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EXPLORATORY AND CONFIRMATORY FACTOR ANALYSIS OF THE SCHOOL LEVEL ENVIRONMENT QUESTIONNAIRE (SLEQ)

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ABSTRACT. The purpose of the present study was to validate an existing school environment instrument, the School Level Environment Questionnaire (SLEQ). The SLEQ consists of 56 items, with seven items in each of eight scales. One thousand, one hundred and six (1106) teachers in 59 elementary schools in a southwestern USA public school district completed the instrument. An exploratory factor analysis was undertaken for a random sample of half of the completed surveys. Using principal axis factoring with oblique rotation, this analysis suggested that 13 items should be dropped and that the remaining 43 items could best be represented by seven rather than eight factors. A confirmatory factor analysis was run with the other half of the original sample using structural equation modeling. Examination of the fit indices indicated that the model came close to fitting the data, with goodness-of-fit (GOF) coefficients just below recommended levels. A second model was then run with two of the seven factors, with their associated items removed. That left five factors with 35 items. Model fit was improved. A third model was tried, using the same five factors with 35 items but with correlated residuals between some of the items within a factor. This model seemed to fit the data well, with GOF coefficients in recommended ranges. These results led to a refined, more parsimonious version of the SLEQ that was then used in a larger study. Future research is needed to see if this model would fit other samples in different elementary schools and in secondary schools both in the USA and in other countries.

KEY WORDS: confirmatory factor analysis, exploratory factor analysis, school climate, structural equation modeling

1. Introduction

The purpose of the present study was to validate an existing school environment instrument, the School Level Environment Questionnaire (SLEQ). As part of a larger study of the relationships between student achievement and teachers' perceptions of school climate, (Johnson, 1998), the SLEQ was completed by 1106 teachers in 59 elementary schools in a southwestern USA public school district. Exploratory and confirmatory factor analyses suggested the use of a shortened version of the SLEQ with a different arrangement of factors.

First reported in 1982 (Burden & Fraser, 1994; Fraser & Rentoul, 1982), the SLEQ has been used in several studies in Australian schools. Cresswell

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and Fisher (1998) used the SLEQ in a study comparing principals' and teachers' perceptions of school environment. Fisher and Fraser (1990) helped classroom teachers to identify and work to change elements of their school's climate. Fisher, Grady, and Fraser (1995) and Fraser, Williamson, and Tobin (1987) investigated the relationships between teachers' perceptions of school climate and their students' perceptions of classroom environment. The relationship between school climate and changes in beginning teachers' attitudes toward individualization was explored by Rentoul and Fraser (1983). Johnson and Templeton (1999) reported the first use of the SLEQ in schools in the USA as part of an effort to help teachers to identify and select aspects of school climate that they worked to improve.

Rentoul and Fraser (1983) described the process used to develop the SLEQ. Existing school environment instruments were reviewed and problems were identified. First, some of the instruments were developed without a great deal of awareness of relevant literature on school environments. Second, some were developed without checking the applicability and importance of the dimensions to classroom teachers. Third, some were designed for non-school environments and contain items that are not relevant to schools and teachers. Fourth, many instruments combined school-level and classroom-level environments. Finally, some of the instruments required too much time for teachers to answer or for researchers to analyze. Based on these findings, a set of six criteria were followed in constructing the SLEQ – consistency with the literature, coverage of Moos's (1974) general categories of human environments, salience to practicing teachers, specific relevance to schools, minimal overlap with classroom environment instruments, and economy.

After writing an initial pool of items, Rentoul and Fraser solicited the reactions of teachers and researchers. Items were refined, and the instrument was given to a sample of 83 teachers in Sydney. Items were removed if they had a low correlation with their own scale or a lower correlation with their own scale than with any other scale in the SLEQ.

The eight scales were chosen based on Moos's three general dimensions for all human environments: relationship dimensions; personal development dimensions; and system maintenance and system change dimensions (Rentoul & Fraser, 1983). After initial testing, one of the original scales (Achievement Orientation) was dropped while another scale (Work Pressure) was added. In addition, two scales had name changes: Formalization was changed to Staff Freedom, and Centralization was changed to Participatory Decision Making. The resulting instrument consists of a total of 56 items, with seven items in each of eight scales – Student Support, Affiliation, Professional Interest, Staff Freedom, Participatory Decision

Making, Innovation, Resource Adequacy, and Work Pressure (Fraser, 1994; see the Appendix).

