

Table 2. Factor Loadings for the Technology-Rich, Outcomes-Focused Learning Environment Inventory (TROFI)

Item No	Factor Loading								
	Student Cohesiveness	Involvement	Task Orientation	Investigation	Cooperation	Equity	Differentiation	Computer Usage	Young Adult Ethos
1	0.72								
2	0.59								
3	0.54								
4	0.82								
5	0.64								
6	0.47								
7	0.70								
8	0.43								

17		0.67							
18		0.75							
19		0.47							
20		0.62							
22		0.65							
23		0.54							
24		0.53							
25			0.62						
26			0.62						
27			0.61						
28			0.53						
29			0.69						
30			0.63						
31			0.52			0.42			
32			0.55						
33				0.73					
3				0.59					

4									
3 5				0.80					
3 6				0.65					
3 7				0.83					
3 8				0.71					
3 9				0.72					
4 0				0.76					
4 1					0.57				
4 2					0.64				
4 3					0.60				
4 4					0.73				
4 5					0.65				
4 6					0.65				
4 7					0.65				
4 8					0.68				
4 9						0.80			
5 0						0.73			

5 1						0.77			
5 2						0.82			
5 3						0.86			
5 4						0.80			
5 5						0.77			
5 6						0.84			
5 9							–		
6 0							0.57		
6 1							–		
6 2							0.78		
6 3							0.81		
6 4							0.76		
6 5								0.56	
6 6								0.71	
6 7								0.72	
6 8								0.75	
6								0.72	

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9									
70								0.73	
71								0.43	
72								0.57	
73									0.61
74									0.79
75									0.74
76									0.74
77									0.64
78									0.74
79									0.78
80									0.69
% Variance	6.56	5.04	5.88	7.96	6.81	9.81	4.50	6.04	7.59

Factor loadings smaller than 0.40 have been omitted.

The sample consisted of 386 students in 33 classes.

The internal consistency reliability of each scale was determined using the Cronbach alpha coefficient for two units of analysis. Table 3 reports the Cronbach alpha coefficient for the actual and preferred versions for each of the nine the nine scales for two units of analysis (individual and class mean). Using the individual as the unit of analysis, scale reliability estimates range from 0.81 to 0.96 for the actual form and from 0.88 to 0.96 for the preferred form. These internal consistency

indices are comparable to those in past studies that have used the WIHIC (Aldridge & Fraser, 2000; Fraser & Chionh, 2000).

Using the individual as the unit of analysis, the discriminant validity results (mean correlation of a scale with other scales) for the nine scales of the TROFI range from 0.20 to 0.42 for the actual form and between 0.24 and 0.54 for the preferred form. The data suggest that raw scores on the TROFI assess distinct but somewhat overlapping aspects of learning environment. However, the factor analysis supports the independence of factor scores on the nine scales.

Table 3. Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation With Other Scales) and Ability to Differentiate Between Classrooms (ANOVA Results) for Two Units of Analysis for the Modified TROFI

Scale	Unit of Analysis	No of Items	Alpha Reliability		Mean Correlation with other Scales		ANOVA Eta^2
			Actual	Preferred	Actual	Preferred	Actual
Student	Individual	8	0.87	0.92	0.33	0.46	0.14**
Cohesiveness	Class Mean		0.91	0.95	0.40	0.49	
Involvement	Individual	7	0.89	0.92	0.40	0.46	0.24**
	Class Mean		0.93	0.92	0.47	0.37	
Task	Individual	8	0.89	0.95	0.36	0.54	0.17*
Orientation	Class Mean		0.93	0.97	0.45	0.53	
Investigation	Individual	8	0.93	0.96	0.38	0.42	0.13**
	Class		0.9	0.97	0.33	0.28	

	Mean		4				
Cooperation	Individual	8	0.92	0.94	0.42	0.51	0.10
	Class Mean		0.92	0.94	0.42	0.47	
Equity	Individual	8	0.96	0.96	0.32	0.43	0.16**
	Class Mean		0.98	0.98	0.41	0.49	
Differentiation	Individual	6	0.81	0.88	0.20	0.24	0.19**
	Class Mean		0.89	0.92	0.28	0.21	
Computer	Individual	8	0.87	0.91	0.25	0.33	0.11
Usage	Class Mean		0.93	0.92	0.24	0.30	
Young Adult	Individual	8	0.92	0.94	0.34	0.43	0.11
Environment	Class Mean		0.93	0.93	0.30	0.42	

* $p<0.05$

** $p<0.01$

The sample consisted of 386 students in 33 classes.

