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ABSTRACT

This study examined the relationships among college students' perceptions of their personal (constructivist-based) learning environments, the extent to which they viewed selected teaching and learning activities as enhancing their personal learning, and their personal learning efficacy. A total of 2,190 students in 145 evening classes offered by Louisiana State University in the 1996 fall semester participated in the study. The students completed three separate measures of assessments of the quality of teaching and learning, personal perceptions of the learning environment, and motivation and outcomes expectancy assessments of personal learning efficacy. The results support the validity of adapting the Science Laboratory Environment Inventory (SLEI), an instrument originally developed for use in secondary classrooms, to the college classroom setting. They also support the use of the Student Assessment of Teaching and Learning (SATL) measure. Correlations between the SATL and SLEI subscales generated in this study suggest that students' personal perceptions of characteristics of the learning environment and their self-reported experiences and behaviors are significantly related to their self-reports of learning enhancement. Copies of the measures used in the study are appended. (Contains 34 references.) (MDM)

Linking Personal Learning Environment, Quality of Teaching and Learning and Learning Efficacy: An Initial Study of College Students

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The quality of undergraduate teaching and learning environments on college campuses is a continuing national concern. The recent call to "reaffirm teaching as the university's primary task" is echoed by the Carnegie Foundation for the Advancement of Teaching in its proposal to redefine scholarship in ways that emphasize the importance of improving undergraduate teaching and learning environments. Extensive literature reviews reflected in the work of Purtle (1982), Aleamoni (1987), Centra (1993), and others reveal considerable support for the use of student ratings as one source for assessing college course characteristics and the quality of instruction, particularly when such information is used for formative evaluation purposes.

Traditionally, student ratings forms used in higher education settings focus on obtaining student judgments about the quality of elements of instruction, the instructor, or course characteristics (e.g. textbook, tests, difficulty of course, etc.). There has also been attention given to the measurement of classroom learning environment characteristics in higher education settings (e.g. the College and University Classroom Environment Inventory (CUCEI), Fraser, Treagust, Williamson, & Tobin, 1986). However, with the exception of an earlier study by Logan & Ellett (1988), no attempts have been made to develop measures of students' perceptions of the extent to which teaching and learning elements of the college classroom environment enhance students' personal learning, particularly in newer, important areas such as the development of higher order thinking skills. Extending the development of assessments to tap students' perceptions of the extent to which their personal learning is enhanced has recently been deemed as highly important,

particularly from the formative evaluation, course development, and instructional improvement perspectives (McKeachie & Kaplan, 1996)..

Of particular interest in this study was examining relationships between a newly developed *enhancement of learning* measure and two important criterion variables: 1) a measure of students' personal (constructivist-based) learning environment adapted from the recent work of Fraser, Fisher, & McRobbie, 1966; and 2) a measure of student self-efficacy for personal learning adapted from scales developed by Loup (1994) and anchored in the rich theoretical social learning constructs reflected in the work of Bandura (1982; 1993). These particular criterion measures were included in the study to examine the viability of linking students' perceptions of the degree to which their personal learning is enhanced to personal motivation and constructivist learning variables as a means of understanding broader sets of validity issues (e.g. Messick, 1995) such as the meaning and consequences for students of increasing the quality of teaching and learning in college classrooms.

Self-Efficacy Beliefs

A key personal, self-perception construct posited as important to social learning is self-efficacy. As conceptualized by Bandura (1977), self-efficacy is an important mediating link between cognition and behavior. The self-efficacy construct is viewed as highly situational and consists of competency and motivational factors which subsequently affect an individual's ability to organize and execute courses of action required to attain various types of goals and/or performances (Bandura, 1977, 1982, 1986, 1993, 1995). In addition, personal perceptions of efficacy and resulting actions are influenced by factors in the environment. Thus, self-efficacy can be understood as involving a complex interplay between perceptions of ability to perform an

activity/skill (competence) and judgments of what can be accomplished given the context/resources in the environment (motivation). Such perceptions, in concert, affect an individual's behavior/performance in the environment.

Researchers and theorists in psychology have suggested that high self-efficacy beliefs enhance motivation (Bandura & Cervone, 1983), promote higher goal-setting behaviors, and influence persistence and commitment to goal accomplishment (Latham & Locke, 1986; Locke, Shaw, Saari, & Latham, 1981; Mento, Steel, & Karren, 1987). Bandura (1977) suggests that perceptions of competence can be manifest in motivational behaviors. For example, if an individual believes he/she is competent enough to execute a set of behaviors that will produce certain outcomes, then he/she is more likely to attempt to initiate the relevant behaviors and is likely to persist in activities (in spite of obstacles and/or failure) that are related to accomplishment of desired outcomes.

Most measures of self and collective efficacies attempt to measure personal perception of confidence or beliefs in abilities to make things happen without adequate specification of what those **things** are (Bandura, 1995; Pajares, 1996). Furthermore, Pajares (1996) states that..."omnibus measures that attempt to assess general self-efficacy, for example, provide global scores that decontextualize the self-efficacy/behavior correspondence and transform self-efficacy into a generalized personality trait rather than the context-specific judgment Bandura (1977, 1986, 1993, 1995) suggest." Most recently, however, a new self and organizational efficacy assessment instrument was developed for use in schools to measure personal, motivational elements of the efficacy construct in terms of effort and persistence toward achieving specific goals

(Loup & Ellett, 1995). The measure attempt to contextualize self-efficacy behavior by requiring respondents to consider the particular context (i.e., school, classroom, etc.) in which specific goals might be achieved. In the initial instrument validation study, Loup (1994) investigated teacher self and organizational efficacy motivation in schools. In further studies the measure showed considerable utility for use across organizational contexts such as a state social agency (Ellett, 1995), and in faculty higher education settings (Clarke, Ellett, Bateman, & Rugutt, 1996). In this study, the measure was adopted to assess both perceptions of competence and motivation to achieve classroom goals in a higher education setting.

While there have been numerous studies that have investigated study self-efficacy in classrooms in K-12 academic settings (Multon, Brown, & Lent, 1991), most studies of college students' efficacy have been related to career decision-making (Peterson & delMas, 1996), student perceptions of classroom control (Furio, 1987), and expected and achieved grades (Locke & Bryan, 1968). Few studies have been conducted using the construct as it relates to student learning in higher education settings.

Learning Environments

Studies of learning environments, particularly during the past 25 years, have rapidly drawn the interests of educational researchers and theorists. In recent decades, there a large number of studies of learning environments concerned with conceptualization and theory development, measurement and unit of analysis issues, and utilization of measurement results for curriculum development, arranging more optimal functioning environments for students and for monitoring and improving schools have been completed (Fraser, 1986; 1989; Fraser & Walberg, 1991).