Fisher and Fraser (1990, 1991) reported alpha reliability (internal consistency) coefficients for the SLEQ for three different Australian samples. The first sample included 83 teachers at 19 elementary and secondary schools in Sydney, the second had 34 teachers from 34 different high schools in New South Wales, and the third was made up of 109 teachers in ten elementary and secondary schools in Tasmania. Fraser et al. (1987) reported alpha coefficients for a fourth sample of 106 teachers at two alternative high schools in Western Australia. In general, most of the internal consistency coefficients ranged from 0.70–0.87. Some of the coefficients, though, were low. For three of the four samples, the coefficients for Staff Freedom were below 0.70 (0.64, 0.64, and 0.68). In addition, the coefficients for Innovation (0.68) and Participatory Decision Making (0.69) were below 0.70 for one sample, and Resource Adequacy (0.65 and 0.68) had coefficients below 0.70 for two samples. There have also been no published reports of reliability checks with samples outside of Australia.

Fisher and Fraser (1990, 1991) and Fraser et al. (1987) provide information on discriminant validity for the same four samples mentioned above in the discussion of internal consistency. Coefficients were given that represent the mean correlation of each scale with all of the other scales. If the items in each scale represent a different construct than do the items in the other scales, then the coefficients should be low. The discriminant validity coefficients ranged from 0.10–0.42. Fisher and Fraser concluded that the coefficients were satisfactory and indicated that the SLEQ scales measure different but somewhat overlapping parts of the overall construct of school environment.

Fisher and Fraser (1990, 1991) also reported results for a sample of Tasmanian teachers indicating that the SLEQ was able to discriminate between teachers at different schools. A one-way analysis of variance (ANOVA) revealed that each scale differentiated significantly between schools. Teachers in different schools perceived their schools' climates differently. The proportion of variance attributable to school membership ranged from 0.16–0.40 for the different scales. This is an important piece of information to consider when looking at the instrument's construct validity. If the SLEQ is meant to measure school environment, then it must be able to find differences between schools.

While the SLEQ was carefully developed in many respects, there have been no published factor analysis results. The eight-scale structure must therefore be considered tentative. The previously-published internal consistency coefficients seem to support the use of the eight factors, but there

are problems with that technique. Coefficient alpha is sensitive to the number of items. A large number of items in a factor will almost always result in a large alpha value (Pedhazur & Schmelkin, 1991, pp. 94 & 101). The SLEQ was developed with eight scales (factors) in mind, but are there really eight factors? Factor analysis, not sensitive to number of items in a factor, could provide evidence to help answer that question. Exploratory factor analysis can be used to see what factors emerge from actual data while confirmatory factor analysis can be used to determine if the factors hold up (Pedhazur & Schmelkin, 1991, pp. 67–71).

2. Methods and Procedures

2.1. *Sample*

The sample consisted of teachers in elementary schools in a southwestern USA public school district. As part of a larger survey, the Teacher Preparation and Professional Development Survey (Stevens, KcKernan, Smith & Winograd, 1998), the SLEQ was distributed to all 5227 teachers at the 113 district high schools, middle schools, and elementary schools. Only completed surveys from teachers in elementary schools were included in this study.

Total district student enrollment for the 1997/1998 school year was 87,003 students. There were 78 elementary schools with 41,627 students. Overall, 46.8% of students were Hispanic, 42.8% were Anglo, 4.0% were Native American, 3.7% were African American, 1.8% were Asian American, and 0.9% were other ethnicity. There was a total of 16,577 students (19.1%) classified as Limited English Proficient (LEP).

The 78 elementary schools in the school district employed a total of 2685 teachers. Ethnicity of the elementary teachers was 68% Anglo, 28% Hispanic, 1.6% Native American, 1.3% African American, 0.4% Asian American, and 0.9% other ethnicity. The highest education degree received was BA for 51% of the sample, MA (48.3%), and PhD (0.6%). Females made up the majority of teachers (88.4%). About 22% of the elementary teachers had 5 or fewer years of teaching experience, 22% had 6–10 years, 18% had 11–15 years, and 38% had over 15 years experience. All teachers at each of the 78 elementary schools were invited to participate. Completed, usable surveys were received from 1237 out of 2658 elementary teachers in the 78 schools, with an overall response rate of 46.5%. Participation rates for individual schools, however, varied greatly. No surveys were received from any teachers at one school, while three schools had a 100% participation rate.

Three elementary schools were excluded from the study because they were new schools, and there were no data available for other variables in the study. Sixteen additional schools were excluded because of low teacher participation rates; each had fewer than nine teachers who completed surveys. Of the original 78 schools, 59 were used in this study. There were 1115 surveys from the 59 participating schools and 122 from the 19 nonparticipating schools. Nine surveys had missing responses for more than 20% of the items (12 items) or for more than two of the seven items from one or more of the eight school climate scales. These were eliminated from the study. Remaining were 1106 completed surveys from 2135 total teachers in the 59 participating schools, and this represents a return rate of 51.8%.

2.2. *Data Analysis*

In order to determine the best factor structure to represent the SLEQ, both an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) were performed. The sample of 1106 elementary teacher surveys was randomly split in half. The first half of the sample was used for the exploratory factor analysis while the second half was used for the confirmatory factor analysis (Bandalos, 1993; Cudeck & Browne, 1983; MacCallum, Roznowski, Mar & Reith, 1994).