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

An analysis of variance (ANOVA) was used to determine the ability of each TROFI scale to differentiate between the perceptions of students in different classes. The one-way ANOVA for each scale involved class membership as the independent variable and the individual student as the unit of analysis. Table 3 reports the ANOVA results showing that six of the nine TROFI scales differentiate significantly between classes ($p<0.05$), namely, Student Cohesiveness, Involvement, Task Orientation, Investigation Equity and Differentiation. Thus, students within the same class perceive the environment in a relatively similar manner, while within-class mean perceptions of the students vary between classes. The eta^2 statistic (an estimate of the strength of association

between class membership and the dependent variable) ranges from 0.10 to 0.24 for different TROFI scales.

The statistics obtained for the internal consistency (alpha reliability) and the ability of each scale to differentiate between the perceptions of the students in different classrooms (eta^2 statistic from ANOVA) are considered acceptable. The data presented in Table 3, in conjunction with the factor analysis results in Table 2, support the contention that the TROFI is a valid and reliable classroom environment instrument for the assessment of students' perceptions of their psychosocial classroom environments at the high school level. Therefore, teachers and researchers can use the TROFI with confidence in the future.

Reliability and Validity of the New Attitude Instrument

To measure students' attitudes, the present study adapted selected scales from three instruments. The three scales were Attitude Towards Subject, Attitudes Towards Computer Usage and Academic Efficacy. The original instrument consisted of 24 items, with 8 eight items in each of three scales. To ensure consistency with the learning environment scale, students responded on the same five-point rating scale of Almost Always, Often, Sometimes, Seldom and Almost Never. (See Appendix 2 for a copy of the new attitude questionnaire used in the present study.)

The data collected from 386 students in 33 classes were used to perform a principal components factor analysis followed by varimax rotation. This resulted in the acceptance of a revised version of the instrument with the three *a priori* factors, but with some items omitted. For the final version, Items 2 and 7 have a loading of more than 0.40 on the Academic Efficacy scale as well as its own scale (namely, Attitude Towards Subject). All other items loaded on their own scale and no other scale (see the factor loadings reported in Table 4). The percentage of variance varies from 13.06 to 22.83 for different scales, with the total variance accounted for being 54.40%.

The internal consistency reliability (Cronbach alpha coefficient) of each of the three scales of the attitude instrument for two units of analysis (individual and class mean) is reported in Table 5. The scale reliability estimates range from 0.70 to 0.82 using the individual as the unit of analysis and from 0.84 to 0.87 using the class mean as the unit of analysis. As a convenient index of the discriminant validity of the attitude questionnaire, use was made of the mean correlation of scale with the other scale for the three scales of the attitude instrument. The mean correlation of a scale with other scales ranged from 0.14 to 0.21 using the individual as the unit of analysis and from 0.14 to 0.27 using the class mean as the unit of analysis (see Table 5).

Table 4. Factor Loadings for the Attitude Instrument

	Factor Loading		
Item No	Attitude Towards Subject	Attitude Towards Computer Usage	Academic Efficacy
2	0.38		0.49
3	0.83		

4	0.84		
6	0.46		0.49
7	0.69		
9		0.79	
10		0.88	
11		0.31	
12		0.79	
13		0.63	
16		0.84	
17			0.75
18			0.81
19			0.67
20			0.77
21			0.71
23			0.55
24			0.61
% Variance	13.06	18.51	22.83

Factor loadings smaller than 0.40 have been omitted.

The sample consisted of 386 students in 33 classes.

Table 5. Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation With Other Scales) and Ability to Differentiate Between Classrooms (ANOVA Results) for Two Units of Analysis for the Modified TROFI

Scale	Unit of Analysis	No of Items	Alpha Reliability		Mean Correlation with other Scales
Attitude Towards Subject	Individual	5	0.79		0.14
	Class Mean		0.87		0.27
Attitude Towards Computer	Individual	6	0.70		0.21
Usage	Class Mean		0.86		0.22
Academic Efficacy	Individual	7	0.82		0.16
	Class Mean		0.84		0.14

** *p*<0.01

* *p*<0.05

The sample consisted of 386 students in 33 classes.

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

Investigating Whether Outcomes-Focused and ICT-Rich Learning Environments are Associated with Student Outcomes

To investigate associations between the outcomes of student attitudes towards their subject, student attitudes towards using the computer, and student self-efficacy and the nine classroom environment scales, simple and multiple correlation analyses were conducted. A simple correlation analysis of relationships between each attitude scale and each of nine learning environment scales was performed to provide information about the bivariate associations between each learning environment scale and each student attitude scale. A multiple correlation analysis of relationships between each attitude scale and the set of nine learning environment scales was conducted to provide a more complete picture of the joint influence of correlated environment dimensions on outcomes and to reduce the Type I error rate associated with the simple correlation analysis. To interpret which individual scales are making the largest contribution to explaining variance in student attitudes, the regression weights were examined to see which

ones were significantly greater than zero ($p<0.05$). The regression weight describes the influence of a particular environment variable on an attitudinal scale when all other environment variables in the regression analysis are mutually controlled. Table 6 shows the association between each of the student attitudes and each TROFI scale using both the individual and the class mean as the units of analysis.