In the 1970s and 1980s, learning environment research followed a traditional pattern of the development of Likert type measures for different class and school-level psychosocial constructs which were subsequently validated against a variety of student outcomes. More recently, greater diversity of methodologies and constructs has begun to appear in the literature, spanning a wide range of issues from appropriate epistemologies of learning (e.g., post positivist vs constructivist views), the use of multiple methodologies, appropriate units of analysis and the value-addedness of mixed quantitative and qualitative methodologies. A summary of recent research on learning environments and recent examples of this great diversity can be found in McRobbie & Ellett (1997).

The diversity of approaches to studying educational learning environments is providing new and enriched understandings. However, the vast majority of learning environment studies to date have been completed in elementary and secondary schools and classrooms. fewer such studies have been completed in higher education settings with college and university students. This paper describes the results of a large study reflecting concern for students' learning environment perspectives at the post secondary level.

Purpose

The purpose of this paper is three-fold: 1) to describe an adaptation to higher education contexts of a constructivist-based, student personal learning environment measure originally developed for studies of secondary school science laboratory learning environments (Fraser, et al., 1996); 2) to discuss the results of an initial study designed to explore the structure and criterion-related validity characteristics of a new student perceptions measure of teaching and learning environment characteristics that enhance student learning in college classrooms; and 3)

to show how these different learning envionment measures relate to each other and to students' global evaluations of their course experiences and the emphasis given in their courses to various forms of knowledge.

Methodology

Sample

The sample for the study consisted of all students (n=2190) in 145 classes offered through the Evening School, Division of Continuing Education at Louisiana State University during the 1996 fall semester. The classes represented a mixture of traditional undergraduate curricula (e.g. math, natural science, social science, humanities). Forty percent of these students were male and 60% were female. Percentages of students by various age groupings were as follows: 17 - 20 yrs. of age (23%); 21-25 (45%); 26-30 (11%); and 31 and over (20.4%). Forty percent of these students stated that they were full time employed.

Within each class, students were administered a packet that included a demographic information form, and three separate measures of 1) assessments of the quality of teaching and learning; 2) personal perceptions of the learning environment; and 3) motivation and outcomes expectancy assessments of personal learning efficacy.

Measures

Student Assessment of Teaching and Learning

A revised (shortened) form of the Student Assessment of Teaching and Learning (SATL) (Evans & Ellett, 1992) was used to measure student perceptions of enhancement of personal learning. The revised SATL (Ellett, Culross, McMullen & Rugutt, 1996), consists of 25 items reflecting classroom events/conditions/teaching practices (e.g., *The kind and number of thought-*

provoking questions asked...to which students respond in view of the extent to which **their personal learning is enhanced** using a three-point scale: Learning (1) NOT ENHANCED; (2) SOMETIMES ENHANCED; or (3) ALMOST ALWAYS ENHANCED. The 25 items were selected from the earlier form of the SATL for this study giving practicl consideration to the length of the survey task, and to the results of item content reviews to select items believed to have the greatest generalizability across multiple classroom and course contexts. The 25 items comprising the short form of the SATL used in this study are included in Table 1 and are also shown on page one and the top of page two in the data collection packet in Appendix A.

Students' Learning Environment Perceptions

Students' personal perceptions of the learning environment were assessed using a modified form of the Science Laboratory Environment Inventory (SLEI) (Fraser, et al., 1996), a constructivist learning-based measure originally designed for use with secondary school students in Australia. The SLEI was modified for this study by deleting 28 of the original 80 items judged as somewhat irrelevant to the college context and/or items that appeared to lack generalizability across the content of various courses (e.g., *I explain the meaning of statements, diagrams and graphs*). Students respond to the frequency of occurrence of each SLEI item with a five-point Likert scale ranging from 1=ALMOST NEVER to 5=ALMOST ALWAYS. The revised (shortened) version of the SLEI used in this study is shown on page five of the data collection packet included in Appendix A.

Student Learning Efficacy

Students' personal efficacy motivation and outcomes expectancy levels were assessed with six items designed to measure individual levels of effort/motivation/persistence, knowledge and

ability, personal responsibility, and perceived success in enhancing personal learning. Each item was responded to using a five-point Likert scale ranging from 1=LITTLE or NONE to 5=A LARGE AMOUNT (e.g., *How much effort did you put forth in this course to enhance your own learning*?). The measure developed for use in this study, Student Learning Efficacy Assessment (SLEA) (Ellett & Loup, 1996), is a revised form of the Teacher Self and Organizational Efficacy Assessment (TSOEA) (Loup & Ellett, 1994). It was developed to measure student personal perceptions of motivation/persistence and ability to attain learning goals.

Factor analyses of the SLEA measure using the sample of students in this study (n=2,190) provided strong support and corroboration of prior findings (McMullen, Ellett, Culross, Loup, & Rugutt, 1997) that the SLEA measures a single personal learning efficacy dimension. A one-factor solution of the SLEI items using this large sample accounted for 49.1% of the total variance in the solution. The six items comprising the SLEA are shown in Appendix A on page four of the data collection packet.

Student Summative Judgments

Students were asked to make summative judgments about several course-related factors. These included emphasis given to various types of learning during the course (learning factual information, developing concepts, understanding and applying principles and rules, understanding and applying theories, critical analysis and problem solving, creative thinking, developing professional, career and job-related skills, developing written communication skills, and developing oral communication skills). Each of these items was rated using a four-point Likert scale ranging from (1)=NO EMPHASIS to (4) VERY MUCH EMPHASIS. The results of recent factor analyses of these items identified two salient factors: (1) Higher Order Thinking Skills

(HOTS); and (2) Personal and Applied Knowledge (PAK) (Ellett, et al., 1996). The HOTS was defined by the first five course emphasis items (see above), with item/factor loadings ranging from .63 to .82 accounting for 33.7% of the variance in the solution. The PAK dimension consisted of the second five emphasis items (see above), with item/factor loadings ranging from .58 to .84 accounting for 30.1% of the total variance in the solution. Students were also asked to grade the quality of teaching in the course and to arrive at an overall course grade using a 100-point scale. These summative judgment data were used as dependent variables in various regression analyses copleted. The HOTS and PAK items and course summative grading scales are shown on page two of the data collection packet included in Appendix A.

Data Collection Procedures

Data were collected for the study using individual instrument packets that were distributed to students within each of the 145 classes in the sample. General instructions about the purpose of the study were provided by faculty. After explaining the purpose of the study, the fact that student anonymity was assured, and encouraging participation, faculty members left their classrooms while students completed the set of measures. All completed packets were sealed in envelopes and collected for data processing by the faculty member upon returning to the classroom, or by a designated student.