Exploratory factor analysis was used in the present study to investigate the factor structure of the SLEQ by analyzing the relationships between items using the first half of the sample. Principal axis factoring and oblimin rotation were used. These methods were chosen because an underlying theoretical structure was hypothesized and because it was assumed that the dimensions or factors describing the structure might be intercorrelated.

For factor extraction, a decision about the number of factors to retain was based initially on eigenvalues, keeping any factor with an eigenvalue of 1.0 or higher. A scree plot was also examined, looking for a change in the slope of the line connecting the eigenvalues of the factors. The next step was to rotate the factors. In the present study, an oblique rotation (oblimin) was used because the factors were assumed to be related. Finally, an examination of items that loaded strongly on each factor was made to see if the items actually fit together.

Confirmatory factor analysis was used to determine whether the factor structure obtained using exploratory factor analysis could be confirmed on the second half of the sample. Structural equation modeling methods (Arbuckle, 1997) were used to estimate the factor model (see Figure 1). All tested models used maximum likelihood estimation. Model goodness of fit (GOF) was evaluated using seven indices: Chi-square, Chi-square/

df ratio, Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), and the Tucker-Lewis index (TLI). GFI, AGFI, TLI, CFI values usually range from 0 to 1.0, and values of 0.90 or greater are considered to be evidence of good model fit (Schumacker & Lomax, 1996, pp. 125–127). RMSEA values of less than 0.06 indicate good model fit (Hu & Bentler, 1999; Schumacker & Lomax, 1996, p. 121). All of the GOF measures mentioned above were used in this study. In addition, the TLI was also calculated with a one-factor model as a plausible, nested alternative (Schumacker & Lomax, 1996, p. 127). When models are fully nested, meaning that models are subsets of each other, the Chi-square difference test can be used. The difference between the Chi-square of the two models is evaluated as a Chi-square statistic using degrees of freedom that are the difference between the degrees of freedom in the two models (Bollen, 1989).

3. Results

3.1. *Data Screening and Preparation*

Teachers sent completed surveys to the district research office. After screening, there were 1237 cases. As mentioned earlier, 19 schools (122 cases) were eliminated from the study so that 1115 cases remained. Another nine cases were missing responses on over 20% of the items and were eliminated, leaving 1106 cases in the data set that was used in the study.

Responses were scored for the 56 SLEQ and four general satisfaction items. The responses were on a five-item Likert-type scale. The 29 positively-worded items were scored as 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. The 27 negatively-worded items were scored in reverse with 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree.

The 1106 cases were randomly split into two groups of 553 each, one for the exploratory factor analysis and one for the confirmatory factor analysis.

3.2. *Exploratory Factor Analysis*

The purpose of the exploratory factor analysis was to investigate the factors underlying the SLEQ. A principal axis factoring analysis with oblimin rotation was run using SPSS 6.1.3 (Norusis, 1993). Cases with missing items had the item mean substituted. The means and standard deviations for each of the items are available on a web site.[1]

Thirteen factors with eigenvalues over 1.0 were extracted, accounting for 58.9% of the variance. After oblimin rotation, three of these factors had only two items with loadings above 0.30, and two factors had no items loading above that level. Another factor had only three items with substantial loadings and two of those items had split loadings on another factor as well. An examination of the scree plot indicated that the biggest change in slope came after four or five factors.

For these reasons, the 13-factor solution did not appear to be the best representation of the structure of the SLEQ. Eight additional exploratory analyses were run setting different numbers of factor constraints, starting with three and going up to ten. All of these analyses were done using principal axis factoring with oblimin rotation. Oblimin rotation was maintained because in the first analysis several of the factors showed correlations above 0.20, large enough to justify use of an oblique rotation. After each analysis, the rotated factor loadings for each item were examined. Items were eliminated if they didn't have a loading of at least 0.30, a commonly used cutoff, with any one factor. Some items had substantial loadings on more than one factor. These were examined to see if it made sense to retain the item in both factors. In some cases it did, and so they were retained; in other cases it made no sense, and so the item was eliminated.

Both the three- and four-factor solutions had problems. In both cases, two factors had a division of items within the factor. The division was apparent because the loadings were positive for one group of items and were negative for the other group of items, or because one group of items had high loadings on only that factor while the other group had lower loadings on that factor and substantial loadings on another factor. An examination of the items themselves also revealed that they did not fit together very well. These were indications that there were more than three or four factors.

The eight-, nine-, and ten-factor solutions also had problems. The eight-factor solution had one factor with only three items, two of which had loadings almost as high on another factor. Eliminating that factor left seven factors. The nine-factor solution had the same problem, and the ten-factor solution had one factor with only one item and another factor with two items, one loading positively and the other negatively.