Student Attitudes Towards their Subject

The results of simple correlation analysis (Table 6) indicate that all but one of the nine TROFI scales, namely, Differentiation, is statistically significantly associated with student attitudes towards their class ($p<0.05$) at the individual level of analysis. Four of the nine scales are statistically significantly ($p<0.05$) related to the Attitudes Towards Subject scale at the class mean level of analysis, namely, Task Orientation, Cooperation, Equity and Young Adult Ethos. The results of the simple correlation analysis suggest that improved student attitudes towards a subject are associated with more emphasis on these four scales.

The multiple correlation (R) between students' perceptions of the set of nine TROFI scales and the Attitude Toward Subject scale (reported in Table 6) is 0.60 at the student level of analysis and 0.77 at the class mean level of analysis, and is statistically significant ($p<0.01$) for both. This result suggests that the learning environment is positively related to the students' attitudes towards their subject. The standardised regression weight was computed to provide information about the unique contribution of each learning environment scale to the Attitude Toward Subject scale when the other eight scales were mutually controlled. Table 6 indicates that three of the nine TROFI scales uniquely account for a significant ($p<0.01$) amount of variance in student attitudes towards their subject (the Involvement, Equity and Young Adult Ethos scales) at the student level of analysis. (No TROFI scale is a significant independent predictor of Attitude Towards Subject at the class level of analysis.)

Attitudes Towards Computer Usage

With the individual as unit of analysis, the results of the simple correlation analysis (reported in Table 6) indicate that eight of the nine TROFI scales (with the exception being Differentiation) are positively and statistically significantly ($p<0.05$) related to the Attitude Towards Computer Usage scale. At the class mean level of analysis, two of the nine TROFI scales (namely, Involvement and Equity) are positively and statistically significantly ($p<0.01$) to Attitudes Towards Computer Usage. The multiple correlation is 0.35 and 0.75, respectively, for the individual and class means level of analysis and is statistically significant ($p<0.01$) for both. The standardised regression weights reported in Table 6 indicate that two of the nine TROFI scales (Differentiation, Equity and Computer Usage) are statistically significantly ($p<0.01$) and independently related to the student Attitudes Towards Computer Usage at the student level of analysis and one TROFI scale (Involvement) is statistically significantly ($p<0.05$) and positively related at the class mean level.

Table 6. Simple Correlation and Multiple Regression Analyses for Associations Between Student Attitudes, Self Efficacy and Dimensions of the TROFI

Scale		Unit of Analysis	Attitude Towards Subject			Attitude Towards Computer Usage			Student Academic Efficacy	
			r	*b*		*r*	*b*		*r*	*b*

Student	Individual	0.27*	0.01	0.14**	0.04	0.20**	0.01
Cohesiveness	Class Mean	0.18	-0.06	0.20	-0.41	0.25	-0.02
Involvement	Individual	0.37**	0.07	0.21**	0.08	0.36**	0.11
	Class Mean	0.25	-0.43	0.52**	0.61*	0.39*	-0.10
Task	Individual	0.51**	0.26**	0.17**	0.04	0.39**	0.21**
Orientation	Class Mean	0.48**	0.15	0.31	-0.26	0.24	0.30
Investigation	Individual	0.28**	0.05	0.16**	0.05	0.39**	0.12*
	Class Mean	-0.04	-0.10	0.30	0.28	0.62**	0.35
Cooperation	Individual	0.35**	0.04	0.20**	0.07	0.27**	-0.06
	Class Mean	0.47**	0.49	0.25	0.02	0.25	0.06
Equity	Individual	0.49**	0.24**	0.19**	0.08	0.30**	0.07
	Class Mean	0.64**	0.77**	0.53**	0.38	0.06	0.26
Differentiation	Individual	0.05	-0.05	-0.04	-0.19**	0.34**	0.21**
	Class Mean	-0.11	0.20	-0.33	-0.36	0.61**	0.62**
Computer	Individual	0.14**	0.03	0.22**	0.23**	0.27**	0.07
Usage	Class Mean	-0.03	0.15	-0.02	0.01	0.53**	0.05
Young Adult	Individual	0.43**	0.12*	0.18**	0.04	0.34**	0.10
Environment	Class Mean	0.42*	0.14	-0.21	0.07	0.00	0.61

Multiple	Individual		0.60**		0.35**		0.55**
Correlation (R)	Class Mean		0.77**		0.75**		0.82**

*p<0.05 **p<0.01

N= 386 Students in 33 classes.