Data Analyses

A variety of data analyses were completed on the learning enhancement, personal learning environment, and efficacy measures and the demographic information form. These included descriptive statistical summaries, extensive factor analyses of the three different measures to identify underlying constructs using students as the units of analysis, Alpha reliabilities of

subscales identified through final factor analysis solutions, bivariate intercorrelations among variables and four separate regression analyses using the four summative, global student judgment variables as dependent variables to explore multivariate linkages between student learning efficacy, learning environment perceptions, and the quality of teaching and learning. A fifth regression analysis was completed using the student efficacy measure as a dependent variable and the learning environment measures as an independent variable set. Seven classes with five or fewer students were eliminated from the analyses that used class means as the units of analysis. Thus, the sample size for these analyses was 138 classes.

Results

Table 1 presents a summary of individual item means and standard deviations for the Student Assessment of Teaching and Learning (SATL) measure for the sample of 2,190 students. Item mean scores ranged from a high of 2.76 (#6, *The instructor's enthusiasm for teaching, learning and the subject taught*) to 2.36 (#15, *The extent to which students learn from one another*). Standard deviations varied from .74 (#14, *The extent to which students are involved in discussions among themselves*) to .51 (Item #6). All item mean scores exceeded to scale midpoint (2.00) and all but two (#15 and #14) were at or exceeded 2.50.

The SATL data were subjected to a series of exploratory, principal components analyses first extracting one, and then multiple factors. Table 2 summarizes the results of a two-factor, principal components solution with orthogonal rotation of factors that best fit the data. Included in the table are item communalities, item/factor loading coefficients (correlations), and eigen values and variances explained for the total solution and for each of the two factors. This two-factor solution accounted for a total of 55.9% of the total variance in the data. The patterning

of item/factor loadings shown in Table 2 was used to identify two SATL measurement dimensions. The first dimension consisted of 17 items (#s 1-7, 10, 11, 16, 17, 19-21, 23-25) and the second dimension consisted of 5 items (#s 8, 9, 13-15). Items were retained on a particular factor if the minimum loading was at least .33. Items loading above .33 on both factors were retained on the factor with the highest loading if the difference between the squared loadings was at or exceeded .10. Three items failed to meet these selection criteria (#s 12, 18, 22). Review of the content focus of the items loading on the two factors suggested that Factor I items measure a construct reflecting the **general quality of teaching and learning** (QTL). The second factor reflects students' perspectives of **motivation and involvement in learning activities** (MI). Using class means (n=138) as the units of analysis, the intercorrelation between the OTL and MI factors identified in this solution was .74 ($p<.0001$).

Table 3 shows means and standard deviations for the shortened version of the Science Laboratory Environment Instrument (SLEI). Item means ranged from a low of 2.86 (#30, *I solve problems by obtaining information from the library)* to a high of 4.44 (#38, *I try to understand the work in this class*). SLEI item standard deviations varied from a high of 1.53 (#44, *I work in groups in this class*) to a low of 0.87 (#38, *I cooperate with other students when doing assigned work)*. Only six of 52 SLEI item means were below the scale midpoint (3.00), and 17 of 52 item means exceeded 4.00.

The SLEI data were also subjected to a series of extensive factor analyses using procedures similar to those described above for the SATL. Table 4 shows item communalities and the patterning of SLEI item/factor loadings for the final four-factor, orthogonal, principal components solution. The item numbers in Table 4 can be cross-referenced for content with the

item statements included as page 5 in Appendix A. Eight of the 52 SLEI items had a factor complexity greater than one and were therefore excluded from the composition of the final subscales. The results of these analyses provided considerable support for four SLEI measurement dimensions. The four factors identified and the number of items operationalizing each was as follows: (1) (Learning/Equity and Clarity) (LEQCLAR) (15); (2) Relationships with Other Students (ROS) (13); (3) Personal Involvement of Students (PIS) (11); and Teacher/Student Relations (TSR) (5). These dimensions collectively accounted for 60.6% of the item variance in the solution (LEQCLAR, 17.9%; ROS, 16.6%; PIS, 14.7%; TSR, 10.9%). Intercorrelations among the four SLEI dimensions using class means (n=138) as the units of analysis were as follows: LEQCLAR/ROS (.38); LEQCLAR/PIS (.48); LEQCLAR/TSR (.71); ROS/PIS (.68); (ROS/TSR (.68); PIS/TSR (.74). All of these correlation coefficients were statistically significant ($p<.0001$). The number of items comprising each of the factored SLEI measurement dimensions and sample items operationalizing each dimension are included in Appendix A.

For the five Higher Order Thinking Skills (HOTS) items, means for *emphasis placed on types of learning* ranged from a low of 3.11 (*critical analysis and/or problem solving*) to a high of 3.31 (*developing concepts*). All five HOTS item means exceeded 3.00 (four-point scale). For the Personal and Applied Knowledge (PAK) items, means ranged from 2.68 (*developing oral communication skills*) to 3.07 (*creative thinking*). The mean score for the summative course evaluation judgement (*How would you grade the quality of teaching in this course*?) was 89.8 (100-point scale) and the summative judgement for, *How would you grade this course overall*?, was 88.4.

Items means for the Student Learning Efficacy Assessment (SLEA) measure varied from a low of 4.03 (*How much effort did you put forth in this course to enhance your own learning*?) to a high of 4.44 (*If you were repeatedly failing in this course, how much effort and persistence would you put forth to continue to enhance your own learning*?). All six SLEA item means exceed 4.00 on the five-point scale used. The SLEA mean score for the total sample of 138 classes was 25.4 (74% of the maximum possible score of 30).

Cronbach Alpha internal consistency reliability coefficients were computed for each of the measurement dimensions of the SATL, SLEI, SLEA, HOTS and PAK measures. These results are shown in Table 5. The range in these coefficients was from .95 (QTL and LEQCLAR) to .78 (SLEA). All of the SLEA dimension reliabilities exceeded .92. The student summative judgment dimension reliabilities were somewhat lower (HOTS =.83; PAK =.87) than those for the SLEA dimensions.

Bivariate correlations between the SATL dimensions [Quality of Teaching and Learning (QTL) and Motivation/Involvement in learning (MI)] and the measurement subscales of the PLEA, SLEA, learning emphasis and summative course evaluation variables, using class means as the units of analysis are shown in Table 6. The correlations between the SATL dimensions and the PLEA subscales were all statistically significant ($p<.0001$), positive in direction and moderate ($r=.42$, QTL/ROS) to rather strong ($r=.78$, MI/TSR) in magnitude. The SATL and SLEA correlations were also statistically significant and positive in direction, but were rather weak in magnitude. The learning emphasis variables (HOTS and PAK) were also positively and significantly correlated with the SATL measurement dimensions, with correlations ranging from

.59 (MI/HOTS) to .81 (MI/PAK). The two student summative course evaluations (Quality of Teaching and Overall Course Grade) variables were also positively and significantly ($p<.0001$) correlated with the two SATL dimensions. These correlations were rather strong in magnitude and ranged from .65 (MI/QT) to .85 (QTL/QT).