The solutions with five, six, and seven factors were most interpretable. Examination of the item loadings, of items with substantial loadings on more than one factor, and of the actual wording of items that ended up being grouped together led to the determination that the seven-factor solution was the best (see Table I). In the seven-factor solution, one of the original SLEQ factors, Professional Interest, was eliminated. Three of its items loaded well

TABLE I

Item Communality and Final Exploratory Factor Analysis Results

Item	Communality	Factor loading						
		Affiliation	Work pressure	Student support	Resource adequacy	Staff freedom	Participatory decision making	Innovation
18	0.552	0.71						
2	0.504	0.70						
34	0.536	0.67						
42	0.515	0.65						
10	0.494	0.65						
50	0.401	0.64						
26	0.425	0.57						
11	0.430	0.56						
43	0.549	0.53						0.31
3	0.392	0.47						
35	0.341	0.36						
56	0.469		0.69					
16	0.450		0.67					
32	0.345		0.54					
40	0.247		0.45					
48	0.264		0.39					
8	0.207		0.34					
24	0.236		0.33					
52	0.131							
41	0.620			0.77				
33	0.569			0.72				
17	0.552			0.70				
25	0.512			0.70				
9	0.488			0.66				
1	0.486			0.61				
49	0.447			0.54				
23	0.530				0.74			
55	0.516				0.71			

TABLE I (Continued)

Item Communality and Final Exploratory Factor Analysis Results

Item	Communality	Factor loading						
		Affiliation	Work pressure	Student support	Resource adequacy	Staff freedom	Participatory decision making	Innovation
7	0.346				0.58			
39	0.311				0.51			
31	0.209				0.38			
15	0.109							
47	0.160							
36	0.302					0.55		
45	0.454					0.44	0.43	
37	0.417					0.43	0.40	
20	0.206					0.40		
44	0.180					0.35		
28	0.124					0.32		
12	0.156					0.31		
4	0.125							
5	0.478						0.66	
53	0.542						0.65	
29	0.484						0.57	
6	0.581						0.54	
13	0.372						0.48	
21	0.444					0.42	0.44	
14	0.434						0.37	0.35
19	0.237							
54	0.544							0.65
46	0.395							0.57
51	0.593	0.45						0.47
38	0.345							0.40
27	0.394	0.35						0.40
30	0.264							0.39
22	0.382							0.38

Loadings less than 0.30 omitted.

on the Affiliation factor. The items, "Teachers frequently discuss teaching methods with each other", "Teachers avoid talking with each other about teaching and learning", and "Teachers are keen to learn from their colleagues", appeared to tell more about how close teachers felt to the other teachers in their school than about how much professional interest there was in each other's work. Four other Professional Interest items didn't load substantially on any factor and were dropped from the analysis. The Professional Interest factor was the first to be eliminated in other factor solutions as well.

Of the original 56 items in the SLEQ, 43 were retained in the seven-factor solution. Of the 13 items eliminated, five items did not load substantially on any of the remaining seven factors while the other eight items had only marginal loadings on factors and were also identified as weak items by their low internal consistency (alpha reliability) coefficients. In comparison to the eight-factor SLEQ, all seven of the original Student Support items were retained. Affiliation consisted of its seven original items as well as the three mentioned earlier that were originally part of Professional Interest, giving it a total of ten items. Four of the seven original Staff Freedom items were retained, and two were added from Participatory Decision Making, both of which loaded substantially on both factors. The other three original Staff Freedom items were eliminated. Five of the seven original Participatory Decision Making items were kept. In addition, one item from Innovation, "It is very difficult to change anything in this school", which appeared to be a better measure of how decisions were made than about how much innovation was taking place, was added. The Participatory Decision Making factor also had substantial loadings from the two items mentioned under Staff Freedom. Five of the Innovation factor's original seven items were retained. One of those items, "Teachers show considerable interest in the professional activities of their colleagues", had a substantial loading on Affiliation as well. Five of the seven original Resource Adequacy items were kept; the other two were eliminated for poor loadings. Four of the Work Pressure factor's original seven items were retained, with the other three being eliminated. Table I shows the item communalities and factor loadings.

3.3. *Confirmatory Factor Analysis*

Confirmatory factor analysis was performed to test the seven-factor solution developed using the exploratory factor analysis with the first half of the sample on the cross-validation sample. Using the second half of the data set, with 553 cases, correlations among the 43 remaining SLEQ items were calculated. Listwise deletion of cases with missing data was used.

There were 517 cases with no missing values on the 43 items. Standard deviations for each of the 43 items were also calculated.

A structural equation model (shown in Figure 1) was tested using AMOS 4.0. The seven latent variables were the seven factors identified by the exploratory factor analysis. The 43 observed variables were the actual items. Parameters led to each item from the factor or factors hypothesized to represent that item. Parameters also led from an overall latent factor, school climate, to each of the seven factors. The resulting goodness-of-fit indices, shown in the first column of Table II, provided mixed results. Chi-square was statistically significant, and the Chi-square/*df* ratio was more than 2.0, indicating that the model did not fit the data well. GFI, AGFI, CFI, and TLI (null) were less than the recommended value of 0.90. However, the RMSEA of 0.05 indicated good model fit.