Student Academic Efficacy

With the individual student as unit of analysis, the results of the simple correlation analysis reported in Table 6 indicate that all nine scales of the TROFI are positively and significantly (p<0.01) related to the Academic Efficacy scale. At the class mean level of analysis, four of the nine TROFI scales were positively and statistically significantly (p<0.01) to the Academic Efficacy scale (namely, Involvement, Investigation, Differentiation and Computer Usage). The multiple correlation (R) between students' perceptions of the learning environment and self-efficacy is positive and statistically significant (p<0.01). This result suggests that the learning environment is positively related to the students' academic efficacy. For the Student Academic Efficacy scale, scales that uniquely account for a significant proportion of variance are Task Orientation and Investigation (at the student level) and Differentiation (at both the student and class levels).

Do Differences Exist Between What Girls and Boys Perceive and Prefer?

This section reports the analyses conducted to investigate differences between the learning environments perceived and preferred by girls and boys. Four of the 33 classes were single-sex classes and were omitted from analyses. As boys and girls are not found in equal number in every co-educational class, the within-class gender mean was chosen as the unit of analysis. The within-class gender mean provides a matched pair of means — one within-class mean for boys and one within-class mean for girls. This reduces confounding in that, for each group of boys within a particular classroom, there is a corresponding group of girls in the same classroom. Sex differences in classroom environment were explored using a one-way MANOVA with the set of TROFI scales as the dependent variables and gender as a repeated measures independent variable. The multivariate test yielded significant results (p<0.01) in terms of Wilks' lambda criterion, indicating that there were sex differences in the set of criterion variables as a whole. Therefore, t-tests for paired samples were conducted. In order to estimate the magnitudes of the differences (in addition to their statistical significance), effect sizes were calculated as recommended by Thompson (1998a, 1998b).

Table 7. Average Item Mean, Average Item Standard Deviation and *t* Test for Paired Samples for Differences between Male and Female Students' Actual and Preferred Perceptions on the TROFI Using the Within-Class Gender Mean as the Unit of Analysis

TROFI Scale	Form	Average Item Mean		Average Item Standard Deviation		Difference

		Male	Female	Male	Female	Effect Size	*t*
Student Cohesiveness	Actual	3.80	4.02	0.35	0.48	0.52	-2.11*
	Preferred	4.04	4.34	0.36	0.49	0.71	-3.16**
Involvement	Actual	3.17	3.25	0.44	0.56	0.16	-0.63
	Preferred	3.50	3.80	0.43	0.51	0.64	-2.73**
Task Orientation	Actual	3.81	3.94	0.47	0.41	0.30	-1.28
	Preferred	4.27	4.56	0.47	0.36	0.70	-3.60**
Investigation	Actual	2.89	2.89	0.54	0.48	0.00	0.05
	Preferred	3.23	3.62	0.71	0.43	0.68	-2.74**
Cooperation	Actual	3.64	3.89	0.44	0.46	0.55	-2.20*
	Preferred	3.97	4.19	0.33	0.57	0.49	-1.98
Equity	Actual	3.84	4.26	0.62	0.40	0.74	-3.41**
	Preferred	4.07	4.57	0.50	0.41	1.10	-4.97**
Differentiation	Actual	2.93	2.79	0.50	0.61	0.25	1.12
	Preferred	3.34	3.27	0.69	0.71	0.10	0.49

Computer Usage	Actual	3.34	3.44	0.57	0.57	0.18	-0.90
	Preferred	3.66	3.90	0.66	0.53	0.40	-1.51
Young Adult Ethos	Actual	3.85	4.14	0.42	0.54	0.64	-2.26*
	Preferred	4.24	4.54	0.49	0.32	0.74	-2.59*

N= 232 male students and 138 female students in 29 classes

Differences between perceptions of the actual learning environment

The effect size for four of the nine scales (Student Cohesiveness, Cooperation, Equity and Young Adult Ethos) of the TROFI range between approximately a half of a standard deviation (0.52) and three quarters of a standard deviation (0.74). These effect sizes suggest a substantial difference between girls' and boys' perceptions of the actual learning environment. *T* tests for paired samples, using the within-class gender mean as the unit of analysis, were used to investigate whether differences in scale scores between girls and boys were statistically significant. Analyses suggest that, whilst the magnitude are small (less than three quarters of a standard deviation), girls perceive statistically significantly ($p<0.05$) more Student Cohesiveness, Cooperation, Equity and Young Adult Ethos than boys (Table 7). (These differences in the perceptions are presented graphically in Figure 1.)