To explore predictive models with the learning emphasis criteria, the Higher Order Thinking Skills (HOTS) and Personal and Applied Knowledge (PAK) variables were regressed on the set of SATL, SLEI and SLEA variables in separate analyses using standard stepwise procedures. For the HOTS analysis, the SATL Quality of Teaching and Learning (QTL) variable and the SLEA Personal Involvement of Students (PIS) variables produced a statistically significant multiple correlation ($R=.80$, $p<.001$) accounting for 64% of the total variation in HOTS across the sample of 138 classes.

A similar analysis using the PAK measure as the dependent variable yielded a statistically significant multiple correlation of $R=.88$ ($p<.001$) which was accounted for by four variables in the following order: 1) SATL Motivation and Interest (MI); 2) SLEI Personal Involvement Of Students (PIS); SLEI Relationships with Other Students (ROS); and the SATL Quality of Teaching and Learning (QTL). These four variables accounted for 78 percent of the total PAK variance among the 138 classes. In each of these regression analyses, variables entering the equations beyond the first step, though statistically significant given the sample size ($n=138$), accounted for rather small amounts of HOTS and PAK variance among classes.

In two additional regression analyses, the two student summative course evaluation judgments (Quality of Teaching and Overall Course Grade) (100 point scales) were also regressed on the SATL, SLEI, SLEA variables as an independent variable set. The results of these analyses

showed that variation among the sample of 138 classes in students' quality of teaching (QT) summative judgements was largely explained by two variables (in order): 1) The SATL Quality of Teaching and Learning (QTL) measure; and 2) the PLEI Learning Equity and Clarity (LEQCLAR) measure. These two variables yielded a multiple correlation of R=.85 ($p<.001$) and accounted for 73% of the variation in students' summative judgments about the overall quality of teaching among classes. A similar analysis was completed using students' summative judgments of an overall course grade as the dependent variable and the SATL, SLEI, SLEA measures as an independent variable set. The results of this analysis showed that the following three variables (in order) accounted for 69% of the variance among classes: 1) SATL Quality of Teaching and Learning (QTL); 2) SLEA; and 3) PLEI Teacher/Student relations (TSR). These three variables produced a multiple correlation of R=.83 ($p<.001$).

A final stepwise regression was completed using the SLEA (Student Learning Efficacy) measure as the dependent variable and the SATL and SLEI factored variables as a independent variable set using class means (n=138) as the units of analysis. This analysis yielded a multiple correlation of R=.42 ($p<.001$) and a two-variable model consisting of (in order) the SLEI LEQCLAR scale and the SLEI ROS scale. Together these two variables accounted for 18% of the variation in student learning efficacy among classes.

Because of the stepwise procedure used in the various regression analyses completed, the variable entered at the first step of an analysis predominantly accounted for most of the variation in the criterion variable.

Discussion

This study was designed to explore relationships among college students' perceptions of their personal (constructivist-based) learning environments (Fraser, et al., 1996), the extent to which they view selected teaching and learning activities as enhancing their personal learning, and their personal learning efficacy. In addition, it was of interest to examine the extent to which various kinds of learning (higher order thinking skills and personal and applied knowledge), and students' global judgements of course quality were related to these various measures. The results of the study are interesting from a variety of perspectives.

First, the results support the viability of adapting//adopting the Science Laboratory Environment Inventory (SLEI) (Fraser, et al., 1996), an instrument originally developed for use in secondary classrooms, to the college classroom setting. As shown in this study, the revised (shortened) version of the SLEI consists of four separate measurement dimensions that reflect college students' personal learning environment perceptions of: 1) learning equity and clarity of learning goals and tasks; 2) cooperative learning relationships with other students; 3) personal involvement (engagement) of students in learning tasks; and 4) the teachers' interest and involvement with students. According to Fraser et al., (1996), the original SLEI tested consisted of seven subscales (student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation and equity). The factor analysis results of this study seem conceptually consistent with the original classification/verification of the SLEI items into subscales. It should be recalled, however that the version of the SLEI used in this study was developed by deleting 28 of the original 80 items deemed not appropriate to, and/or not generalizable across, varied higher education classroom contexts and course contents. The results reported here provide support for overlap between the shortened version of the SLEI and the original SLEI on

constructs reflecting learning equity, teacher support, student involvement in learning tasks, and cooperation and cohesiveness in learning tasks among class members. Thus, core constructs of the original SLEI appear to rather uniformly tap students/ personal learning environment perceptions in both secondary and post-secondary classrooms settings.

Second, the results speak to two somewhat different but conceptually related measures, and to new perspectives on the study of learning environments in higher education settings. A new measure of interest in this study was the short form of the Student Assessment of Teaching and Learning (SATL) (Ellett, et al., 1996) designed to assess college students' perceptions of the extent to which various teaching and learning activities and classroom events enhance their personal learning. Unlike the SLEI described above, the SATL requests that students make self-reflective judgments about teaching and learning environment elements from the perspective of *the extent to which personal learning is enhanced.* The SLEI response format, on the other hand, requests a *personal reporting of students' observations and feelings about classroom activities and events, and personal behaviors* related to class activities (see Appendix A).

The SATL response format is believed to be unique among the large number of measures available that typically evaluate college classes, courses and instructors (Evans & Ellett, 1992). However, this response format may also be a useful in the further development of contructivist-based measures of the personal learning environment. Though considerable work has already begun on the development of such measures (e.g, with the original personal and class forms of the SLEI, Fraser et al., 1996), the response format of the SATL might add to these endeavors through future research. Measuring students' personal reports of observations, classroom events and activities as done with the SLEI, while refreshing and quite useful, does not seem to reflect

the importance of how these activities, events, behaviors and experiences relate to teaching and learning quality and student motivation and involvement factors that enhance students' personal learning.

From the criterion-related validity perspective, correlations between the SATL and SLEI subscales generated in this study, suggest that students' personal (constructivist-based) perceptions of characteristics of the learning environment and their self-reported experiences and behaviors as measured (SLEI), are significantly related to their self reports of learning enhancement (SATL). This finding might partially be explained by some degree of conceptual overlap between the SLEI and SATL items. Though not exactly phrased the same way, the two pools of items reflect some common teaching and learning environment constructs such as interpersonal climate, clarity, learning equity, encouragement and enthusiasm, student motivation and involvement, and so on. Interestingly, the two measures were developed, at different times, by different researchers, and for different reasons.

Factor analyses of the SATL for this large sample (n=2190) of university students shows that the SATL measures two distinct dimensions of students' perceptions: 1) the extent to which personal learning is enhanced by the general quality of teaching and learning activities; and 2) the extent to which personal learning is enhanced by student motivation, interest and involvement in teaching and learning activities. The distribution of SATL items on these two dimensions suggests that additional development of the motivation/interest/involvement dimension is needed. Though developed with orthogonal factor analysis solutions, the two SATL dimensions were positively and rather strongly related to each other ($r=.74$, $p<.0001$). Thus, the SATL taps two

distinct measurement constructs, which in the reality of classroom life in higher education settings, appear to be highly interrelated in facilitating students' personal learning.