Examination of the coefficients in the model revealed that the parameters from all seven factors to each of their items were all significant, indicating that the items did indeed relate to those factors. Two of the seven factors, however, had nonsignificant parameters from school climate. Staff Freedom and Work Pressure appeared from this model to be measured well by their items but did not fit well with the other five factors in an overall school climate model.

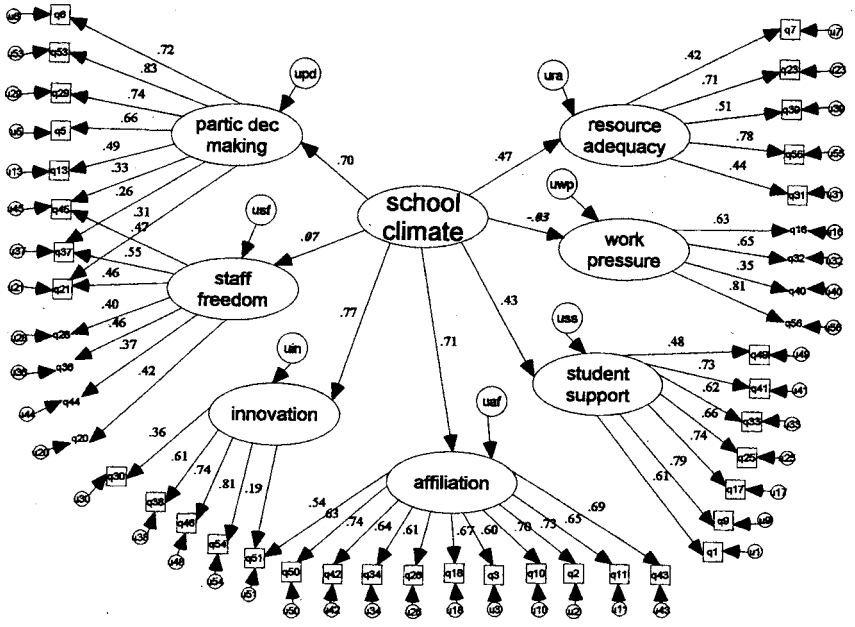

Figure 1. The seven-factor, 43-item exploratory factor analysis model.
Note. Bold/italics coefficients are not statistically significant ($p > 0.05$).

TABLE II

Fit Indices for Confirmatory Factor Analysis Models

Index	CFA Model			
	7-factor	5-factor	5-factor w/mods	1-factor
Chi-square	1972.64	1600.67	897.88	3813.02
df	849	554	526	560
probability	0.000	0.000	0.000	0.000
chi-sq/*df* ratio	2.32	2.89	1.71	6.81
GFI	0.84	0.84	0.91	0.62
AGFI	0.82	0.82	0.89	0.58
CFI	0.85	0.85	0.95	0.52
RMSEA	0.05	0.06	0.04	0.11
TLI (null)	0.84	0.83	0.94	0.49
TLI (1 factor)[a]	0.77	0.67	0.88	–
Sig. residuals	14%	12%	7%	21%

[a]The seven-factor model was compared to a 43-item, one-factor model as the baseline. The five-factor models were compared with the 35-item, one-factor model as the baseline.

A second model was then run with Staff Freedom and Work Pressure eliminated from the construct of school climate. That left five factors with 35 items. Comparisons of Chi-square/*df* ratio, GFI, AGFI, CFI, and RMSEA (see Table II) showed that the five-factor model was very comparable to the seven-factor model, with no substantial changes in GOF measures. As there was still room for improvement, an examination of the modification indices was made. Using such indices to revise a model must be done cautiously (Loehlin, 1992, pp. 189–191), only making changes that make sense in the model. In this case, the modification indices suggested that there were relationships among some of the residuals between items within factors. Because residuals represent influences that are not included in the model, it is plausible that items within a factor are influenced in similar ways. Correlations between some of the residuals within a scale were made (see Figure 2) which improved fit in the five-factor model. A one-factor model with 35 items was also run, allowing a plausible, nested model for comparison.

The modified five-factor model, with 35 items arranged in five factors, clearly fits the data best. It had the best values for Chi-square/*df* ratio, GFI, AGFI, CFI, RMSEA, and TLI (comparing to a null model) compared to the other models. Chi-square difference tests were also performed. The unmodified five-factor model had a significantly lower Chi-square value, χ^2 difference (6) = 2212.35, $p < 0.001$, than the one-factor model. The modified five-factor model showed additional improvement in goodness-of-fit, with a significantly lower value than either the unmodified five-factor model , χ^2 difference (27) = 702.79, $p < 0.001$, or the one-factor model, χ^2 difference (33) = 2915.14, $p < 0.001$.