Differences between perceptions of the preferred learning environment

The results indicate that girls would prefer a learning environment that includes more of eight of the nine learning environment scales than their male counterparts, who would prefer more differentiation. Effect sizes and *t* tests were calculated to investigate the differences between the preferred learning environment of girls and boys (Table 7). The effect size for six of the nine scales of the TROFI range between approximately two thirds of a standard deviation (0.64) and over one standard deviation (1.10) for class means. These effect sizes suggest a substantial difference between the learning environment preferred by girls and boys on these scales, with the exception of Cooperation, Differentiation and Computer Usage. *T* tests for paired samples, using the within-class gender mean as the unit of analysis, were used to investigate whether differences in prefer scale scores between girls and boys were statistically significant. With the exception of Differentiation, girls consistently prefer their classroom environment to include more of all scales than did boys (see Figure 1). There is a statistically significant difference ($p<0.05$) for the scales of Student Cohesiveness, Involvement, Task Orientation, Investigation, Equity and Young Adult Ethos (see Table 7).
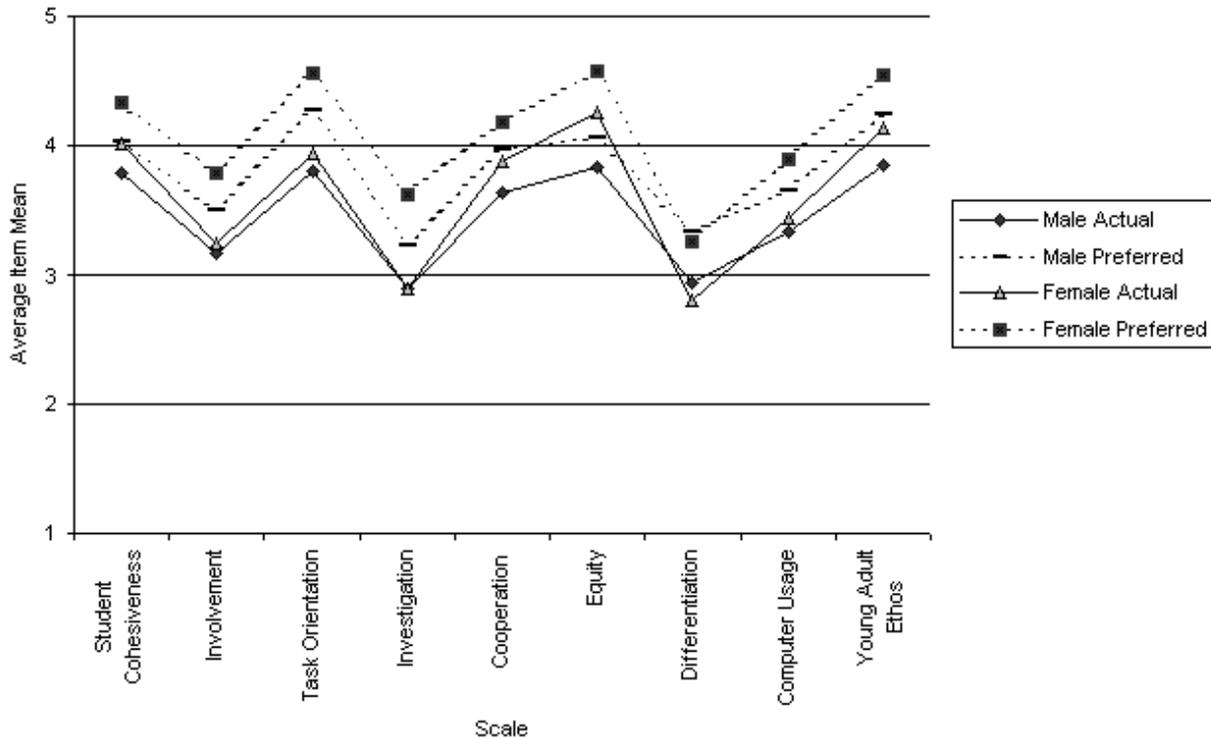
Figure 1 Average Item Mean for Male and Female Students' Actual and Preferred Perceptions on the TROFI and Attitude Instrument

Figure 1 suggests that, whilst girls and boys perceive slightly different learning environments, there is a larger gender difference in the learning environments that they would prefer on some scales.

Discussion and Conclusion

A major contribution of the present study has involved the development and validation of a widely-applicable and distinctive questionnaire for assessing students' perceptions of their actual and preferred classroom learning environments in outcomes-focused, technology-rich learning settings. This research, by examining the learning environment in an innovative new school and its impact on student attitudes towards learning and computer usage, has the potential to provide information to teachers on how ICT can be used in creating outcomes-focused education and promoting improved outcomes for all students.

