

ABSTRACT

Title of Document: THE MEASUREMENT OF SCHOOL
CLIMATE USING SURVEYS: EXPLORING
UNIT OF ANALYSIS

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School climate researchers have used different units of analysis when assessing school climate features. Overall, there is little research available to understand how different levels of analysis, individual or aggregated, influence the psychometric properties of a survey instrument. The purpose of the current research was to explore the use of different unit of analysis choices in instrument development. Further, the present study sought to replicate findings that the wording of survey instruments may influence the conceptualization of school climate by survey informants. Results indicate that unit of analysis affects on the factor structure, but that there is some overlap in the factors that emerge. Further, the present research confirmed past findings that the wording of climate items appears to affect the perception of items by respondents. Limitations and future directions are discussed. Unit of analysis remains an important theoretical and methodological concept in school climate research.

THE MEASUREMENT OF SCHOOL CLIMATE USING SURVEYS:
EXPLORING UNIT OF ANALYSIS

By

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Chapter 1: Introduction

Research on school climate blossomed in the late 1970s, generally finding that differences in the normative climate of schools were contributing factors to differences in outcomes. Researchers have found relations between school climate and variables, including student academic and social-emotional adjustment (e.g., Roesner, Eccler, & Sameroff, 2000), student delinquency (e.g., G. Gottfredson, D. Gottfredson, Payne, & N. Gottfredson, 2005), and teacher job satisfaction (e.g., Taylor & Tashakkori, 1995). Although it remains important in research today (Brand, Felner, Seitsinger, Burns, & Bolton, 2008), school climate is defined in numerous ways and differing definitions relate to how climate is conceptualized and measured (Van Horn, 2003).

Climate Defined

Organizational climate has been described in multiple ways. Van Houtte (2005) wrote, “Already in 1958, Argyris struggled with how to analyze and conceptualize something as complicated as organizational climate without oversimplification” (p. 72). During this time period, climate was defined as organizational features that affect personal behavior of organization members (Van Houtte, 2005). James and Jones (1974) explored the literature and defined organizational climate from the three broad approaches of that time: “multiple measurement-organizational attribute approach”, “perceptual measurements-organizational attribute approach”, and “perceptual measurement-individual attribute approach” (p.1096 - 1097). Multiple measurement-organizational attitude approach defined climate as a set of characteristics, describing an organization, which endure over time and influence the behavior of people in that

organization (Van Houtte, 2005). James and Jones described this approach as climate viewed as a set of organizational attributes that can be measured by a variety of methods. A second approach, perceptual measurements-organizational attitude, defined climate as a set of attributes that are inferred based on how an organization is perceived by its members (Van Houtte, 2005). According to James and Jones, the perceptual variables are seen as organizational variables. Finally, perceptual measurement-individual attribute approach is defined as properties of the individuals that make up the organization and subsequently affect the experiences of others in that organization. According to Van Houtte, currently, organizational climate is often viewed from the second approach in which individuals are asked to rate their perceptions of organizational features. Thus, organizations are rated by individuals and then the perceptions are used as organizational variables.

Van Houtte (2005) credited Pace and Stern as the first to use the term school climate in 1958. By 1990, Hoy provided a concise definition of school climate from a perceptual measurements-organizational attitude approach that is applicable to the present research. Hoy (1990) wrote, "School climate is the relatively enduring quality of the school environment that is experienced by participants, affects their behavior, and is based on their collective perceptions of behavior in schools" (p. 152). There is ongoing debate about whether school climate is in fact an organizational feature (definition two from above) or a perception of the school that remains a property of the individuals that make up that school (definition three from above, Van Horn, 2003). To illustrate this dichotomy, it is helpful to consider the target of intervention in school climate research. If climate is viewed as organizational in nature, then intervention efforts may be targeted

to improving features of the school. An example would be providing a safer environment through the use of metal detectors. However, if climate is viewed as a property of individuals, then intervention efforts may include information sessions geared toward improving personal responsibility and knowledge about safety issues. James (1982) referred to this dichotomy as the “unit-of-theory” for school climate. The unit-of-theory, whether climate is a property of individuals or of organizations, is difficult to divorce from how climate is measured in the literature.

Measurement of School Climate

While there are various ways of assessing school climate (including observational techniques), often school informants are asked to rate a series of questions about their school environment using a survey technique (Raudenbush, Rowan, & King, 1991). The survey responses are then combined in various ways to yield scale scores for individuals or groups of individuals. Such approaches require researchers to choose a unit of analysis because responses are all individual perceptions. In addition, there is evidence that the wording of surveys makes a difference. Both level of analysis and wording of surveys are discussed here.

Unit of analysis. An individual level approach would use scale scores of individuals in analysis. James (1982) theorized the measurement of climate should be at the individual level. He wrote that in the 1980s climate was viewed as a psychological construct that should be measured by soliciting individual perceptions of organizational characteristics. These individual perceptions could then be aggregated to provide a useful tool to explain and predict different phenomenon. However, according to James, threshold internal consistency criteria must be met in order to justify such aggregation.

James (1982) discussed how researchers historically approached demonstrating internal consistency. Specifically, he wrote about the relative merits of using Intra Class Correlations (ICC), a common practice in organizational research, to estimate interrater reliability. Although there are several formulas and interpretations for calculating ICCs, the two most germane to the unit of analysis issue are explained below.

ICC(1) is the reliability of a single rating or measurement. A high ICC(1) would demonstrate that in general respondents did not vary much in their responses to a particular item within a particular school relative to total variability in responses including variance within and between schools. Yet, low ICC(1) scores may not be due solely to reliable differences among raters (James, 1982). Low ICC(1)s could result from interactions between survey respondents and climate features as well as from error. Therefore, according to James (1982), simply finding a low ICC(1) should not be considered sufficient to demonstrate lack of agreement.

Next, James (1982) discussed calculating the ICC(2) using the ICC(1). The ICC(2) may provide an estimate of the reliability of a set of scores in a group of organizations/schools in order to determine if organizations reliably differ in perceptions on a given attribute. If there are many raters within an organization, it is possible to obtain high ICC(2) scores with low ICC(1) scores. In other words, with sufficient sample sizes within each organization, it is possible to demonstrate that organizations differ on a climate construct but also find that within those organizations there is little agreement. Based on his unit of theory, James believed that ICC(1) should be used to justify aggregation since it is construed as a psychological construct; however, ICC(2) may be

used to understand differences among organizations by assessing the reliability of organizational means.

An organizational approach would be to use aggregated individual scores in analysis. For example, Richards, D. Gottfredson, and G. Gottfredson (1991) used different units-of-theory to investigate the *ecological fallacy* as described by Robinson (1950). Specifically, the *ecological fallacy* holds that it may be erroneous to interpret variation among ecological units as variation among individuals within these units (Robinson, 1950). Richards (1990) proposed it may be equally erroneous to assume that variation among individuals holds at an organizational level and labeled this the *individual difference fallacy*. For example, differences in individual perceptions of safety between organizations may not actually measure the safety of those organizations. To further investigate the individual difference fallacy, Richards et al. (1991) assessed three units-of analysis to determine the best operational level of classroom climate. After exploring individuals and classrooms, the researchers concluded that classroom settings, rather than individuals, were the appropriate unit-of- analysis for organizational research when researchers are attempting to understand variation among classroom.

Finally, some researchers take a different approach to school climate theory and measurement. Sirotnik (1980) described the unit of analysis problem as substantive rather than statistical. He wrote that if the property is viewed as individual or phenomenological, then the analysis of within group variation is warranted and the individual is selected as unit. If the property is viewed as organizational, than between group variation should be analyzed with the group selected as the unit. Sirotnik wrote that there is no logical reason to think that something measured at a systemic level is the same

construct when it is measured at an individual level. Furthermore, he provided empirical evidence for potential differences when climate is defined at different levels. While Sirotnik found some similarities in clustering on climate items, he found that the factors obtained contained different items based on unit of analysis and that interpretation was much easier for pooled within analysis (individual level) versus between analysis (organizational).

At present, research indicates that it may be valuable to investigate different levels of analysis in school climate research. For example, researchers have advocated taking a hierarchical approach to investigate school climate in which both individual perceptions and school level aggregated perceptions are used to model outcomes (Mok & McDonald, 1994; Raudenbush et al., 1991). Using this approach, Raudenbush et al. (1991) found that while most of the variation in teacher perceptions lies within schools, that analysis of school-level consistencies also contributed to their model.

In addition to cogently outlining school climate theory, Sirotnik (1980) also differentiated between two phases of climate data analysis. The *psychometric* phase is used by researchers to evaluate school climate measures, while the *study* phase subsequently investigates relationships between climate measures and other variables of interest. Discussion of the unit of analysis is almost exclusively in the *study* phase. There is not as detailed discussion about the unit of analysis in the *psychometric* portion of climate research. Specifically, few studies consider at what level instruments are validated and then subsequently analyzed. Sirotnik wrote that the psychometric implications have been “largely ignored” (p. 158). Common practice in the *psychometric stage* is to compute internal consistency indices for each scale based on individual

responses or to factor analyze individual items to create climate scales (Raudenbush et al., 1991). Then, aggregated individual responses are used for the *study* phase. This is potentially problematic considering Sirotnik's finding that there may be differences in a construct when measured at different levels.

One purpose of the present study was to explore different factor analytic approaches to measuring school climate based on the unit of analysis selected in order to reconfirm Sirotnik's finding that different approaches yield different factor structures. Only a few studies have investigated different units of analysis during the *psychometric* stage of climate research (Raudenbush et al., 1991; Schulte, Ostroff, & Kinicki, 2006; Van Horn, 2003), with two of these using analytic approaches similar to the present research.