Third, and of particular interest in the study, was the finding that both student perceptions of the personal learning environment and assessments of teaching and learning are positively (though rather moderately) correlated with students' assessments of their personal efficacy for learning. However, when considered in combination, the SLEI Learning Equity and Clarity (LEQCLAR) and Relationships with Other Students (ROS) subscales explained the majority of variance in student learning efficacy across the sample of 138 classes. These findings suggest that building an equitable and cooperative learning environment in which course activities and learning goals are clear may be an important element of enhancing students' efficacy for learning and subsequent academic success.

It should be noted here that the correlations between the efficacy measure and the SLEI and SATL measures may have been attenuated by low reliability and ceiling effects for this sample of university students. This interpretation of these results seems in order since university students' efficacies for learning are typically high as a result of a lifetime of experiencing rather positive academic experiences. In addition, it has recently been noted by Pajares (1997), that generalized measures of academic efficacy designed to measure broad academic domains (in this case the particular, entire course), may be both conceptually and psychometrically problematic. In this regard, there is a constant tension in collecting student academic efficacy data between the convenience and practicality of using standard, global measures, and the need to address individual differences among students in various potential academic efficacies, *within courses*. Thus, in a math class, Bandura's (1982; 1993) views of the task specificity of human efficacy

suggest that a given student could posses quite different levels of efficacy related to solving numerical equations, as opposed to solving word problems.

.The results linking the SLEI and SATL dimensions to the efficacy measure show that students' views about the quality of teaching and learning in university classrooms can be meaningfully linked to theoretically rich criterion variables such as the personal learning environment of students (Fraser et al., 1996) and personal efficacy for learning (Bandura, 1982; 1993). These findings make intuitive sense, but more importantly they provide information useful for assessing and arranging more positive, functioning learning environments at the college level...perhaps particularly for marginal students with low levels of academic efficacy in various subjects.

Fourth, in this study students were also asked: 1) to provide information about the emphasis given in their courses to higher order thinking skills and to personal and applied forms of knowledge; and 2) to make summative, global evaluations of the quality of teaching and the overall merit of the course. Variation in knowledge judgements from class to class was best explained by the SATL quality of teaching and learning (QTL) and motivation, interest and involvement (MI) subscales, in combination with SLEI subscales tapping student perceptions of relationships with other students and personal involvement in learning. Thus, both personal learning environment and enhancement of learning perceptions are rather strongly and positively linked to how students' view the relative emphasis given to various forms of knowledge in higher education settings.

Students' global, summative judgements (course grades) were also positively and strongly linked to their learning enhancement and environment perceptions as measured by the SATL and

the SLEI. The strongest linkage was established between students' global course evaluations (course grade ratings) and students' perceptions of the degree to which teaching and learning activities enhanced their learning. These results strongly suggest that students' overall evaluations of courses in higher education settings are defined in terms of how they view these courses as contributing to their personal learning. To the extent that students' learning enhancement perspectives are valued as criteria, these results show considerable validity for students' global, end-of-course evaluations. From a somewhat different and more global perspective, this finding adds to the somewhat mixed literature reflecting past attempts to validate student ratings of teaching and courses in higher education settings using academic performance criteria (Cohen, 1981; Centra, 1993).

In pointing out the importance of student reflection on learning as part of course evaluations in higher education settings, McKeachie and Kaplan (1996) recently stated:

> There is, however, a value that we have failed to emphasize in our use of student ratings of teaching: that is, the potential benefit to students' own learning that can occur in the process of filling out rating forms. Student ratings of teaching should encourage students to *think* about their educational experiences --- to develop clearer conceptions of teaching and educational experiences that contribute most to their learning. (pp.5-6)

McKeachie and Kaplan further express the viewpoint that:

> student ratings of their *own* learning, of their own achievement of course goals (such as critical thinking), and of their own motivation for further learning in the area of course evaluations are preferable to their evaluations of *teacher* characteristics. (p.7)

Finally, and following Mckeachie and Kaplan's perspectives, the *enhancement of learning* response format of the SATL, the constructivist-based format of the SLEI, the personal efficacy focus of the SLEA, and the other variables explored in this study seem to speak directly to

ongoing concerns about the need to improve teaching and learning environments in higher education settings. Collectively they represent a set of important but related measurement constructs that, when combined with personal reflection and ongoing assessment processes, have much potential for improving learning environments in higher education settings, and perhaps other education settings as well.

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APPENDIX A

Data Collection Packet/Study Measures

Factored SLEI Dimensions and Sample Items Operationalizing Each Dimension

STUDENT ASSESSMENT OF TEACHING AND LEARNING

Louisiana State University

INSTRUCTIONS TO RESPONDENTS

This form is designed to assess teaching and learning in college classes. There are three parts to the instrument. Part I asks questions about teaching, learning and course characteristics. Part II asks about the type of learning in the course. Part III asks for overall evaluations of the course and additional comments.

DIRECTIONS: Part I
Enhancement of Student Learning

Three scale points are provided for each item. Read each item carefully and then select the one scale point which best reflects your judgement about the teaching/learning or course characteristic.

The three scale points that follow must be *read carefully* before completing the assessment form. Refer to these scale point descriptions as you read and score each item.

1 = Learning NOT Enhanced

2 = Learning SOMETIMES Enhanced

3 = Learning ALMOST ALWAYS Enhanced

PLEASE CAREFULLY READ AND SCORE EACH ITEM INDEPENDENTLY. That is, try not to let your response to one item influence your response to the next item.

All responses are strictly confidential. You do not need to sign your name anywhere on this instrument.

Student Assessment of Teaching and Learning

This form is to be used by students to assess the quality of teaching and learning and other course-related factors. Use a #2 Pencil only in completing your response to each item.

PART I: ENHANCEMENT OF STUDENT LEARNING

DIRECTIONS: Please carefully reflect upon your experiences as a learner in the course you are evaluating, read each item carefully, and bubble in one scale point that best reflects your assessment of the teaching/learning and/or course characteristic. This part requests that you do more than rate the instructor. Instead, consider the degree to which each item enhanced your learning as a student. Use the scale provided below in assessing each item.