The new questionnaire measures nine dimensions of the actual and preferred classroom environments at the high school level (Technology-Rich, Outcomes-Focused Learning Environment Inventory, TROFI). The questionnaire includes a novel structure that incorporates the actual and preferred responses on the same form, providing an economical format that reduces the administration time. The questionnaire has 69 items in nine scales and takes around 30 minutes to administer.

In work still in progress, the TROFI has been found to be valid and reliable at the high school level across a number of different subjects and learning areas. A series of item and factor analyses led to a refined version of the TROFI that displays satisfactory factorial validity. At both the individual and class mean levels of analysis, the internal consistency reliability and discriminant validity are satisfactory for both the actual and preferred responses to the TROFI. Further analyses support the ability of the actual responses to differentiate between classrooms on most scales. These results support the reliability and validity of the TROFI and, therefore, teachers and researchers can use it with confidence in the future.

An attitude instrument was also developed for the present study. The three scales that each examines an important affective outcome of this technology-rich, outcomes-focused school are Attitude Towards Subject, Attitude Towards Computer Usage and Academic Efficacy. Satisfactory factorial validity, internal consistency and discriminant validity were supported for the new instrument for both the individual and class mean as the units of analysis.

To explore the usefulness of the TROFI, data were analysed to examine two separate applications. The first involved an investigation of whether associations exist between the classroom learning environment and three affective outcomes (student attitude towards their subject, student attitude towards computer usage and student academic efficacy). The results suggest that improved student attitude towards their subject are associated with more emphasis on Involvement, Equity and Young Adult Ethos

The second application involved an investigation of the differences between girls and boys in their perceptions of the actual and preferred learning environment. Following the use of MANOVA, t tests for paired samples, using the within-class gender mean as the unit of analysis, were used to investigate whether boys and girls have different perceptions. Whilst the magnitudes are small (less than three quarters of a standard deviation) girls perceive statistically significantly more Student Cohesiveness, Cooperation, Equity and Young Adult Ethos than boys.

Interestingly, the results also suggest that girls would prefer a different learning environment to that which boys would prefer. It would appear that girls prefer a learning environment in which there is more student cohesiveness and involvement, Overall, the results suggest that the classroom environment is perceived more favourably by girls than by boys, thus supporting earlier studies in which high school boys and girls differ in their perceptions of their classroom learning environment (Fisher, Henderson, & Fraser, 1997; Henderson, Fisher, & Fraser, 2000; Wong & Fraser, 1996).

Since the school opened recently, teachers have begun to introduce and integrate ICT into all facets of their work, thus generating a wealth of knowledge that is directly transferable to other schools. This paper is significant because the study could have important implications for educational systems concerning how ICT can be used effectively to maximise educational outcomes for individual students. The study is innovative within the field of learning environments because of its focus on outcomes-based and technology-rich settings at an innovative new school.

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Technology-Rich, Outcomes-Focused Learning Environment Inventory (TROFI)

Directions for Students

These questionnaires contain statements about practices that could take place in your class. You will be asked how often each practice takes place. The 'Actual' column is to be used to describe how often each practice actually takes place in this class. The 'Preferred' column is to be used to describe how often you would like each practice to take place (a wish list).

There are no 'right' or 'wrong' answers. Your opinion is what is wanted. Your responses will be confidential.

	Student Cohesiveness	ACTUAL					PREFERRED				
		Almost Never	Seldom	Sometimes	Often	Almost Always	Almost Never	Seldom	Sometimes	Often	Almost Always
1.	I make friends among students in this class.	1	2	3	4	5	1	2	3	4	5
2.	I know other students in this class.	1	2	3	4	5	1	2	3	4	5
3.	I am friendly to members of this class.	1	2	3	4	5	1	2	3	4	5
4.	Members of the class are my friends.	1	2	3	4	5	1	2	3	4	5
5.	I work well with other class members.	1	2	3	4	5	1	2	3	4	5
6.	I help other class members who are having trouble with their work.	1	2	3	4	5	1	2	3	4	5
7.	Students in this class like me.	1	2	3	4	5	1	2	3	4	5
8.	In this class, I get help from other students.	1	2	3	4	5	1	2	3	4	5

	Teacher Support	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
9.	The teacher takes a personal interest in me.	1	2	3	4	5	1	2	3	4	5
10.	The teacher goes out of his/her way to help me.	1	2	3	4	5	1	2	3	4	5
11.	The teacher considers my feelings.	1	2	3	4	5	1	2	3	4	5
12.	The teacher helps me when I have trouble with the work.	1	2	3	4	5	1	2	3	4	5
13.	The teacher talks with me.	1	2	3	4	5	1	2	3	4	5
14.	The teacher is interested in my problems.	1	2	3	4	5	1	2	3	4	5
15.	The teacher moves about the class to talk with me.	1	2	3	4	5	1	2	3	4	5