Using common rules of thumb for interpretation of model fit, the modified five-factor model fit the data well. The Chi-square/*df* ratio (1.71) was below 2.0, GFI (0.91) was above 0.90, AGFI (0.89) was very close to 0.90, CFI (0.95) was above 0.90, RMSEA (0.04) was below 0.05, and TLI (null) (0.94) was above 0.90. Forty-seven (7%) of 630 standardized residuals were significant at the 0.05 level, a smaller percentage than in any other model. Squared multiple correlations for individual items ranged from 0.07–0.63 and for factors from 0.20–0.64. Table III shows the model's parameter estimates along with their standard errors and significance.

Pearson's bivariate correlations between the five latent factors in the model were also calculated. All were statistically significant at the 0.01 level. Innovation was most strongly correlated with Affiliation ($r = 0.67$) and Participatory Decision Making ($r = 0.67$). Affiliation and Participatory Decision Making were also moderately correlated ($r = 0.62$). Student Support was not as strongly correlated with the first three factors (Affiliation, $r = 0.43$; Participatory Decision Making, $r = 0.43$; Innovation, $r =$

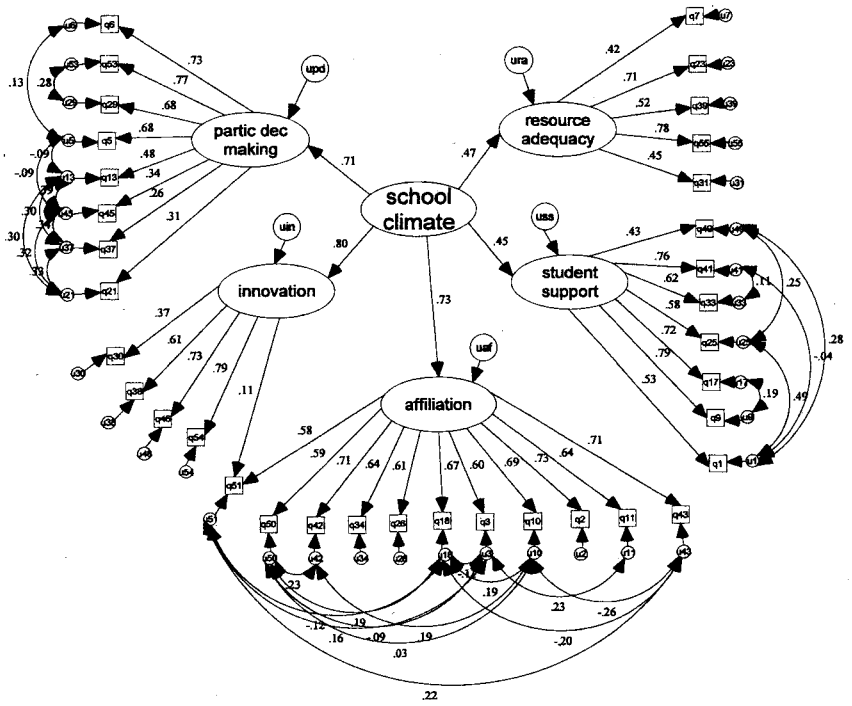

Figure 2. The modified five-factor, 35-item solution with correlated residuals.
Note. All coefficients are statistically significant ($p < 0.05$).

TABLE III

Five-Factor Confirmatory Factor Analysis Results

Regression weights	Maximum likelihood estimates		
	Estimate	Standard error	Critical ratio
resource adequacy <— school climate	1.000		
student support <— school climate	0.788	0.172	4.585
affiliation <— school climate	1.722	0.297	5.802
innovation <— school climate	1.066	0.219	4.872
participatory decision making <— school climate	2.385	0.416	5.730
39 <— resource adequacy	1.070	0.145	7.358
23 <— resource adequacy	1.431	0.173	8.279
7 <— resource adequacy	1.000		
55 <— resource adequacy	1.490	0.177	8.401
31 <— resource adequacy	1.047	0.154	6.785
25 <— student support	1.333	0.144	9.248
33 <— student support	0.853	0.105	8.145
41 <— student support	1.333	0.152	8.777
49 <— student support	1.000		
17 <— student support	1.191	0.140	8.525
9 <— student support	1.296	0.148	8.771
1 <— student support	1.270	0.142	8.969
18 <— affiliation	0.965	0.075	12.860
3 <— affiliation	1.087	0.087	12.495
10 <— affiliation	0.996	0.077	12.901
2 <— affiliation	1.273	0.083	15.329
11 <— affiliation	0.943	0.070	13.411
43 <— affiliation	1.000		
26 <— affiliation	0.912	0.071	12.875
34 <— affiliation	0.968	0.071	13.572
42 <— affiliation	1.067	0.072	14.904
50 <— affiliation	0.959	0.077	12.434
51 <— affiliation	0.838	0.076	11.068
51 <— innovation	0.289	0.131	2.201
54 <— innovation	2.156	0.282	7.658
46 <— innovation	1.987	0.263	7.561
38 <— innovation	1.488	0.207	7.202
30 <— innovation	1.000		
45 <— participatory decision making	0.372	0.055	6.704
5 <— participatory decision making	1.006	0.069	14.498
29 <— participatory decision making	0.870	0.072	12.027
53 <— participatory decision making	0.932	0.071	13.146
6 <— participatory decision making	1.000		
37 <— participatory decision making	0.273	0.051	5.364
13 <— participatory decision making	0.550	0.058	9.511
21 <— participatory decision making	0.341	0.054	6.308