SCALE

1 = Learning NOT Enhanced
2 = Learning SOMETIMES Enhanced
3 = Learning ALMOST ALWAYS Enhanced

CLARITY
CLIMATE

1. Clarity with which the course objectives are communicated	①	②	③
2. Clarity with which student responsibilities and expectations are explained	①	②	③
3. Use of class time	①	②	③
4. Outside assignments and integration of outside assignments with other course activities	①	②	③
5. Teaching and learning techniques used during the course	①	②	③
6. The instructor's enthusiasm for teaching, learning and the subject taught	①	②	③
7. The interpersonal climate in the classroom (e.g., patience, courtesy, respect)	①	②	③
8. Encouragement for students to express their own ideas	①	②	③
9. Encouragement for students to participate in discussions	①	②	③
10. Clarity and understandability of the instructor's speech	①	②	③
11. Directions and explanations given for course content	①	②	③
12. The kind and number of thought-provoking questions asked	①	②	③
13. The extent to which students are encouraged to compare and contrast ideas ✓	①	②	③
14. The extent to which students are involved in discussions among themselves ✓	①	②	③
15. The extent to which students learn from one another	①	②	③
16. The degree to which the instructor helps students organize information and understand relationships among various topics	①	②	③
17. Explanation(s) given for difficult material/ideas	①	②	③
18. Encouragement for students to ask questions E N C	①	②	③
19. Clarification of content/ideas when confusion exists	①	②	③
20. Feedback about learning provided during teaching and learning activities	①	②	③
21. The extent to which adjustments are made in a lesson when needed	①	②	③
22. The degree to which students are encouraged to apply course content to solve problems or to understand real life situations S N C	①	②	③
23. The quantity/quality of feedback provided on graded work	①	②	③

SCALE

1 = Learning NOT Enhanced
2 = Learning SOMETIMES Enhanced
3 = Learning ALMOST ALWAYS Enhanced

24. The quantity/quality of feedback provided on tests given ① ② ③

25. The extent to which students are provided opportunities to determine their progress in the course ① ② ③

PART II: TYPES OF LEARNING

DIRECTIONS: Use the four-point scale below to evaluate the degree to which each type of learning is emphasized in this course. (DO NOT rate how <u>much</u> you have learned ...Only the amount of emphasis given to each <u>type</u> of learning).

1 = No emphasis
2 = Some emphasis
3 = Much emphasis
4 = Very much emphasis

E

Rate the emphasis placed on each type of learning listed below:

26. learning factual information ① ② ③ ④

27. developing concepts ① ② ③ ④

28. understanding and applying principles and rules ① ② ③ ④

29. understanding and applying theories ① ② ③ ④

30. critical analysis and/or problem solving ① ② ③ ④

31. creative thinking ① ② ③ ④

32. developing knowledge of self and others ① ② ③ ④

33. developing professional, career, and job-related skills ① ② ③ ④

34. developing written communication skills ① ② ③ ④

35. developing oral communication skills ① ② ③ ④

PART III: OVERALL COURSE EVALUATION

DIRECTIONS: Use the 100-point scale provided below and pencil in the appropriate spaces in "tens" and "ones" that best reflect the numerical grade you would give this course for each of the three items that follow.

SCALE
A = 90 - 100
B = 80 - 89
C = 70 - 79
D = 60 - 69
F = Below 60

36. How would you grade the quality of teaching in this course?
Tens ⓪①②③④⑤⑥⑦⑧⑨
Ones ⓪①②③④⑤⑥⑦⑧⑨ 100 ○

37. What was the contribution of the course to your personal learning?
Tens ⓪①②③④⑤⑥⑦⑧⑨
Ones ⓪①②③④⑤⑥⑦⑧⑨ 100 ○

38. How would you grade this course overall?
Tens ⓪①②③④⑤⑥⑦⑧⑨
Ones ⓪①②③④⑤⑥⑦⑧⑨ 100 ○

DEMOGRAPHIC INFORMATION

Sex : ○ Male
○ Female

Age : ○ 17 - 20
○ 21 - 25
○ 26 - 30
○ 31 and Over

Degree seeking : ○ Yes
○ No

Are you in the PASS program? ○ Yes
○ No

Do you work full time? ○ Yes
○ No

Do you take classes: ○ during the day
○ during the evening
○ both day and evening classes

LSU Evening School
Student Opinionnaire

Directions: Please respond to each of the following items by filling in the number that best reflects your opinion about each question.

1. How much effort did you put forth in this course to enhance your own learning?

Little or None		Some		A Large Amount
①	②	③	④	⑤

2. When there were difficult or uncertain obstacles to overcome in learning/achieving in this course, how much effort and persistence did you put forth to enhance your own learning?

Little or None		Some		A Large Amount
①	②	③	④	⑤

3. If you were repeatedly failing in this course, how much effort and persistence would you put forth to continue to enhance your own learning?

Little or None		Some		A Large Amount
①	②	③	④	⑤

4. How much knowledge and/or ability do you think you have to accomplish your learning objectives in this course?

Little or None		Some		A Large Amount
①	②	③	④	⑤

5. How much personal responsibility do you think you have to accomplish your learning objectives in this course?

Little or None		Some		A Large Amount
①	②	③	④	⑤

6. To what extent do you believe your efforts can accomplish the learning objective of this course?

Not at All		Somewhat		To a Large Extent
①	②	③	④	⑤

LSU Evening School
Student Opinionnaire

Directions: Please respond to each of the following items by filling in the number that best reflects your opinion about each question.

1. How much <u>effort</u> did you put forth in <u>this course</u> to enhance your own learning?

Little or None		Some		A Large Amount
①	②	③	④	⑤

2. When there were difficult or uncertain obstacles to overcome in learning/achieving in <u>this course</u>, how much <u>effort and persistence</u> did you put forth to <u>enhance your own learning</u>?

Little or None		Some		A Large Amount
①	②	③	④	⑤

3. If you were repeatedly failing in <u>this course</u>, how much <u>effort and persistence</u> would you put forth to continue to <u>enhance your own learning</u>?

Little or None		Some		A Large Amount
①	②	③	④	⑤

4. How much <u>knowledge and/or ability</u> do you think you have to <u>accomplish your learning objectives</u> in <u>this course</u>?

Little or None		Some		A Large Amount
①	②	③	④	⑤

5. How much <u>personal responsibility</u> do you think you have to <u>accomplish your learning objectives</u> in <u>this course</u>?

Little or None		Some		A Large Amount
①	②	③	④	⑤

6. To what extent do you believe your efforts can accomplish the learning objective of <u>this course</u>?

Not at All		Somewhat		To a Large Extent
①	②	③	④	⑤

Please fill in the number on the scale at the right which best reflects your feelings.