16.	The teacher's questions help me to understand.	1	2	3	4	5	1	2	3	4	5
	Involvement	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
17.	I discuss ideas in class.	1	2	3	4	5	1	2	3	4	5
18.	I give my opinions during class discussions.	1	2	3	4	5	1	2	3	4	5
19.	The teacher asks me questions.	1	2	3	4	5	1	2	3	4	5
20.	My ideas and suggestions are used during classroom discussions.	1	2	3	4	5	1	2	3	4	5
21.	I ask the teacher questions.	1	2	3	4	5	1	2	3	4	5
22.	I explain my ideas to other students.	1	2	3	4	5	1	2	3	4	5
23.	Students discuss with me how to go about	1	2	3	4	5	1	2	3	4	5

	solving problems.									
24.	I am asked to explain how I solve problems.	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
	Task Orientation	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
25.	Getting a certain amount of work done is important to me.	1	2	3	4	5	1	2	3	4	5
26.	I do as much as I set out to do.	1	2	3	4	5	1	2	3	4	5
27.	I know the goals for this class.	1	2	3	4	5	1	2	3	4	5
28.	I am ready to start this class on time.	1	2	3	4	5	1	2	3	4	5
29.	I know what I am trying to accomplish in this class.	1	2	3	4	5	1	2	3	4	5
30.	I pay attention during this class.	1	2	3	4	5	1	2	3	4	5

3 1.	I try to understand the work in this class.	1	2	3	4	5	1	2	3	4	5
3 2.	I know how much work I have to do.	1	2	3	4	5	1	2	3	4	5
	Investigation	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
3 3.	I carry out investigations to test my ideas.	1	2	3	4	5	1	2	3	4	5
3 4.	I am asked to think about the evidence for statements.	1	2	3	4	5	1	2	3	4	5
3 5.	I carry out investigations to answer questions coming from discussions.	1	2	3	4	5	1	2	3	4	5
3 6.	I explain the meaning of statements, diagrams and graphs.	1	2	3	4	5	1	2	3	4	5
3 7.	I carry out investigati	1	2	3	4	5	1	2	3	4	5

		Almost Never	Seldom	Sometimes	Often	Almost Always	Almost Never	Seldom	Sometimes	Often	Almost Always
	ons to answer questions that puzzle me.										
38.	I carry out investigations to answer the teacher's questions.	1	2	3	4	5	1	2	3	4	5
39.	I find out answers to questions by doing investigations.	1	2	3	4	5	1	2	3	4	5
40.	I solve problems by using information obtained from my own investigations.	1	2	3	4	5	1	2	3	4	5
	Cooperation	Almost Never	Seldom	Sometimes	Often	Almost Always	Almost Never	Seldom	Sometimes	Often	Almost Always
41.	I cooperate with other students when doing assignment work.	1	2	3	4	5	1	2	3	4	5
42.	I share my books and resources with other students when doing assignmen	1	2	3	4	5	1	2	3	4	5

	ts.									
43.	When I work in groups in this class, there is teamwork.	1	2	3	4	5	1	2	3	4	5
44.	I work with other students on projects in this class.	1	2	3	4	5	1	2	3	4	5
45.	I learn from other students in this class.	1	2	3	4	5	1	2	3	4	5
46.	I work with other students in this class.	1	2	3	4	5	1	2	3	4	5
47.	I cooperate with other students on class activities.	1	2	3	4	5	1	2	3	4	5
48.	Students work with me to achieve class goals.	1	2	3	4	5	1	2	3	4	5

		ACTUAL					PREFERRED				
	Equity	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
4	The	1	2	3	4	5	1	2	3	4	5

9.	teacher gives as much attention to my questions as to other students' questions.									
50.	I get the same amount of help from the teacher as do other students.	1	2	3	4	5	1	2	3	4	5
51.	I have the same amount of say in this class as other students.	1	2	3	4	5	1	2	3	4	5
52.	I am treated the same as other students in this class.	1	2	3	4	5	1	2	3	4	5
53.	I receive the same encouragement from the teacher as other students do.	1	2	3	4	5	1	2	3	4	5
54.	I get the same opportunity to contribute to class discussions as other students.	1	2	3	4	5	1	2	3	4	5