Note. All critical ratios were statistically significant at 0.05 level. The numerals in the first column refer to item numbers.

0.33) or with the fifth factor, Resource Adequacy (r = 0.33). Similarly, Resource Adequacy was not strongly related to Affiliation (r = 0.39), Participatory Decision Making (r = 0.39) or Innovation (r = 0.36).

3.4. *Internal Consistency*

Internal consistency of the SLEQ was checked by calculating alpha reliability coefficients using SPSS 6.1.3. Results are shown in Table IV. The overall alpha coefficient of 0.90 was good. There were no items whose elimination would have improved the coefficient substantially. The individual alpha coefficients for different scales ranged from 0.70–0.90. One factor, Innovation, contained an item whose elimination caused the alpha coefficient to go up from 0.70–0.73. No other factors contained such items.

As can be seen in Table IV, the reliability coefficients are in the same range as those from previous studies (Fisher & Fraser, 1990, 1991; Fraser et al., 1987).

4. Discussion

The 35-item, five-factor version of the SLEQ was a good solution for use with this sample of elementary school teachers. All of the items loaded significantly on their factor(s). Each factor also loaded significantly on overall school climate. There were items, however, that had low squared multiple correlations, indicating that not much of the variance in the items was accounted for by the factors. There were seven items with squared multiple correlations below 0.20, namely, Items 7 and 31 (Resource Adequacy), Items 21, 45, and 37 (Participatory Decision Making), Item 49 (Student Support), and Item 30 (Innovation). Further testing could be done to see if elimination or rewording of these items would result in a better model.

Two of the factors, Resource Adequacy and Student Support, also had low squared multiple correlations of 0.22 and 0.20, respectively. While they had significant loadings on overall school climate, showing that they fit with the other three factors, their variance was not completely related to a construct representing overall school climate. It could be that, for this sample, there were other factors in addition to school climate that were responsible for perceptions of Resource Adequacy and Student Support.

TABLE IV

Internal Consistency Reliability Results for the Five-Factor, 35-Item SLEQ

Factor	Alpha reliability coefficient	
	Present study	Previous studies
Overall school climate	0.90	not reported
Student support	0.84	0.70, 0.79, 0.85
Affiliation	0.90	0.87, 0.85, 0.84, 0.78
Innovation	0.70	0.84, 0.78, 0.81, 0.68
Participatory decision making	0.82	0.80, 0.69, 0.82, 0.78
Resource adequacy	0.70	0.81, 0.80, 0.65, 0.68

In addition, two of the factors had internal consistency coefficients of 0.70, a value that is often considered adequate but is lower than one might expect with factors in an instrument such as this.

A revised form of the SLEQ could be devised based on these results. While this model of 35 items in five factors worked well, a revised version could lead to improvement. As mentioned earlier, the items and the factors with low squared multiple correlations should be examined. In addition, the number of items in each factor could be reviewed. While an instrument with 35 items might be preferable to a longer instrument with 56 items, these 35 items are not arranged into factors in a balanced way. Affiliation has ten items (along with an eleventh item which it shared with Innovation), Participatory Decision Making has eight items, Innovation has four items (along with another item which it shared with Affiliation), Student Support has seven items, and Resource Adequacy has five items. While it is not necessary for each factor to have the same number of items, a more balanced distribution of items on factors might result in a more efficient instrument.

The five school climate constructs in the final model were used in an examination of the relationships between student achievement and teachers' perceptions of school climate. Results of that study, reported elsewhere (Johnson, 1998; Johnson & Stevens, 2000), provide insights into how these constructs interact with teacher characteristics and school and community context as well as with indicators of student achievement.

The School-Level Environment Questionnaire needs to be evaluated further. If the factors identified in this study are replicable, it suggests the need for a revised SLEQ with fewer factors and fewer items. The seven factors found in the exploratory factor analysis seem to be fairly well measured, but at least two of the factors, Staff Freedom and Work Pressure, did not fit with the other factors. Two of the remaining five factors, Student Support and Resource Adequacy, did not contribute as strongly to overall school climate as Affiliation, Participatory Decision Making, and Innovation. In addition to replicating these factors with other samples, more work is needed examining factor structure. It could be that there are different facets of school climate represented by different groups of factors, with Affiliation, Participatory Decision Making, and Innovation representing one facet, Student Support and Resource Adequacy representing another, and Staff Freedom and Work Pressure representing a third. These facets could relate differently to other variables of interest as well.