Schulte et al. (2006) analyzed a 94-item climate scale using three different approaches to exploratory factor analysis. The researchers analyzed individual-level items, aggregated organizational-level items, and unit-within-organization items. Results revealed similar factor structures for each approach. Van Horn (2003) used confirmatory factor analysis, for a modified version of an existing climate survey, on within-school and between-school covariance matrices. Like Schulte et al., Van Horn reported similar factor structure for both levels of analysis. Unlike Sirotnik's (1980) findings, both Schulte et al. and Van Horn found similar factor structures, thus indicating that perhaps similar constructs are measured at each level.

Raudenbush et al. (1991) used a hierarchical approach in order to understand the proportion of variance of each climate item at the teacher and school levels. In other words, a scale's internal consistency was measured at an individual level (teachers'

perceptions within schools) and at a school level (differences among schools in perceived climate) for a 35 item school climate instrument. Raudenbush et al. found similar levels of internal consistency for four of the five scales. Further, the researchers found that consistency at the school level depended on four properties: the number of items in the scale, the level of intercorrelation at the individual level, the level of agreement among teachers in a given school, and the number of teachers sampled within the school (Raudenbush et al., 1991). Thus, consistency at the school level was related to consistency at the individual level, among other factors.

Overall, the little research available to understand how different levels of analysis influence the psychometric properties of a survey instrument yielded different results from Sirotnik's seminal work. Schulte et al. (2006) did not provide extensive discussion or results related to unit of analysis as this was not the central purpose of their study. Van Horn's (2003) research used confirmatory analysis to establish the psychometric properties of an instrument at different levels. The factor structure was supported in this research at both the within- and between-school levels. The authors did not provide item by item results so it is difficult to know the level of similarity in factors obtained in the research. Raudenbush et al. (1991) used a different methodology (hierarchical) and found similarities on four of the five factors obtained. Overall, it is difficult to know how 'similar' is defined by each of these researchers without item by item results.

The present research replicates and extends past research by using methodology for exploring unit of analysis in survey instrument development. Items from a school climate survey were factor analyzed using exploratory procedures as would be typical in

instrument development. Further, item by item analysis is presented in order to provide more conclusive evidence for differences at individual versus school levels.

Survey wording. Another purpose of the present study is to replicate findings that the wording of survey instruments may influence the conceptualization of school climate by survey informants. Klein, Conn, Smith, and Sorra (2001) wrote that a central consideration for using individual-level data to operationalize organizational constructs is agreement among the unit members. The researchers proposed that the wording of survey instruments could influence what individual raters perceive as the target of the question. For example, the researchers proposed that questions written with references such as “I” or “my” may encourage raters to look within at their own experiences and not consider the experiences of others. In contrast, references such as “we” or “our” may encourage the assumption of a shared perspective. In addition, the researchers hypothesized that asking for objective responses may lead to more within-unit agreement than asking for more subjective or evaluative responses. For example, evaluations that ask employees to decide whether or not an objective or neutral characteristic described their organization would yield more agreement than questions that ask employees to rate positive or negative evaluations of their work environments. Thus, the wording of a survey item alone may influence the amount of relative agreement within an organization on that particular item.

Klein et al. (2001) tested both of these hypotheses and found that evaluative questions yielded greater within-unit agreement after controlling for social desirability, contrary to their hypothesis. On the other hand, the use of “I” versus “we” language yielded differential agreement in the expected direction. As predicted, “we” language

resulted in greater agreement within a unit than “I” language. This research provided support for the hypothesis that the wording of survey items alone may contribute to differential responding on climate items.

Research Questions

The purpose of the present research is to investigate the measurement of school climate in the *psychometric* stage of research using the Effective School Battery (ESB, Gottfredson, 1991). The ESB provides an opportunity to explore measurement issues for a school climate survey. In the manual, Gottfredson (1991) described the assessment of school climates as fundamentally different from the measurement of individuals. He explained that climate is the assessment of an environment in which individual differences are viewed as measurement error, essentially an organizational view of climate.

Specifically, the following research questions were addressed:

1. Do different unit of analysis approaches to exploratory factor analysis yield different factor structures for the Effective School Battery school climate survey?
2. What are the factor structures that arise from an individual level approach versus a school level approach?
3. Do climate items with language requesting reports about the environment have higher ICCs than climate items with language requesting reports about the individual?

To examine the research questions, first I used exploratory factor analysis to determine whether different factor structures are found using individual versus school level analyses for the ESB. Then, using the same school climate items, I investigated whether survey

questions with individual language yielded greater within school variability than items with language describing the school.

Chapter 2: Method: Measure and Sample

Exploratory factor analysis with unrotated and rotated factor solutions were examined for research questions one and two and calculation of intra-class correlations was used to explore research question three. For all research questions, the same items and sample were used, as described in greater detail immediately below.

Measure

The Effective School Battery (Gottfredson, 1991) is a school climate inventory developed to provide secondary schools with feedback on several areas of school climate in order to help guide school improvement. The ESB contains both student and teacher questionnaires. Survey questions were selected for relevance to problem behavior and school safety. In addition, each item had to contribute to the creation of a reliable and useful survey instrument and was screened for ease of answering and offensiveness (Gottfredson, 1991).

The student and teacher surveys have multiple scales hypothesized to measure different aspects of school climate (Gottfredson, 1991). Only the teacher survey is used in the present research. Therefore a more detailed explanation of the teacher survey is provided. A more thorough account of the student survey can be found in the ESB manual (Gottfredson, 1991).

In the teacher's survey, Gottfredson (1991) distinguished between two kinds of measures of school climate: *psychosocial climate* and *school population climate*. All items were coded such that higher values indicate desirable responses.

Psychosocial Climate Scales. *Psychosocial climate*, a term borrowed from Moos (1973), is assessed based on reports of students and teachers about their environments

(Gottfredson, 1991). Scales were designed to measure how people in the school typically perceive and describe the environment. The psychosocial climate scales were based on previous research (G. Gottfredson & D. Gottfredson, 1985; National Institute of Education, 1978) and on other accounts of school climate in the literature (Gottfredson, 1991). To develop each scale, internal consistency item analyses were performed on items aggregated to the school-level. The final survey contained nine psychosocial climate scales based on teacher reports with internal consistency estimates ranging from moderate to very high (.70 to .90, Gottfredson, 1991). The ESB manual provides detailed reliability and validity information for each of these scales; but only preliminary exploratory factor analyses (with 69 schools) have been conducted to date (Gottfredson, 1991). See Table 1 for scale labels, descriptions, number of items, and reliabilities as found in the ESB manual.

Population Climate Scales. In contrast to the *Psychosocial Climate* scales, the *Population Climate* scales measure average student and teacher characteristics. Students and teachers are asked to describe their own personal and behavioral characteristics. Some of the questions used to measure *Population Climate* were also based on items from the NIE (1978) Safe School Study questionnaire and previous work with this questionnaire (G. Gottfredson & D. Gottfredson, 1985). Additionally, the *Job Satisfaction* scale contains items from Hoppock's (1935) job satisfaction scale. Internal consistency item analysis revealed scale reliability estimates ranging from poor to moderate (.54 to .80). See Table 2 for labels, descriptions, number of items, and individual-level reliabilities for each scale as found in the ESB manual.

Table 1

<i>Psychosocial Climate Scales</i>				
Scale	Description	<i>n</i>	<i>α</i>	
Safety	Feelings of safety in different areas of school	10	0.94	
Morale	Commitment to and overall feelings about the school	11	0.94	
Planning and Action	Systematic planning and openness to change	9	0.89	
Smooth Administration	Administrative leadership	12	0.93	
Resources for Instruction	Amount of resources available for teachers in the school	4	0.81	
Race Relations	How well different groups get along in the school	2	0.74	
Parent/Community Involvement	Parent and community involvement in the school	6	0.81	
Student Influence	Student participation in decision making in the school	5	0.85	
Avoidance of the Use of Grades as a Sanction	Grade changes made in response to discipline concerns	2	0.65	

Note. Adapted from “Effective School Battery: User’s Manual” by G. D. Gottfredson, 1991, Marriottsville, MD: Gottfredson Associates, Inc. Copyright 1984 by Gary D. Gottfredson. *n* = number of items per scale.

Table 2

<i>Population Climate Scales</i>				
Scale	Description	<i>n</i>	<i>α</i>	
Pro-Integration Attitude	Teacher attitudes related to integrated education	4	0.69	
Job Satisfaction	How well teachers like their jobs	3	0.80	
Interaction with Students	Out-of-classroom interactions between teachers and students	6	0.67	
Personal Security	Teacher's experiences with violence in their schools	8	0.67	
Classroom Orderliness	How often behavior disrupts classroom instruction	2	0.78	
Professional Development	In-service and other professional development opportunities	8	0.74	
Nonauthoritarian Attitudes	Sympathetic attitudes toward students	3	0.54	

Note. Adapted from “Effective School Battery: User’s Manual” by G. D. Gottfredson, 1991, Marriottsville, MD: Gottfredson Associates, Inc. Copyright 1984 by Gary D. Gottfredson. *n* = number of items per scale.

Sample

School districts contract with Gottfredson Associates Inc. for scoring of the Effective School Battery. The sample used for this research was selected from 252 schools using the ESB between the years 1993 and 2008. A total of 7526 teachers completed the ESB in these schools and the number of teachers per school ranged from 3 to 157. The final sample contained only those schools with sufficient teachers to warrant analysis. Retention decision was three-fold: (a) based on James (1982) recommendation of at least 10 informants per organization; (b) based on Raudenbush et al.'s (1991) discussion on the influence of sample size on reliability estimates; and (c) based on the desired school-level reliability.