In this class:	Almost Never	Seldom	Some-times	Often	Almost Always
1. I make friendships with other students.	①	②	③	④	⑤
2. I know other students.	①	②	③	④	⑤
3. I do favors for members of this class.	①	②	③	④	⑤
4. Students help me with my learning.	①	②	③	④	⑤
5. I help other class members who are having trouble with their work.	①	②	③	④	⑤
6. In this class, I am able to depend on other students for help.	①	②	③	④	⑤
7. The teacher takes a personal interest in me.	①	②	③	④	⑤
8. The teacher considers my feelings.	①	②	③	④	⑤
9. The teacher helps me when I have trouble with the work.	①	②	③	④	⑤
10. The teacher talks with me.	①	②	③	④	⑤
11. The teacher moves about the class to talk with me.	①	②	③	④	⑤
12. It is all right for me to tell the teacher that I do understand.	①	②	③	④	⑤
13. The teacher's questions help me to understand.	①	②	③	④	⑤
14. I discuss ideas in class.	①	②	③	④	⑤
15. I give my opinions during class discussions.	①	②	③	④	⑤
16. My ideas and suggestions are used during classroom discussions.	①	②	③	④	⑤
17. I explain my ideas to other students.	①	②	③	④	⑤
18. Students discuss with me how to go about solving problems.	①	②	③	④	⑤
19. I discuss different answers to questions.	①	②	③	④	⑤
20. I have a say in how my class time is used.	①	②	③	④	⑤
21. I have a say in deciding what activities I do.	①	②	③	④	⑤
22. I have a say in deciding how my learning is assessed.	①	②	③	④	⑤
23. The teacher decides when I move on to a new topic.	①	②	③	④	⑤
24. I am given a choice of topics for assignments.	①	②	③	④	⑤
25. I work at my own pace.	①	②	③	④	⑤
26. I carry out investigations to test my ideas.	①	②	③	④	⑤
27. I am asked to think about the evidence for statements.	①	②	③	④	⑤
28. I carry out investigations to answer questions coming from discussions.	①	②	③	④	⑤
29. I carry out investigations to answer the teacher's questions.	①	②	③	④	⑤
30. I solve problems by obtaining information from the library.	①	②	③	④	⑤
31. I solve problems by using information obtained from my own investigations.	①	②	③	④	⑤
32. I know what has to be done in this class.	①	②	③	④	⑤
33. Class assignments are clear so I know what to do. ~Cl/12	①	②	③	④	⑤
34. I do as much as I set out to do.	①	②	③	④	⑤
35. I know the goals for this class.	①	②	③	④	⑤
36. I know what I am trying to accomplish in this class. Cl/12	①	②	③	④	⑤
37. I pay attention during this class.	①	②	③	④	⑤
38. I try to understand the work in this class.	①	②	③	④	⑤
39. I cooperate with other students when doing assigned work.	①	②	③	④	⑤
40. I share my books and resources with other students when doing assignments.	①	②	③	④	⑤
41. I learn from other students in this class.	①	②	③	④	⑤
42. I work with other students in this class.	①	②	③	④	⑤
43. I cooperate with other students on class activities.	①	②	③	④	⑤
44. I work in groups in this class.	①	②	③	④	⑤
45. The teacher gives as much attention to my questions as to other students' questions.	①	②	③	④	⑤
46. I get the same amount of help from the teacher as do other students.	①	②	③	④	⑤
47. I am treated the same as other students in this class.	①	②	③	④	⑤
48. I receive the same encouragement from the teacher as other students do.	①	②	③	④	⑤
49. I get the same opportunity to contribute to class discussions as other students.	①	②	③	④	⑤
50. I am asked about the same number of questions as other students.	①	②	③	④	⑤
51. My work receives as much praise as other students' work.	①	②	③	④	⑤
52. I get the same opportunity to answer questions as other students.	①	②	③	④	⑤

Factored Dimensions of the Revised Science Laboratory Environment Inventory (SLEI) and Sample Items Operationalizing Each Dimension

Dimension I: Learning Equity and Clarity (LEQCLAR)

32. *I know what has to be done in this class.*

33. *I know the goals for this class.*

47. *I am treated the same as other students in this class.*

48. *I get the same opportunity to contribute to class discussions as other students.*

Dimension II: Relationships with Other Students (ROS)

1. *I make friendships with other students.*

2. *I know other students.*

39. *I cooperate with other students hen doing assigned work.*

42. *I work with other students in this class.*

Dimension III: Personal Involvement of Students (PIS)

20. *I have a say in how my class time is used.*

21. *I work at my own pace.*

27. *I am asked to think about the evidence for statements.*

29. *I carry out investigations to answer the teacher's questions.*

Dimension IV: Teacher and Student Relationships (TSR)

7. *The teacher takes a personal interest in me.*

8. *The teacher considers my feelings.*

9. *The teacher helps me when I have trouble with the work.*

Table 1. Summary of Item Means and Stardard Deviations for the Student Assessment of Teaching and Learning (SATL) Measure (n = 2,190 Students)

	Item	$\bar{x}$	S.D.
1.	Clarity with which the course objectives are communicated	2.63	.56
2.	Clarity with which student responsibilities and expectations are explained	2.67	.54
3.	Use of class time	2.63	.59
4.	Outside assignments and integrations of outside assignments with other course activities	2.54	.65
5.	Teaching and learning techniques used during the course	2.57	.63
6.	The instructor's enthusiasm for teaching, learning and the subject taught	2.76	.51
7.	The interpersonal climate in the classroom (e.g., patience, courtesy, respect)	2.74	.52
8.	Encouragement for students to express their own ideas	2.70	.55
9.	Encouragement for students to participate in discussions	2.71	.55
10.	Clarity and understandability of the instructor's speech	2.73	.53
11.	Directions and explanations given for course content	2.64	.58
12.	The kind and number of thought-provoking questions asked	2.58	.59
13.	The extent to which students are encouraged to compare and contrast ideas	2.51	.65
14.	The extent to which students are involved in discussions among themselves	2.39	.74
15.	The extent to which students learn from one another	2.36	.72
16.	The degree to which the instructor helps students organize information and understand relationships among various topics	2.56	.63
17.	Explanation (s) given for difficult material / ideas	2.58	.62
18.	Encouragement for students to ask questions	2.71	.55
19.	Clarification of content / ideas when confusion exists	2.62	.60
20.	Feedback about learning provided during teaching and learning activities	2.58	.59
21.	The extent to which adjustments are made in a lesson when needed	2.63	.59
22.	The degree to which students are encouraged to apply course content to solve problems or to understand real life situations	2.57	.63
23.	The quantity / quality of feedback provided on graded work	2.53	.64
24.	The quantity / quality of feedback provided on tests given	2.50	.66
25.	The extent to which students are provided opportunities to determine their progress in the course	2.50	.67

Rating Scale: 1 = Learning NOT Enhanced
2 = Learning SOMETIMES Enhanced
3 = Learning ALMOST ALWAYS Enhanced

Table 2. Summary of Item Communalities and Rotated Factor Structure Coefficients for Two-Factor Solution for the Student Assessment of Teaching and Learning (SATL) Measure (n = 2,190 Students)