55.	My work receives as much praise as other students' work.	1	2	3	4	5	1	2	3	4	5
56.	I get the same opportunity to answer questions as other students.	1	2	3	4	5	1	2	3	4	5
	Differentiation	Almost Never	Seldom	Sometimes	Often	Almost Always	Almost Never	Seldom	Sometimes	Often	Almost Always
57.	I work at my own speed.	1	2	3	4	5	1	2	3	4	5
58.	Students who work faster than me move on to the next topic.	1	2	3	4	5	1	2	3	4	5
59.	I am given a choice of topics.	1	2	3	4	5	1	2	3	4	5
60.	I am set tasks that are different from other students' tasks.	1	2	3	4	5	1	2	3	4	5
61.	I am given work that suits my ability.	1	2	3	4	5	1	2	3	4	5
62.	I use different	1	2	3	4	5	1	2	3	4	5

		Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
	materials from those used by other students										
63.	I use different assessment methods from other students.	1	2	3	4	5	1	2	3	4	5
64.	I do work that is different from other students' work.	1	2	3	4	5	1	2	3	4	5
	Computer Usage	Almost Never	Seldom	Some times	Often	Almost Always	Almost Never	Seldom	Some times	Often	Almost Always
65.	I use the computer to type my assignments.	1	2	3	4	5	1	2	3	4	5
66.	I use the computer to email assignments to my teacher.	1	2	3	4	5	1	2	3	4	5
67.	I use the computer to ask the teacher questions.	1	2	3	4	5	1	2	3	4	5
68.	I use the computer to find out information about the course.	1	2	3	4	5	1	2	3	4	5

69.	I use the computer to read lesson notes prepared by the teacher.	1	2	3	4	5	1	2	3	4	5
71.	I use the computer to find out information about how my work will be assessed.	1	2	3	4	5	1	2	3	4	5
72.	I use the computer to take part in on-line discussions with other students.	1	2	3	4	5	1	2	3	4	5
73.	I use the computer to obtain information from the Internet.	1	2	3	4	5	1	2	3	4	5
	Young Adult Ethos	Almost Never	Seldom	Sometimes	Often	Almost Always	Almost Never	Seldom	Sometimes	Often	Almost Always
74.	I am treated like a young adult.	1	2	3	4	5	1	2	3	4	5
75.	I am given responsibility.	1	2	3	4	5	1	2	3	4	5
76.	I am expected to think for myself.	1	2	3	4	5	1	2	3	4	5

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77.	I am dealt with as a grown up.	1	2	3	4	5	1	2	3	4	5
78.	I am regarded as reliable.	1	2	3	4	5	1	2	3	4	5
79.	I am considered mature.	1	2	3	4	5	1	2	3	4	5
80.	I am given the opportunity to be independent.	1	2	3	4	5	1	2	3	4	5
81.	I am encouraged to take control of my own learning.	1	2	3	4	5	1	2	3	4	5

Attitude and Efficacy Questionnaire

	Attitude Towards Subject	Almost Never	Seldom	Some times	Often	Almost Always
1.	I look forward to lessons in this subject.	1	2	3	4	5
2.	Lessons in this subject are fun.	1	2	3	4	5
3.	I dislike lessons in this subject.	1	2	3	4	5
4.	Lessons in this subject bore me.	1	2	3	4	5
5.	This subject is one of the most interesting school subjects.	1	2	3	4	5
6.	I enjoy lessons in this subject.	1	2	3	4	5
7.	Lessons in this subject are a waste of time.	1	2	3	4	5
8.	These lessons make me interested in this subject.	1	2	3	4	5

	Attitude Towards Computer Usage	Almost Never	Seldom	Some times	Often	Almost Always
9.	I'm good with computers.	1	2	3	4	5
10.	I like working with computers.	1	2	3	4	5
11.	Working with computers makes me nervous.	1	2	3	4	5
12.	I am comfortable trying new software on the computer.	1	2	3	4	5
13.	Working with computers is stimulating.	1	2	3	4	5
14.	I get a sinking feeling when I think of using a computer.	1	2	3	4	5
15.	I do as little work as possible using a computer.	1	2	3	4	5
16.	I feel comfortable using a computer.	1	2	3	4	5
	Academic Efficacy	Almost Never	Seldom	Some times	Often	Almost Always
17.	I find it easy to get good grades in this subject.	1	2	3	4	5
18.	I am good at this subject.	1	2	3	4	5
19.	My friends ask me for help in this subject.	1	2	3	4	5
20.	I find this subject easy.	1	2	3	4	5
21.	I outdo most of my classmates in this subject.	1	2	3	4	5
22.	I have to work hard to pass this subject.	1	2	3	4	5
23.	I am an intelligent student.	1	2	3	4	5
24.	I help my friends with their homework in this subject.	1	2	3	4	5