The James (1982) recommendation needs little explanation, as a very low number of respondents per school would result in very low school-level reliability. Raudenbush et al. (1991) cautioned that as sample sizes between schools vary, so do internal consistency estimates. The authors found that about 30 teachers per school were needed to achieve internal consistency reliabilities of .90 (Raudenbush et al., 1991). Finally, since sample size influences reliability estimates, acceptable sample size was calculated based on the Spearman-Brown formula. There is little consensus regarding acceptable reliability of means estimates ($\hat{\lambda}$ or ICC(2)); but Schulte et al. (2006) cited estimates between .5 and .7 as marginal with .7 being considered acceptable. Also needed for the Spearman-Brown formula are estimates of interrater reliability (ICC(1)). James (1982) reported that ICC(1) typically ranges from .01 to .20 with a median of about .12. For the purposes of this research, the acceptable reliability of means estimate was relaxed to .61, and the minimum ICC(1) was set at .10 in order to obtain a sample size greater than 200

schools. To achieve this, schools with fewer than 14 teachers were dropped from the sample. This yielded a final sample of 7014 teachers within 204 schools. The number of teachers per school ranged from 14 – 157, with an average of 34 teachers per school.

The sample for this research was one of convenience. Schools or school districts self-selected participation and varied in the number of teachers and students who completed the survey. To protect the confidentiality of these schools, minimal demographic information was available with the data.

Chapter 3: Analyses and Results

To address research question one, unrotated factor solutions were generated. Solutions were compared to determine if individual or school level differences existed based on unit of analysis. Unrotated factor solutions allow for the examination of the factors in the order of factor strength. Also to address research question one, I examined communalities, sample sizes, loadings, reflection, and graphical rotation of the unrotated solutions. Research question two was an extension of question one in which the final solutions for question one were subjected to orthogonal rotation to ease interpretation. Finally, research question three involved the calculation of intra-class correlations to determine agreement within and between schools on the survey items. The following section is a detailed description of the analyses used for each research questions followed by results for each question.

Research Question 1

Analysis. The purpose of the first research question is to investigate the factor structures that may arise due to the unit of analysis chosen. Specifically, the first research question addresses whether similar factor structures arise from both individual-level analysis and school-level analysis. For each approach to factor analysis, the psychosocial climate items and the population climate items were analyzed separately. The first approach to factor analysis was similar to traditional approaches to factor analysis for the psychometric phase of climate battery development (Raudenbush et al., 1991; Sirotnik, 1980). Individual responses to items were factor analyzed across all schools using exploratory factor analysis. The second approach to factor analysis was

more organizational in nature. Individual scores were aggregated to school level and then subjected to exploratory factor analysis.

Exploratory factor analysis was selected because historically there were only preliminary factor analyses performed on separate subsets of teacher items (G. Gottfredson & D. Gottfredson, 1985). Further, initial results indicated low to moderate degrees of intercorrelations among some scales, indicating that factor analysis with a larger sample may result in a reduction in the number of scales (Gottfredson, 1991). Different statistical packages were used for factor analysis of the individual level versus the school level. Several of the questionnaire items were dichotomous. Typical Pearson's correlations, used in factor analytic procedures in SPSS (Version 16.0) may have underestimated the relations among survey items if they are viewed as dichotomized continuous variables. Therefore, for the individual level analyses, PRELIS (SSI, 2005), was used to obtain polychoric correlation matrices to account better for dichotomous and polytomous data, and ordinal factor analyses were employed. SPSS was used for analysis of aggregated data at the school level.

A multi-step process was used to decide on the number of factors to extract at both the individual- and the school-levels as well as on a parallel subset of items to include in both analyses. This process was applied to items classified by Gottfredson (1991) as indicators of psychosocial climate and separately to items he classified as indicators of school population. The process began by subjecting all available items of each type to an exploratory factor analysis.

Scree plots were examined to make decisions about the number of factors to be extracted. In Russell's (2002) paper on the use (and abuse) of factor analysis, he

recommended that Kaiser's criterion for extracting eigenvalues greater than or equal to 1.0 should only be used for Principal Components Analysis. For Principal Axis Factoring, as used in the present study, examining scree plots (Cattell, 1966) is a reasonable method to decide how many factors to extract. Overextraction of factors results in factors that only account for a small amount of the total variance and should be avoided (Russell, 2002).

Therefore, I analyzed individual- and school-level scree plots simultaneously to determine a conservative number of factors to extract. Individual items were evaluated and excluded from subsequent analysis if the item had communality less than .2 in an analysis with the specified number of factors. A threshold of .2 means that more than 4% of variance of each retained item is in the factor space. Complete lists of items, along with descriptive information and decision criteria, are presented in Table 3 for the psychosocial climate set and Table 4 for the population climate set.

To determine whether the factor structures were similar, factor analyses were rerun with the specified number of factors after the low-communality items were removed. This was done to obtain unrotated factor solutions for each set of items at the individual level and after aggregation of items to the school level. The unrotated factor solutions were examined to determine if they produced similar factors at the school and individual levels of analysis.

Table 3

Initial Solutions for Psychosocial Climate Items

Item	Min	Max	Individual Level Analysis				School Level Analysis			
			<i>N</i>	Mean	<i>SD</i>	<i>h</i> ²	<i>N</i>	Mean	<i>SD</i>	<i>h</i> ²
How much influence does PTO have?	1	2	6654	1.37	0.48	0.29	204	1.39	0.27	0.48
Parents help decide about school prog?	1	2	6683	1.10	0.30	0.25	204	1.11	0.12	0.37
Parents serve as tutors or aides?	1	2	6711	1.08	0.28	0.34	204	1.10	0.16	0.35
Community involvement is sought?	1	2	6716	1.23	0.42	0.22	204	1.24	0.15	0.33
<i>I change plans based on student suggest?</i>	1	2	6623	1.40	0.49	0.01	204	1.40	0.13	0.13
<i>I lower grades for misbehavior in my class</i> ^a	1	2	6629	1.87	0.33	0.04	204	1.88	0.10	0.11
<i>School supplies me with materials I need?</i>	1	4	6852	3.00	0.90	0.03	204	3.03	0.41	0.42
<i>School has adequate space?</i>	1	4	6902	2.65	1.01	0.02	204	2.66	0.58	0.05
<i>Program extends outside of building?</i>	1	4	6802	2.57	0.89	0.03	204	2.59	0.36	0.46
<i>Simple procedures exist for resource acquisition?</i>	1	2	6588	1.57	0.50	0.17	204	1.59	0.17	0.44
<i>Able to get materials when needed?</i>	1	4	6828	2.77	0.87	0.04	204	2.81	0.40	0.47
<i>How often work on planning committee?</i>	1	2	6829	1.65	0.48	0.08	204	1.68	0.17	0.29
<i>Teachers and students make rules?</i>	1	2	6851	1.53	0.50	0.11	204	1.57	0.18	0.40
<i>Students can get unfair rules changed?</i>	1	2	6674	1.54	0.50	0.11	204	1.55	0.15	0.23
<i>Students help make school rules?</i>	1	2	6771	1.34	0.47	0.16	204	1.35	0.17	0.42
<i>Lower grades for repeated misconduct</i> ^a	1	2	6277	1.92	0.28	0.02	204	1.92	0.08	0.06
Students of different races get along?	1	2	6846	1.48	0.50	0.31	204	1.51	0.20	0.47
Students of different nationalities get along?	1	2	6637	1.52	0.50	0.34	204	1.55	0.19	0.60
Teachers and administrators get along?	1	2	6787	1.51	0.50	0.49	204	1.55	0.23	0.77
Parents and teachers get along?	1	2	6786	1.45	0.50	0.37	204	1.47	0.18	0.59
How much a problem is criminal behav in school? ^a	1	5	6898	3.48	1.09	0.35	204	3.59	0.59	0.77
Hesitated to confront student from fear? ^a	1	5	6790	4.68	0.68	0.24	204	4.70	0.20	0.47
How safe is your classroom while teaching?	1	5	6687	4.31	1.03	0.42	204	4.32	0.31	0.46
How safe are empty classrooms?	1	5	6453	3.90	1.13	0.52	204	3.92	0.38	0.66
How safe are hallways and stairs?	1	5	6687	3.84	1.12	0.71	204	3.92	0.48	0.78
How safe is the cafeteria?	1	5	6423	3.94	1.07	0.67	204	4.01	0.47	0.74