	Item	Communality	Factor I	Factor II
1.	Clarity with which the course objectives are communicated	.59	.74	.21
2.	Clarity with which student responsibilities and expectations are explained	.56	.72	.21
3.	Use of class time	.51	.69	.17
4.	Outside assignments and integrations of outside assignments with other course activities	.37	.49	.36
5.	Teaching and learning techniques used during the course	.61	.70	.34
6.	The instructor's enthusiasm for teaching, learning and the subject taught	.51	.61	.37
7.	The interpersonal climate in the classroom (e.g., patience, courtesy, respect)	.46	.53	.42
8.	Encouragement for students to express their own ideas	.59	.36	.68
9.	Encouragement for students to participate in discussions	.59	.33	.69
10.	Clarity and understandability of the instructor's speech	.46	.61	.30
11.	Directions and explanations given for course content	.70	.78	.23
12.	The kind and number of thought-provoking questions asked *	.32	.47	.57
13.	The extent to which students are encouraged to compare and contrast ideas	.64	.39	.70
14.	The extent to which students are involved in discussions among themselves	.69	.15	.81
15.	The extent to which students learn from one another	.63	.14	.78
16.	The degree to which the instructor helps students organize information and understand relationships among various topics	.63	.71	.36
17.	Explanation (s) given for difficult material / ideas	.69	.78	.28
18.	Encouragement for students to ask questions *	.55	.51	.54
19.	Clarification of content / ideas when confusion exists	.64	.73	.33
20.	Feedback about learning provided during teaching and learning activities	.62	.63	.47
21.	The extent to which adjustments are made in a lesson when needed	.56	.64	.39
22.	The degree to which students are encouraged to apply course content to solve problems or to understand real life situations *	.49	.47	.52
23.	The quantity / quality of feedback provided on graded work	.51	.64	.32
24.	The quantity / quality of feedback provided on tests given	.45	.61	.27
25.	The extent to which students are provided opportunities to determine their progress in the course	.45	.61	.28
	Eigen Values	13.99	8.64	5.36
	Total Varience Explained	55.9	34.5	21.4

* Item not retained in solution

Table 3

Summary of Item Means and Standard Deviations for the Revised Version of the Science Laboratory Environment Inventory (SLEI) Measure (n=2190 Students)

SLEI Item Number	Mean	S.D.
1.	3.74	1.17
2.	3.75	1.21
3.	3.30	1.28
4.	3.21	1.28
5.	3.25	1.25
6.	3.39	1.27
7.	3.58	1.24
8.	3.72	1.20
9.	3.99	1.20
10.	3.90	1.17
11.	3.32	1.35
12.	4.15	1.02
13.	3.96	1.07
14.	3.37	1.32
15.	3.36	1.34
16.	3.05	1.33
17.	3.17	1.28
18.	3.08	1.29
19.	3.19	1.25

Table 3 (Cont.)

SLEI Item Number	Mean	S.D.
20.	2.92	1.33
21.	2.99	1.34
22.	2.95	1.33
23.	3.73	1.22
24.	2.93	1.45
25.	3.39	1.34
26.	2.95	1.33
27.	3.24	1.28
28.	3.03	1.30
29.	3.09	1.29
30.	2.86	1.43
31.	3.35	1.27
32.	4.19	0.97
33.	4.20	0.98
34.	4.17	0.91
35.	4.29	0.93
36.	4.31	0.92
37.	4.34	0.87
38.	4.44	0.79
39.	4.16	1.09

Table 3(Cont.)

SLEI Item Number	Mean	S.D.
40.	3.79	1.28
41.	3.65	1.25
42.	3.57	1.33
43.	3.75	1.27
44.	3.28	1.53
45.	4.22	1.07
46.	4.06	1.19
47.	4.37	0.96
48.	4.35	0.97
49.	4.40	0.91
50.	4.21	1.08
51.	4.18	1.08
52.	4.38	0.94

Table 4

Item Communalities and Item/Factor Loadings (Correlations) for a Four-Factor Orthogonal Principal Components Analysis of the Revised Science Learning Environment Inventory (SLEI) (n=2190 Students)

SLEI Item Number	Communality	Factors I	II	III	IV
1.	.60		.75		
2.	.51		.70		
3.	.61		.75		
4.	.66		.78		
5.	.61		.74		
6.	.60		.74		
7.	.66				.66
8.	.66				.65
9.	.65				.64
10.	.69				.69
11.	.62				.60
12.	.51				
13.	.59				
14.	.61				
15.	.58				
16.	.67				
17.	.67				
18.	.69		.63		

Table 4 (Cont.)

SLEI Item Number	Communality	Factors I	II	III	IV
19.	.66				
20.	.61			.58	
21.	.52			.64	
22.	.49			.62	
23.	.13				
24.	.47			.62	
25.	.38			.58	
26.	.71			.80	
27.	.64			.72	
28.	.75			.81	
29.	.71			.80	
30.	.54			.70	
31.	.58			.70	
32.	.62	.76			
33.	.62	.77			
34.	.54	.76			
35.	.68	.69			
36.	.67	.81			
37.	.55	.72			
38.	.61	.76			

Table 4 (Cont.)

SLEI Item Number	Communality	Factors I	II	III	IV
39.	.56		.58		
40.	.51		.64		
41.	.66		.74		
42.	.72		.78		
43.	.65		.73		
44.	.56		.63		
45.	.63	.64			
46.	.52	.56			
47.	.73	.77			
48.	.75	.74			
49.	.71	.75			
50.	.58	.60			
51.	.63	.65			
52.	.64	.69			
Eigen Values	31.53	9.30	8.62	7.95	5.66
Variance Explained	60.60	17.88	16.58	15.29	10.89

Table 5

Cronbach Alpha Internal Consistency Reliability Coefficients for Factored Dimensions of the Study Measures (SATL, SLEI, SLEA, Hots, PAK) (n=2190 Students)

Study Variable	Alpha
Student Assessment of Teaching and Learning (SATL)	
QTL (17)*	.95
MI (5)	.82
Science Laboratory Environment Inventory (SLEI)	
LEQCLAR (15)	.95
ROS (13)	.94
PIS (11)	.93
TSR (5)	.92
Student Learning Efficacy Assessment (SLEA) (6)	.78
Hots (5)	.83
PAK (5)	.87

*number of items comprising measure

Table 6

Intercorrelations Between Student Perceptions of the Quality of Teaching and Learning (SATL), Personal Learning Environment (SLEI), Learning Efficacy Assessment (SLEA), Learning Emphasis (HOTS, PAK) and Summative Course Evaluations

	Student Assessment of Teaching and Learning (SATL) Factors	
Personal Learning Environment Assessment (SLEI)	QTL (17)	MI (5)
LEQCLAR (15)*	.74	.55
ROS (13)	.42	.71
PIS (11)	.48	.68
TSR (5)	.73	.78
Student Learning Efficacy Assessment (SLEA) (6)	.28	.24**
Learning Emphasis		
HOTS (5)	.79	.59
PAK (5)	.64	.81
Summative Course Evaluations		
(QT)	.85	.65
(OCG)	.82	.66

* number of items comprising measure

** $p<.004$; all other correlation coefficients are statistically significant beyond the .001 level

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