NOTES

1. SLEQ item means and standard deviations are available on the Internet at http://www.ed.arizona.edu/johnson/sleq1.htm.

APPENDIX

SCHOOL-LEVEL ENVIRONMENT QUESTIONNAIRE (SLEQ)

Directions

The following are statements about the school in which you work and your working environment. Think about how well each statement AGREES WITH YOUR DESCRIPTION OR VIEWS of your school environment. For each statement, please indicate your response choices on your answer sheet.

A Strongly Disagree
B Disagree
C Neither Agree nor Disagree
D Agree
E Strongly Agree

1.	SS	There are many disruptive students in the school.
2.	AF	I seldom receive encouragement from colleagues.
3.	PI	Teachers frequently discuss teaching methods and strategies with each other.
4.	SF	I am often supervised to ensure that I follow directions correctly.
5.	PD	Decisions about the running of the school are usually made by the principal or a small group of teachers.
6.	IN	It is very difficult to change anything in this school.
7.	RA	The school library includes an adequate selection of books and periodicals.
8.	WP	There is constant pressure to keep working.
9.	SS	Most students are helpful and cooperative to teachers.
10.	AF	I feel accepted by other teachers.
11.	PI	Teachers avoid talking with each other about teaching and learning.
12.	SF	I am **not** expected to conform to a particular teaching style.
13.	PD	I have to refer even small matters to a senior member of staff for a final answer.
14.	IN	Teachers are encouraged to be innovative in this school.
15.	RA	The supply of equipment and resources is inadequate.
16.	WP	Teachers have to work long hours to complete all their work.
17.	SS	Most students are pleasant and friendly to teachers.
18.	AF	I am ignored by other teachers.
19.	PI	Professional matters are seldom discussed during staff meetings.
20.	SF	It is considered very important that I closely follow syllabuses and lesson plans.
21.	PD	Action can usually be taken without gaining the approval of a senior member of the staff.
22.	IN	There is a great deal of resistance to proposals for curriculum change.
23.	RA	Video equipment, tapes, and films are readily available and accessible.
24.	WP	Teachers do **not** have to work very hard in this school.
25.	SS	There are many noisy, badly behaved students.
26.	AF	I feel that I could rely on my colleagues for assistance if I should need it.
27.	PI	Many teachers attend inservice and other professional development courses.
28.	SF	There are few rules and regulations that I am expected to follow.
29.	PD	Teachers are frequently asked to participate in decisions concerning administrative policies and procedures.

APPENDIX (Continued)

30.	IN	Most teachers like the idea of change.
31.	RA	Adequate duplicating facilities and services are available to teachers.
32.	WP	There is **no** time for teachers to relax.
33.	SS	Students get along well with teachers.
34.	AF	My colleagues seldom take notice of my professional views and opinions.
35.	PI	Teachers show little interest in what is happening in other schools.
36.	SF	I am allowed to do almost as I please in the classroom.
37.	PD	I am encouraged to make decisions without reference to a senior staff member.
38.	IN	New courses or curriculum materials are seldom implemented in the school.
39.	RA	Tape recorders and cassettes are seldom available when needed.
40.	WP	You can take it easy and still get the work done.
41.	SS	Most students are well-mannered and respectful of the school staff.
42.	AF	I feel that I have many friends among my colleagues at this school.
43.	PI	Teachers are keen to learn from their colleagues.
44.	SF	My classes are expected to use prescribed textbooks and prescribed resource materials.
45.	PD	I must ask a senior member of staff before I do most things.
46.	IN	There is much experimentation with different teaching approaches.
47.	RA	Facilities are inadequate for serving a variety of classroom activities and learning groups of different sizes.
48.	WP	Seldom are there deadlines to be met.
49.	SS	Very strict discipline is needed to control many of the students.
50.	AF	I often feel lonely and left out of things in the staff room.
51.	PI	Teachers show considerable interest in the professional activities of their colleagues.
52.	SF	I am expected to maintain very strict control in the classroom.
53.	PD	I have very little say in the running of the school.
54.	IN	New and different ideas are always being tried out in this school.
55.	RA	Projectors for filmstrips, transparencies, and films are usually available when needed.
56.	WP	It is hard to keep up with your work load.

Note. The initials refer to the scale (factor) for which the item is designed: SS – Student Support, AF – Affiliation, PI – Professional Interest, SF – Staff Freedom, PD – Participatory Decision Making, IN – Innovation, RA – Resource Adequacy, WP – Work Pressure.

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