How safe is student restroom?	1	5	6513	3.63	1.15	0.62	204	3.72	0.51	0.73
How safe is locker room or gym?	1	5	5604	3.75	1.13	0.64	204	3.89	0.52	0.66
How safe is parking lot?	1	5	6554	3.80	1.08	0.58	204	3.86	0.46	0.54
How safe is elsewhere on school grounds?	1	5	6619	3.74	1.05	0.58	204	3.79	0.46	0.62
<i>Students should have say in running of school?</i>	1	2	6800	1.41	0.49	0.03	204	1.40	0.15	0.25
Administrators and teachers collaborate?	1	2	6723	1.77	0.42	0.73	199	1.80	0.17	0.74
There is little admin/teacher tension?	1	2	6663	1.62	0.49	0.65	199	1.64	0.24	0.81
Principal is a good rep of school?	1	2	6546	1.86	0.35	0.76	199	1.87	0.16	0.72
Principal encourages experimentation?	1	2	6474	1.83	0.38	0.53	199	1.84	0.15	0.57
Teacher eval is used in performance improvement?	1	2	6498	1.77	0.42	0.43	199	1.80	0.14	0.50
Principal lets tchrs & stdnts know when they do well?	1	2	6605	1.78	0.41	0.57	199	1.79	0.16	0.56
<i>Teachers and students can arrange to deviate?</i>	1	2	6354	1.64	0.48	0.10	199	1.64	0.19	0.28
Teachers feel free to communicate w principal?	1	2	6583	1.80	0.40	0.77	199	1.81	0.18	0.71
Administration is supportive of teachers?	1	2	6595	1.79	0.41	0.79	199	1.80	0.17	0.82
Hard to change established procedures? ^a	1	2	6496	1.52	0.50	0.39	199	1.56	0.18	0.61
Students don't care about school? ^a	1	2	6562	1.75	0.44	0.41	199	1.77	0.19	0.70
Problems here are too big for teachers to dent? ^a	1	2	6642	1.87	0.33	0.34	199	1.89	0.11	0.57
Parents and community receptive to new ideas?	1	2	6432	1.66	0.47	0.28	199	1.68	0.19	0.43
My ideas are listened to and used?	1	2	6533	1.69	0.46	0.65	199	1.73	0.16	0.76
Want to keep working w this kind of students?	1	2	6572	1.86	0.35	0.23	199	1.86	0.10	0.36
<i>Principal is informal?</i>	1	2	6388	1.74	0.44	0.12	199	1.75	0.19	0.18
Principal is open to staff input?	1	2	6488	1.82	0.39	0.80	199	1.83	0.16	0.80
Principal is planful?	1	2	6341	1.81	0.40	0.49	199	1.81	0.18	0.38
Principal is progressive?	1	2	6382	1.81	0.39	0.56	199	1.82	0.16	0.57
<i>Faculty is apathetic? ^a</i>	1	2	6460	1.67	0.47	0.05	199	1.68	0.13	0.18
Faculty is cohesive?	1	2	6452	1.63	0.48	0.40	199	1.67	0.20	0.49
<i>Faculty is conservative? ^a</i>	1	2	6352	1.36	0.48	0.12	199	1.36	0.21	0.56
Faculty is enthusiastic?	1	2	6437	1.75	0.43	0.50	199	1.77	0.16	0.66
Faculty is frustrated? ^a	1	2	6467	1.38	0.49	0.51	199	1.40	0.22	0.71
Faculty is innovative?	1	2	6332	1.76	0.43	0.36	199	1.77	0.14	0.54
Faculty is open to change?	1	2	6372	1.68	0.47	0.37	199	1.70	0.16	0.54
Faculty is satisfied?	1	2	6387	1.53	0.50	0.52	199	1.56	0.22	0.79
Faculty is tense? ^a	1	2	6347	1.54	0.50	0.44	199	1.55	0.22	0.71

Faculty is traditional? ^a	1	2	6305	1.32	0.47	0.20	199	1.35	0.23	0.65
Faculty is unappreciated? ^a	1	2	6476	1.56	0.50	0.53	199	1.59	0.21	0.73

Note. Italized items were removed from graphical rotation due to low communality.

^a Reverse coded item.

Table 4

Initial Solutions for Population Climate Items

Item	Min	Max	Individual Level Analysis				School Level Analysis			
			<i>N</i>	Mean	<i>SD</i>	<i>h</i> ²	<i>N</i>	Mean	<i>SD</i>	<i>h</i> ²
How do you like your job?	1	4	6946	3.37	0.64	0.48	204	3.39	0.19	0.53
How much of time satisfied with job?	1	4	6924	2.86	0.62	0.48	204	2.87	0.17	0.60
How like job compared to others?	1	4	6900	2.64	0.63	0.39	204	2.64	0.16	0.39
<i>How often attend prof. dev. courses?</i>	1	2	6833	1.07	0.25	0.13	204	1.07	0.09	0.25
How much curriculum inservice?	1	2	6765	1.71	0.46	0.20	204	1.73	0.17	0.52
How much group relations inservice?	1	2	6749	1.41	0.46	0.29	204	1.41	0.17	0.39
This year, learned about texts, materials?	1	2	6719	1.65	0.48	0.26	204	1.67	0.14	0.51
This year, learned about theories of learning?	1	2	6690	1.50	0.50	0.21	204	1.54	0.23	0.37
This year, learned about discipline methods?	1	2	6663	1.44	0.50	0.64	204	1.46	0.18	0.67
This year, learned about handling disruptive students?	1	2	6656	1.43	0.50	0.64	204	1.45	0.17	0.64
This year, learned about heterog. class management?	1	2	6695	1.40	0.49	0.48	204	1.41	0.15	0.48
Past two weeks, students asked advice?	1	4	6851	2.39	1.21	0.28	204	2.32	0.35	0.44
<i>How often tutor students?</i>	1	4	6784	2.36	1.19	0.15	204	2.23	0.51	0.59
How often work on extracurricular activities?	1	4	6777	2.20	1.13	0.25	204	2.10	0.42	0.78

<i>How often go on fieldtrips?</i>	1	4	6776	1.61	0.57	0.07	204	1.67	0.23	0.42
<i>How often attend student activities?</i>	1	4	6766	1.91	0.85	0.19	204	1.83	0.39	0.65
How often discuss student personal problems?	1	4	6852	2.59	1.06	0.20	204	2.59	0.29	0.31
How much time in classroom dealing w discipline? ^a	1	4	6772	2.85	0.63	0.49	204	2.83	0.25	0.66
Student behavior prevents teaching? ^a	1	4	6762	2.53	0.76	0.52	204	2.50	0.30	0.71
Past month, damage to property LT \$10? ^a	0	1	6777	0.80	0.40	0.57	204	0.80	0.11	0.51
Past month, damage to property GT \$10? ^a	0	1	6740	0.90	0.30	0.62	204	0.90	0.08	0.40
Past month, theft of property GT \$10? ^a	0	1	6672	0.82	0.38	0.45	204	0.82	0.11	0.39
Past month, theft of property LT \$10? ^a	0	1	6656	0.92	0.27	0.48	204	0.93	0.07	0.32
<i>Past month, attacked and had to see doctor?^{a b}</i>	0	1	6649	0.99	0.08		204	0.99	0.02	0.16
Past month, attacked, but not too serious? ^a	0	1	6702	0.95	0.21	0.33	204	0.95	0.07	0.39
Past month, received obscene remark? ^a	0	1	6675	0.57	0.50	0.46	204	0.60	0.20	0.75
Past month, threatened by student? ^a	0	1	6662	0.80	0.40	0.52	204	0.80	0.15	0.72
<i>Past month, student pulled weapon?^{a b}</i>	0	1	6772	1.00	0.06		204	1.00	0.01	0.17
Most black students better in all black schools? ^a	1	4	6775	3.75	0.59	0.83	204	3.76	0.17	0.45
Most white students better in all white schools? ^a	1	4	6783	3.75	0.60	0.99	204	3.76	0.17	0.65
<i>Amount of prejudice in country exaggerated?^a</i>	1	4	6760	2.88	0.87	0.02	204	2.87	0.27	0.57
<i>Students should not be bused?^a</i>	1	4	6656	2.39	1.00	0.00	204	2.40	0.32	0.23
<i>Using obscene language is moral offense?^a</i>	1	4	6706	2.13	0.96	0.01	204	2.11	0.26	0.24
<i>A few students are just hoodlums?^a</i>	1	4	6706	2.92	1.04	0.04	204	3.01	0.38	0.68
<i>Physical punishment is effective?^a</i>	1	4	6783	3.40	0.89	0.11	204	3.41	0.33	0.48

Note. Italicized items were removed from graphical rotation due to low communality.

^a Reverse coded items.

^b For individual analysis, item was removed in order to obtain a factor solution.

MacCallum, Widaman, Zhang, and Hong's (1999) recommendation for post hoc analysis of sample size was investigated. According to MacCallum et al., communalities and factor saturation determine if there is sufficient sample size to approximate population factor loadings. Specifically, with communalities greater than .60, a smaller sample size (less than 100) still yields accurate results (MacCallum et al., 1999). With average communalities around .50, sample sizes should range from 100-200 for accurate results. Overdetermination also plays a role. Less sample size is needed if there are 6 or 7 items that load highly per factor. With low communalities (around .50) and a small number of high loadings per factor, sample sizes may need to exceed 300 to approximate population values. Post hoc analysis of communalities and overdetermination was used to determine if the sample size was adequate.

Finally, unrotated factor solutions were plotted two factors at a time and then graphical rotation, as described by Harman (1976), was used to determine if solutions overlapped. The items with the 10 highest communalities at both the school and individual level were plotted in two factor pairings. Due to overlap, 13 items were graphed for the Psychosocial Climate (see Table 5 for communalities and Table 6 for specific items graphed and results) and 14 items were graphed for the Population Climate (see Table 7 for communalities and Table 8 for specific items graphed and results). Then, the plots were copied onto transparencies, two factors per graph, in order to compare results (rotate) at the individual and school level.

Psychosocial Climate Results. Initial solutions to factor analysis indicate that some items had different communalities at each level. Table 3 shows that several items that appear in the school factor space are only minimally in the individual level factor

space as evidenced by varying communalities (Ex. Faculty is conservative). This provides evidence that the obtained factor structures are different at each level.

Scree plot examination indicated that a three-factor solution was appropriate for the Psychosocial scale items at both the school and individual level. Preliminary analysis of the three factor solutions indicated that 17 psychosocial items had communalities less than .20 in the factor solution at either the individual or the school level. Thus, 44 items were retained for final analyses. Based on a subset of factor space excluding items not represented in the factor space at both levels of analysis, unrotated factor solutions at the individual and school level yielded different factor loadings (see Table 5). For individual level analysis, item communalities for the unrotated factor solutions ranged from .11 to .81 with an average of .5, thus representing low communalities as defined by MacCallum and colleagues (1999) for some items. This solution was overidentified (six or more item loadings greater than .4) and had a huge sample size (~6,500). Therefore, the low communalities obtained may not result in obtained values markedly differently from the population.

For school level analysis, communalities ranged from .34 to .85 with an average of .6. Although the saturation for this solution was not overidentified, the sample size of 199 and communality levels indicate the obtained solution probably would be similar to population values. Results indicated that 5 of the original 204 schools had large portions of survey data missing. While they were not excluded from the analysis if data were present, the sample size is reduced to 199 for many of the items due to these missing data. The school-level analysis looked more like a one-factor solution providing further evidence of different factor solutions emerging from the two approaches.

Graphical rotation of factor solutions two factors at a time yielded similar results for only the first pairing. With reflection of axis y (multiplying loadings for factor 2 by -1) and 340° rotation of the school level solution, Factor 1 x 2 at the individual and school levels produced similar results (see Table 6). But, neither reflection nor rotation led to similar results for Factor 1 x 3 or Factor 2 x 3 graphically. Overall, the factor solutions appear different. When items with low communalities are excluded, the subset of items remaining show some overlap in factor structures. However, this only represents part of the overall factor space.

Population Climate Results. Initial solutions to factor analysis indicate that some population climate items had different communalities at each level, much like the results for psychosocial climate items. Table 4 shows that several items that appear in the school factor space are only minimally in the individual level factor space as evidenced by varying communalities (Ex. How often go on fieldtrips?). This provides evidence that the obtained factor structures are different at each level.

A three factor solution was selected based on examination of the scree plots at each level of analysis. Preliminary analysis of the three factor solution indicated that 11 of the 35 population items had communalities less than .20. After removal of these 11 items, 24 items were retained for final analysis. For the remaining subset of climate items, unrotated factor solutions at the individual and school level yielded different factor loadings, although there is definite overlap on some factors (see Table 7).

Table 5

Unrotated Factor Loadings and Communalities for Psychosocial Climate Items

Items	Individual Level Factors				School Level Factors			
	1	2	3	h^2	1	2	3	h^2
How much influence does PTO have?	0.55	0.00	0.00	0.30	0.61	0.32	0.23	0.53
Parents help decide about school prog?	0.50	-0.05	0.00	0.25	0.52	0.25	0.30	0.43
Parents serve as tutors or aides?	0.56	-0.14	0.06	0.33	0.47	0.37	0.16	0.38
Community involvement is sought?	0.43	0.06	-0.01	0.18	0.46	-0.05	0.35	0.34
Students of different races get along?	0.52	-0.12	0.17	0.32	0.53	0.34	0.26	0.46
Students of different nationalities get along?	0.55	-0.13	0.18	0.35	0.62	0.41	0.23	0.61
Teachers and administrators get along?	0.60	0.35	0.16	0.51	0.81	-0.32	0.08	0.76 ^b
Parents and teachers get along?	0.61	-0.05	0.10	0.39	0.75	0.20	0.13	0.61
How much a problem is criminal beh in school? ^a	0.46	-0.02	0.37	0.35	0.74	0.46	-0.03	0.76 ^b
Hesitated to confront student from fear? ^a	0.34	0.06	0.34	0.23	0.64	0.17	-0.20	0.47
How safe is your classroom while teaching?	0.26	-0.12	0.58	0.42	0.59	0.27	-0.32	0.53
How safe are empty classrooms?	0.22	-0.08	0.69	0.53	0.70	0.26	-0.38	0.71
How safe are hallways and stairs?	0.30	-0.14	0.78	0.72 ^b	0.76	0.42	-0.19	0.80 ^b
How safe is the cafeteria?	0.31	-0.14	0.75	0.68 ^b	0.77	0.38	-0.18	0.77 ^b
How safe is student restroom?	0.27	-0.14	0.73	0.63	0.74	0.43	-0.14	0.75
How safe is locker room or gym?	0.29	-0.18	0.74	0.67 ^b	0.71	0.38	0.01	0.65
How safe is parking lot?	0.24	-0.15	0.72	0.59	0.60	0.29	-0.33	0.56
How safe is elsewhere on school grounds?	0.20	-0.16	0.72	0.59	0.62	0.36	-0.36	0.65
Administrators and teachers collaborate?	0.56	0.59	0.24	0.73 ^b	0.84	-0.28	0.00	0.77 ^b
There is little admin/teacher tension?	0.46	0.61	0.25	0.65 ^b	0.78	-0.40	-0.17	0.80 ^b
Principal is a good rep of school?	0.41	0.71	0.32	0.77 ^b	0.73	-0.47	-0.10	0.77 ^b
Principal encourages experimentation?	0.38	0.59	0.18	0.53	0.56	-0.46	-0.05	0.54
Teacher eval is used in performance improvement?	0.44	0.47	0.16	0.43	0.69	-0.21	0.01	0.52
Principal lets tchrs & stdnts know when they do well?	0.35	0.65	0.25	0.60	0.64	-0.40	-0.12	0.59
Teachers feel free to communicate w principal?	0.46	0.70	0.34	0.81 ^b	0.64	-0.49	-0.19	0.69
Administration is supportive of teachers?	0.46	0.70	0.32	0.80 ^b	0.79	-0.46	-0.18	0.86 ^b

Hard to change established procedures? ^a	0.46	0.41	0.07	0.38	0.68	-0.32	0.21	0.60
Students don't care about school? ^a	0.64	0.06	0.15	0.43	0.76	0.35	0.03	0.70
Problems here are too big for teachers to dent? ^a	0.53	0.18	0.22	0.36	0.73	0.15	-0.13	0.57
Parents and community receptive to new ideas?	0.51	0.07	0.07	0.27	0.56	0.25	0.24	0.43
My ideas are listened to and used?	0.50	0.59	0.24	0.66 ^b	0.82	-0.32	0.10	0.78 ^b
Want to keep working w this kind of students?	0.45	0.07	0.18	0.24	0.55	0.19	0.00	0.34
Principal is open to staff input?	0.42	0.73	0.29	0.80 ^b	0.68	-0.57	-0.10	0.80 ^b
Principal is planful?	0.37	0.57	0.20	0.50	0.56	-0.31	-0.06	0.42
Principal is progressive?	0.44	0.58	0.16	0.55	0.64	-0.41	0.08	0.59
Faculty is cohesive?	0.57	0.28	-0.02	0.41	0.69	-0.11	0.19	0.53
Faculty is enthusiastic?	0.70	0.14	-0.04	0.51	0.74	0.08	0.35	0.67
Faculty is frustrated? ^a	0.63	0.32	0.16	0.53	0.84	0.01	-0.04	0.71
Faculty is innovative?	0.58	0.12	-0.12	0.36	0.58	-0.02	0.48	0.57
Faculty is open to change?	0.55	0.14	-0.01	0.32	0.51	-0.14	0.51	0.55
Faculty is satisfied?	0.62	0.37	0.16	0.55	0.88	0.02	-0.12	0.79 ^b
Faculty is tense? ^a	0.53	0.37	0.18	0.45	0.82	-0.09	-0.17	0.70
Faculty is traditional? ^a	0.26	-0.11	-0.18	0.11	0.12	-0.01	0.61	0.39
Faculty is unappreciated? ^a	0.56	0.46	0.17	0.55	0.83	-0.15	0.05	0.72

Note. Bolded items indicate inclusion in graphical rotation.

^a Reverse coded items.

^b Top ten communalities.

Table 6

Psychosocial Factor 1 x 2 Graphical Rotation

Item	Individual		School		School Reflected		School Reflected and Rotated	
	1	2	1	2	1	2	1	2
Teachers and administrators get along?	0.60	0.35	0.81	-0.32	0.81	0.32	0.65	0.57
How much a problem is criminal beh. in school? ^a	0.46	-0.02	0.74	0.46	0.74	-0.46	0.85	-0.18
How safe are hallways and stairs?	0.30	-0.14	0.76	0.42	0.76	-0.42	0.86	-0.13
How safe is the cafeteria?	0.31	-0.14	0.77	0.38	0.77	-0.38	0.85	-0.10
How safe is locker room or gym?	0.29	-0.18	0.71	0.38	0.71	-0.38	0.80	-0.11
Administrators and teachers collaborate?	0.56	0.59	0.84	-0.28	0.84	0.28	0.69	0.55
There is little admin/teacher tension?	0.46	0.61	0.78	-0.40	0.78	0.40	0.60	0.64
Principal is a good rep of school?	0.41	0.71	0.73	-0.47	0.73	0.47	0.52	0.70
Teachers feel free to communicate w principal?	0.46	0.70	0.64	-0.49	0.64	0.49	0.43	0.68
Administration is supportive of teachers?	0.46	0.70	0.79	-0.46	0.79	0.46	0.58	0.70
My ideas are listened to and used?	0.50	0.59	0.82	-0.32	0.82	0.32	0.66	0.58
Principal is open to staff input?	0.42	0.73	0.68	-0.57	0.68	0.57	0.45	0.77
Faculty is satisfied?	0.62	0.37	0.88	0.02	0.88	-0.02	0.83	0.28

^a Reverse coded items.

For the individual level of analysis, communalities ranged from .07 to .75 with an average communality of .39. This represents low communalities and therefore overidentification and higher sample sizes are needed for accurate results (MacCallum et al., 1999). The three factor solution was overidentified and the sample size was quite large (~6500); therefore, results may approximate population values.

For the school level of analysis, communalities ranged from .09 to .75 with an average of .47. Additionally the solution was only overidentified for the first two factors and had a sample size of 199. Therefore, this probably does not reflect a solution that would match the population values. Overall, the population climate scale resulted in lower communalities, lower saturations, and more overlap in factor structure.

Results of graphical rotation for the Population scale items were mixed. Table 8 contains the reflected and rotated factor solution for Factor 1 x 2. Total reflection (multiplying both factors by -1) and 313° graphical rotation of the school level solution led to similar results for this factor pairing, but no other factor pairings. Figure 1 represents an example of factor solutions with similar, overlapping results. Figure 2 represents an example of factor solutions with differing, non-overlapping results. Overall, results for population climate indicate different factor structures at each level. With the removal of low communality items, the remaining subset reveal a factor structure with some overlap. However, the overlap only represents a portion of the total factor space.

Table 7

<i>Unrotated Factor Loadings and Communalities For Population Climate Items</i>								
Item	Individual Level Analysis				School Level Analysis			
	1	2	3	h^2	1	2	3	h^2
How do you like your job?	0.73	0.00	0.00	0.54 ^b	0.70	0.19	0.16	0.55 ^b
How much of time satisfied with job?	0.71	0.07	0.00	0.51 ^b	0.74	-0.01	0.28	0.63 ^b
How like job compared to others?	0.66	-0.03	-0.10	0.44	0.51	0.01	0.44	0.45
How much curriculum inservice?	0.22	-0.21	0.26	0.16	0.10	0.65	-0.30	0.52 ^b
How much group relations inservice?	0.26	-0.30	0.32	0.26	0.10	0.60	0.16	0.40
This year, learned about texts, materials?	0.29	-0.18	0.36	0.24	0.36	0.64	-0.02	0.54 ^b
This year, learned about theories of learning?	0.26	-0.18	0.29	0.19	0.21	0.57	-0.29	0.46
This year, learned about discipline methods?	0.30	-0.49	0.63	0.72 ^b	0.17	0.61	0.39	0.55 ^b
This year, learned about handling disruptive students?	0.31	-0.48	0.62	0.72 ^b	0.16	0.60	0.42	0.56 ^b
This year, learned about heterogen. class management?	0.38	-0.35	0.48	0.50 ^b	0.31	0.56	0.21	0.45
Past two weeks, students asked advice?	0.23	-0.34	-0.20	0.21	-0.37	-0.25	0.44	0.39
How often work on extracurricular activities?	0.23	-0.14	-0.15	0.09	-0.12	-0.45	0.53	0.50
How often discuss student personal problems?	0.20	-0.32	-0.15	0.16	-0.38	0.21	0.27	0.26
How much time in classroom dealing w discipline? ^a	0.52	0.42	-0.10	0.46	0.67	-0.41	0.26	0.68 ^b
Student behavior prevents teaching? ^a	0.59	0.37	-0.05	0.48 ^b	0.71	-0.34	0.37	0.75 ^b
Past month, damage to property LT \$10? ^a	0.21	0.64	0.40	0.61 ^b	0.68	-0.15	-0.04	0.49
Past month, damage to property GT \$10? ^a	0.13	0.66	0.48	0.68 ^b	0.52	-0.26	-0.23	0.40
Past month, theft of property GT \$10? ^a	0.19	0.57	0.34	0.48	0.62	-0.09	-0.05	0.40
Past month, theft of property LT \$10 ? ^a	0.11	0.57	0.40	0.50 ^b	0.45	-0.17	-0.32	0.33
Past month, attacked, but not too serious? ^a	0.28	0.49	0.03	0.32	0.36	-0.40	-0.15	0.32
Past month, received obscene remark? ^a	0.41	0.51	0.19	0.47	0.84	0.06	-0.19	0.75 ^b
Past month, threatened by student? ^a	0.22	0.56	0.15	0.51 ^b	0.80	-0.18	-0.19	0.70 ^b
Most black students better in all black schools? ^a	-0.25	-0.05	0.09	0.07	0.24	0.13	-0.13	0.09
Most white students better in all white schools? ^a	-0.26	-0.02	0.10	0.08	0.28	0.17	-0.15	0.13

Note. Bolded items indicate inclusion in graphical rotation.

^a Reverse coded items.

^b Top ten communality.

Table 8

Population Factor 1 x 2 Graphical Rotation

Item	Individual		School		School Reflected		School Reflected and Rotated	
	1	2	1	2	1	2	1	2
How do you like your job?	0.73	0.00	0.70	0.19	0.70	-0.19	0.62	0.38
How much of time satisfied with job?	0.71	0.07	0.74	-0.01	0.74	0.01	0.50	0.55
How much curriculum inservice?	0.22	-0.21	0.10	0.65	0.10	-0.65	0.54	-0.37
This year, learned about texts, materials?	0.29	-0.18	0.36	0.64	0.36	-0.64	0.71	-0.17
This year, learned about discipline methods?	0.30	-0.49	0.17	0.61	0.17	-0.61	0.56	-0.29
This year, learned about handling disruptive students?	0.31	-0.48	0.16	0.60	0.16	-0.60	0.55	-0.29
This year, learned about heterogen. class management?	0.38	-0.35	0.31	0.56	0.31	-0.56	0.62	-0.15
How much time in classroom dealing w discipline? ^a	0.52	0.42	0.67	-0.41	0.67	0.41	0.15	0.77
Student behavior prevents teaching? ^a	0.59	0.37	0.71	-0.34	0.71	0.34	0.23	0.75
Past month, damage to property LT \$10? ^a	0.21	0.64	0.68	-0.15	0.68	0.15	0.36	0.60
Past month, damage to property GT \$10? ^a	0.13	0.66	0.52	-0.26	0.52	0.26	0.17	0.56
Past month, theft of property LT \$10? ^a	0.11	0.57	0.45	-0.17	0.45	0.17	0.18	0.45
Past month, received obscene remark? ^a	0.41	0.51	0.84	0.06	0.84	-0.06	0.61	0.58
Past month, threatened by student? ^a	0.22	0.56	0.80	-0.18	0.80	0.18	0.42	0.70

^a Reverse coded items.

Figure 1. Factor Solutions with Similar Results after Reflection and Rotation

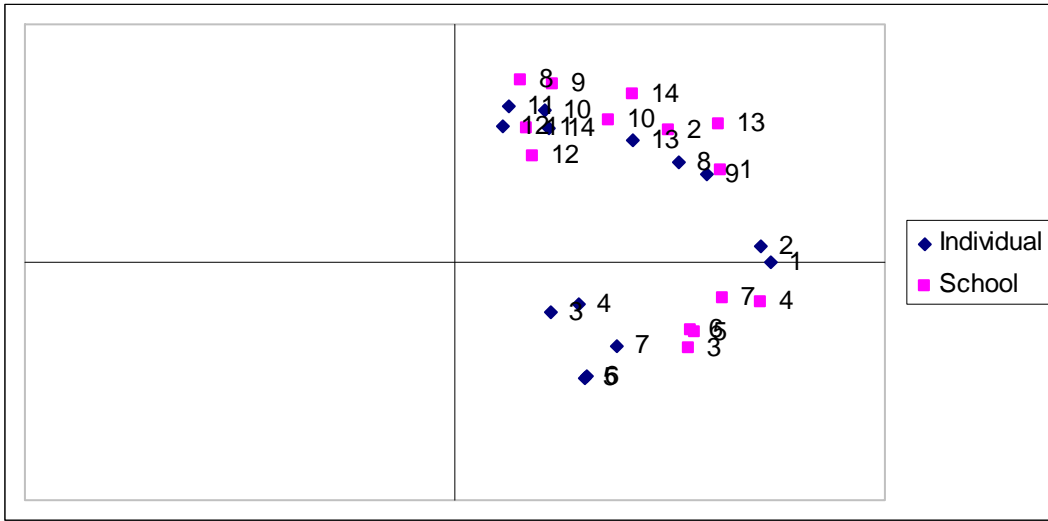


Figure 1. The items with the ten highest communalities were plotted at both the individual and school level for each factor pairing considered. This figure represents one factor pairing (Population Climate Factor 1 x 2) that resulted in similar factor structures with reflection and rotation.

Figure 2. Factor Solutions with Differing Results after Reflection.

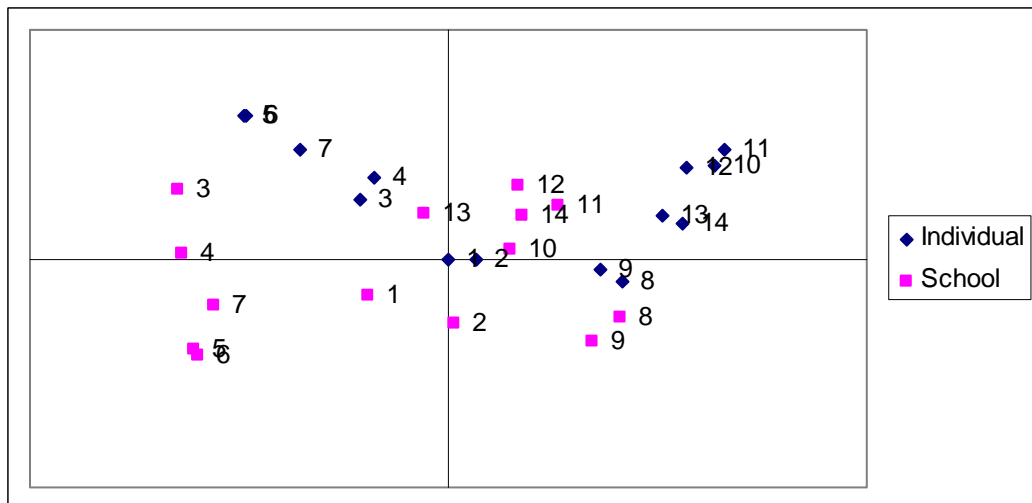


Figure 2. This figure represents a factor pairing (Population Climate Factor 2 x 3) that resulted in nonoverlapping results. Neither reflection nor rotation resulted in similar factor structures.

Research Question 2

Analysis. The second research question addressed what factor structures arose from the different approaches to factor analysis. This question was addressed using only the subset of items with substantial variance in the first three factors emerging using both individual-level and aggregate-level approaches. Orthogonal rotations were used for final factor solutions above, and examination of items with factor loadings above .40 was used to label each factor.

Psychosocial scale results. After rotation the order of factors is not as important as the interpretation of factor loadings. At the individual level, the three factors that emerged were *Positive Relationships*, *Smooth Administration*, and *Safe School* (see Table 9 for factor loadings). The first factor, *Positive Relationships*, was a combination of parent influence items, all of the people get along in the school items, as well as many of the teacher morale items. The second individual level factor extracted contains most of the smooth administration items as well as some of the morale items. Finally, the third individual level factor has almost all of the safety items.

At the school level, the three factors could be labeled *Smooth Administration*, *Positive Environment*, and *Positive Relationships*. The first factor extracted contains most of the smooth administration items as well as some of the morale items. The second factor contains the parent influence items, the 'get along' items, the safety items, and the teacher morale items. This factor looks like a combination of individual level factors one and three. Finally, the third factor pulls items from a variety of areas including morale, student influence, parent involvement, and the items pertaining to how well everyone gets along. It seems similar to individual-level factor one.

Population climate results. At the individual level, the three factors could be labeled *Perceived Job Satisfaction*, *Perceived Security*, and *Professional Development* (see Table 10 for factor loadings). The first factor is a combination of three job satisfaction items and two student behavior items. For this factor, job satisfaction loaded with items about classroom discipline and student behavior. The second factor at the individual level contains only items pertaining to personal security. The third factor at the individual level contains the professional development items.

At the school level, the three factors extracted could be labeled, *Perceived Security and Job Satisfaction*, *Professional Development*, and *Positive Relationships*. The first factor contained the three job satisfaction items, the two classroom orderliness items, and all personal safety items. Additionally, the item indicating that students share personal problems with the teacher loaded negatively on this factor. The second school-level factor contained two job satisfaction items and several professional development items. The third factor at the school level is quite different and contains items from professional development, student relations, and classroom orderliness as well as one security item. This factor is somewhat similar to the psychosocial climate items that represent *Positive Relationships*.

Table 9

Psychosocial Climate Rotated Factor Solutions

Items	Individual				School			
	1	2	3	h^2	1	2	3	h^2
How much influence does PTO have?	0.51	0.18	0.10	0.30	0.13	0.53	0.48	0.53
Parents help decide about school prog?	0.48	0.12	0.11	0.25	0.12	0.40	0.50	0.43
Parents serve as tutors or aides?	0.54	0.07	0.20	0.33	0.01	0.49	0.37	0.38
Community involvement is sought?	0.38	0.19	0.06	0.18	0.29	0.15	0.49	0.34
Students of different races get along?	0.47	0.10	0.29	0.32	0.06	0.48	0.48	0.46
Students of different nationalities get along?	0.50	0.10	0.29	0.34	0.07	0.60	0.50	0.61
Teachers and administrators get along?	0.43	0.55	0.16	0.51	0.75	0.29	0.33	0.76
Parents and teachers get along?	0.56	0.18	0.22	0.39	0.32	0.58	0.42	0.61
How much a problem is criminal beh in school? ^a	0.34	0.22	0.44	0.36	0.16	0.80	0.30	0.76
Hesitated to confront student from fear? ^a	0.21	0.24	0.36	0.23	0.32	0.60	0.08	0.47
How safe is your classroom while teaching?	0.13	0.10	0.62	0.42	0.24	0.68	-0.04	0.53
How safe are empty classrooms?	0.05	0.15	0.71	0.53	0.33	0.77	-0.06	0.71
How safe are hallways and stairs?	0.11	0.14	0.83	0.72	0.22	0.85	0.16	0.80
How safe is the cafeteria?	0.13	0.14	0.81	0.69	0.25	0.82	0.17	0.77
How safe is student restroom?	0.10	0.12	0.78	0.63	0.20	0.82	0.20	0.75
How safe is locker room or gym?	0.13	0.09	0.80	0.67	0.19	0.71	0.32	0.65
How safe is parking lot?	0.08	0.10	0.76	0.59	0.24	0.70	-0.04	0.56
How safe is elsewhere on school grounds?	0.04	0.07	0.76	0.59	0.21	0.78	-0.05	0.65
Administrators and teachers collaborate?	0.31	0.78	0.16	0.73	0.76	0.37	0.27	0.77
There is little admin/teacher tension?	0.20	0.77	0.15	0.65	0.84	0.31	0.08	0.80
Principal is a good rep of school?	0.11	0.85	0.18	0.77	0.85	0.20	0.11	0.77
Principal encourages experimentation?	0.15	0.71	0.07	0.53	0.72	0.08	0.10	0.54
Teacher eval is used in performance improvement?	0.24	0.60	0.09	0.43	0.61	0.31	0.24	0.52
Principal lets tchrs & stdnts know when they do well?	0.09	0.76	0.12	0.60	0.74	0.19	0.07	0.59
Teachers feel free to communicate w principal?	0.09	0.84	0.19	0.75	0.81	0.16	0.00	0.69

Administration is supportive of teachers?	0.16	0.86	0.18	0.80	0.88	0.28	0.06	0.86
Hard to change established procedures? ^a	0.30	0.54	0.04	0.38	0.65	0.16	0.40	0.60
Students don't care about school? ^a	0.54	0.29	0.24	0.43	0.23	0.72	0.35	0.70
Problems here are too big for teachers to dent? ^a	0.38	0.38	0.25	0.36	0.39	0.62	0.17	0.57
Parents and community receptive to new ideas?	0.44	0.24	0.14	0.27	0.14	0.44	0.46	0.43
My ideas are listened to and used?	0.25	0.76	0.15	0.66	0.76	0.29	0.35	0.78
Want to keep working w this kind of students?	0.36	0.25	0.23	0.24	0.23	0.49	0.23	0.34
Principal is open to staff input?	0.12	0.88	0.14	0.80	0.88	0.11	0.08	0.80
Principal is planful?	0.14	0.69	0.10	0.50	0.61	0.18	0.11	0.42
Principal is progressive?	0.21	0.71	0.07	0.55	0.71	0.12	0.25	0.59
Faculty is cohesive?	0.46	0.44	0.01	0.41	0.51	0.31	0.42	0.53
Faculty is enthusiastic?	0.62	0.35	0.05	0.51	0.37	0.41	0.61	0.67
Faculty is frustrated? ^a	0.46	0.53	0.18	0.53	0.56	0.57	0.28	0.71
Faculty is innovative?	0.53	0.27	-0.04	0.36	0.32	0.19	0.66	0.57
Faculty is open to change?	0.51	0.27	-0.07	0.34	0.36	0.06	0.64	0.55
Faculty is satisfied?	0.44	0.58	0.16	0.55	0.58	0.63	0.21	0.79
Faculty is tense? ^a	0.35	0.55	0.16	0.45	0.63	0.54	0.13	0.70
Faculty is traditional? ^a	0.31	-0.06	-0.09	0.11	-0.01	-0.15	0.61	0.39
Faculty is unappreciated? ^a	0.35	0.64	0.13	0.55	0.65	0.43	0.34	0.72

Note. Only loadings greater than or equal to .40 used for interpretation.

^a Reverse coded items.

Table 10

Population Climate Rotated Factor Solutions

Items	Individual				School			
	1	2	3	h^2	1	2	3	h^2
How do you like your job?	0.67	0.09	0.29	0.54	0.60	0.40	0.17	0.55
How much of time satisfied with job?	0.65	0.14	0.25	0.51	0.72	0.34	-0.04	0.63
How like job compared to others?	0.64	0.00	0.20	0.44	0.50	0.40	-0.21	0.45
How much curriculum inservice?	0.08	-0.02	0.39	0.16	-0.14	0.31	0.64	0.52
How much group relations inservice?	0.08	-0.06	0.50	0.26	-0.09	0.57	0.25	0.40
This year, learned about texts, materials?	0.10	0.07	0.48	0.24	0.13	0.54	0.48	0.54
This year, learned about theories of learning?	0.10	0.03	0.42	0.19	-0.01	0.29	0.61	0.46
This year, learned about discipline methods?	-0.03	-0.06	0.85	0.72	-0.02	0.74	0.09	0.55
This year, learned about handling disruptive students?	-0.02	-0.05	0.85	0.72	-0.02	0.74	0.06	0.56
This year, learned about heterogeneous class management?	0.11	-0.01	0.70	0.50	0.12	0.62	0.24	0.45
Past two weeks, students asked advice?	0.25	-0.36	0.11	0.21	-0.23	0.00	-0.58	0.39
How often work on extracurricular activities?	0.25	-0.16	0.05	0.09	0.07	-0.02	-0.70	0.50
How often discuss student personal problems?	0.20	-0.32	0.13	0.16	-0.41	0.24	-0.18	0.26
How much time in classroom dealing w discipline? ^a	0.56	0.37	-0.09	0.46	0.78	0.01	-0.27	0.68
Student behavior prevents teaching? ^a	0.59	0.36	0.01	0.48	0.80	0.14	-0.30	0.75
Past month, damage to property LT \$10? ^a	0.10	0.77	0.06	0.61	0.69	0.02	0.12	0.49
Past month, damage to property GT \$10? ^a	0.00	0.82	0.07	0.68	0.57	-0.22	0.16	0.40
Past month, theft of property GT \$10? ^a	0.10	0.68	0.04	0.48	0.61	0.04	0.14	0.40
Past month, theft of property LT \$10? ^a	0.01	0.70	0.05	0.50	0.46	-0.23	0.26	0.33
Past month, attacked, but not too serious? ^a	0.30	0.46	-0.12	0.32	0.47	-0.31	-0.03	0.32
Past month, received obscene remark? ^a	0.36	0.58	0.04	0.47	0.76	0.11	0.40	0.75
Past month, threatened by student? ^a	0.39	0.60	-0.01	0.51	0.80	-0.07	0.25	0.70
Most black students better in all black schools? ^a	-0.26	-0.03	-0.01	0.07	0.17	0.07	0.24	0.09
Most white students better in all white schools? ^a	-0.28	0.00	-0.02	0.08	0.20	0.10	0.29	0.13

Note. Only loadings greater than or equal to .40 used for interpretation. ^a Reverse coded items.

Research Question 3

Analysis. Since the ESB provides two different approaches to measuring climate, the battery provides a way of investigating how the wording of questions may or may not affect agreement within schools. Specifically, both the Psychosocial Climate portion of the battery and the Population Climate portion contain scales measuring perceptions of school safety. The *Safety* scale measures how safe teachers perceive their school to be with questions worded to tap collective beliefs (Ex: At your school during school hours, how safe from vandalism, personal attacks and theft are hallways and stairs?) The *Personal Security* scale measure personal experiences of theft and aggression (Ex: In the past month, have you personally in this school been threatened in remarks by a student). Although both scales tap similar constructs, previous research suggests that the questions with individual words (such as ‘you’ and ‘I’) would elicit less agreement among school members than questions with collective words that ask about the environment (such as ‘this school’ and ‘we’).

First, individual items from both the psychosocial and population sets were examined to determine if they contained individual or collective wording. That is, they were examined to determine whether the question pertained to the individual or to the school. Two of the psychosocial climate items contained individual language (‘I’ and ‘your classroom’); as a result, these items were considered individual in wording. The remaining psychosocial climate items referred to school areas in general and were considered collective in wording. All population climate items were considered individual in wording.

Then, ICC(1)s were calculated for each item, using the Hierarchical Linear Modeling (HLM) program (Raudenbush, Bryk, Cheong, & Congdon, 2000) to estimate the proportion of variance in the item that was due to differences between schools. When comparing ICC(1)s for individual items, higher values indicate that there is more variability between schools than items with lower ICC(1) values. Items that are collective are expected to have more variability between schools (and less relative variability within schools), therefore these items are expected to have higher ICC(1) values.

Results. Results of research question three provide additional evidence that collectively worded items yield greater agreement than individually worded items. Another interpretation of the results would be that asking individual respondents about a place yields different results from asking individual respondents about themselves. Overall, the top seven ICCs were seven out of eight of the collectively worded items. Individually worded items represented the lowest nine ICCs. Only one collectively worded item, How safe are empty classrooms?, was not clustered with the collectively worded items. See Table 11 for individual item results including exact ICC values.

Table 11

<i>ICC Analysis by Question Type</i>									
Variable Label	N	Mean	SD	Min	Max	τ	σ^2	ICC	Type
Past month, damage to property GT \$10? ^a	6740	0.90	0.30	0	1	0.0024	0.0899	0.03	Ind
Past month, student pulled weapon? ^a	6772	1.00	0.06	0	1	0.0001	0.0038	0.03	Ind
Past month, damage to property LT \$10? ^a	6777	0.80	0.40	0	1	0.0042	0.1543	0.03	Ind
Past month, theft of property GT\$10? ^a	6656	0.92	0.27	0	1	0.0021	0.0694	0.03	Ind
Past month, theft of property LT \$10? ^a	6672	0.82	0.38	0	1	0.0059	0.1400	0.04	Ind
How safe is your classroom while teaching?	6687	4.31	1.03	1	5	0.0528	1.0183	0.05	Ind
Hesitated to confront student from fear? ^a	6790	4.68	0.68	1	5	0.0268	0.4407	0.06	Ind
Past month, attacked, but not too serious? ^a	6702	0.95	0.21	0	1	0.0030	0.0413	0.07	Ind
How safe are empty classrooms?	6453	3.90	1.13	1	5	0.0981	1.1670	0.08	Col
Past month, threatened by student? ^a	6662	0.80	0.40	0	1	0.0152	0.1487	0.09	Ind
Past month, received obscene remark? ^a	6675	0.57	0.50	0	1	0.0300	0.2162	0.12	Ind
Past month, attacked and had to see doctor? ^a	6649	0.99	0.08	0	1	0.0010	0.0068	0.13	Ind
How safe is parking lot?	6654	3.80	1.07	1	5	0.1705	0.9919	0.15	Col
How safe is the cafeteria?	6423	3.94	1.07	1	5	0.1726	0.9724	0.15	Col
How safe are hallways and stairs?	6687	3.84	1.12	1	5	0.1910	1.0637	0.15	Col
How safe is student restrooms?	6513	3.63	1.15	1	5	0.2105	1.1166	0.16	Col
How safe is elsewhere on school grounds?	6619	3.74	1.05	1	5	0.1762	0.9287	0.16	Col
How safe is locker room or gym?	5604	3.75	1.13	1	5	0.2261	1.0440	0.18	Col
How much problem criminal beh in school?	6898	3.48	1.09	1	5	0.3117	0.8819	0.26	Col

Note. τ = between-school variance; σ^2 = within-school variance; Ind = individually worded items; Col = collectively worded items.

^a Reverse coded item.

Chapter 4: Discussion

During the psychometric phase of instrument development, factor analysis is a tool used for data reduction as well as confirmatory procedures. Other researchers have discussed the use of factor analysis in recent research and called for more careful use of this methodology in research (MacCallum et al., 1999; Russell, 2002). In this section, I interpret the present results in the context of prior research in this area, offer suggestions for researchers measuring school climate, describe limitations, and suggest future directions for this work.

The first question addressed by this study was how factor solutions differed by unit of analysis for a school climate survey. The unit of measurement, the individual level or the school level, yield mixed results when factor analyzing the same survey instrument. The answer is that the solutions differ. Many items represented in the factor space at one level have little variance in a solution at the other level. When a subset of items represented in the factor space at both levels of analysis are factor analyzed, factor loadings, communalities, and graphical rotation for some factors were similar and were different for other factors. At first inspection solutions as a whole appeared different; however for both climate scales, reflection and graphical rotation revealed similar results for the first two factors extracted at both the individual and school level. Research question two provided additional information about the factor solutions through rotation. Orthogonal rotation indicated that certain factors were similar, for example the factor *Positive Relationships* was found for the psychosocial climate scale at both the individual and school level. But, other factors were different at the individual and school level. Thus, the results of this study were similar to some past research, namely Sirotnik's

(1980) and Raudenbush et al.'s (1991). I can not conclude that the factor structures were alike at the different levels as Schulte et al. (2006) and Van Horn (2003) found in their research.

Although researchers often use individual-level factor analysis decisions in the *psychometric* phase of instrument creation (Sirotnik, 1980), the results of the present research indicate that theoretical operationalization should play a role in decision making as originally suggested by Sirotnik. If climate is viewed as an individual property a priori, then individual level analysis may be warranted. However, if climate is viewed as a property of the school, then school level analysis may be logical in instrument development. The results of this work imply the need for a precise definition of climate by researchers prior to instrument creation.

Question three asked whether the wording of survey items may influence sensitivity to differences among environments. The results of this research provide more evidence that the way a survey question is worded may influence how people perceive these questions. Individually worded items yielded less between school variance, indicating that these items may be tapping individual differences more than a collective climate. Collectively worded items had greater between school variance indicating more agreement within schools and indicating that these items may be tapping collective climate. Researchers should invest time in evaluating individual items and considering how to analyze climate survey tools based on their theoretical approach to how climate should be measured during the instrument creation process.

Contrary to some past work in this area, the results of this study provided evidence that unit of analysis does matter when psychometrically investigating a climate

measure. Further, this work provided evidence of the influence of question wording in climate scales. This topic remains unresolved and more attention is needed with regard to how to approach climate in survey development, validation, and predictive use.

Limitations

While this research adds to literature regarding unit of analysis for school climate surveys, there are some important limitations to consider. Schools self-selected to administer the ESB; therefore, it is important to consider if this self-selection may have influenced the results of this analysis. It is plausible that schools with ‘difficult’ or ‘troubled’ climates would be overrepresented in the sample. This could influence the analysis in several ways. For example, a limited sample may result in restriction of variance that limits the size of correlations in the factor analysis. Yet the present sample represents the schools that use this particular climate battery, and therefore the results have utility.

Another limitation to this work involves the use of different statistical packages at each level. Although item inclusion, factor extraction, and all decision making criteria were the same at each level, the use of different statistical packages may have influenced the obtained results due to subtle differences in programs.

This research is limited to the climate items found in the ESB. Other climate scales assess different climate constructs which may have different resulting factor structures. It would be helpful to assess additional climate scales to buttress the results of this research. Finally, the examination of the similarity of factor solutions in this research was limited to the subset of ESB items with substantial variance in the factor space defined at both levels of analysis. Obviously, when some items are represented in the

factor space at one level of analysis and not at the other, the factor results differ at the two levels. Additional future directions are presented below.

Future Directions

The purpose of the ESB is to be a practical tool used by schools to identify areas of needed system change (Gottfredson, 1991). It may be interesting to obtain a more representative sample of schools, in order to replicate these findings in light of the above limitations. A broader sampling of schools may result in stronger correlations to factor analyze. Also, as more and more schools complete the ESB, confirmatory factor analysis could be used to confirm the results for question two. Confirmatory factor analysis would also provide a way to determine if extraction criteria used in the present research was appropriate and to investigate model fit in subsequent work. Finally, the ESB was intended to be analyzed at the school level. It may be interesting to compare the current results to the same methods applied to a survey instrument intended to be analyzed at the individual level or one intended to be analyzed at both levels. Overall, more research is needed to explore how level of analysis may impact school climate survey interpretation and results.

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