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ABSTRACT

The purpose of this research was to investigate the construct validity of the Enrolled Student Survey (ESS) as applied to East Tennessee State University students. It has been suggested that cultural differences among students may cause the latent constructs underlying student satisfaction to be developed differently. The ESS is a state-recommended survey for measuring student satisfaction with the university. Approximately 2,600 undergraduates were surveyed in the spring semester 1993. Constructs proposed by the Tennessee Higher Education Commission, a six-factor model, were compared with data-based constructs in three data-based models produced by exploratory factor analysis and confirmatory factor analysis. Data were analyzed using hierarchical confirmatory factor analysis through the LISREL computer program. A comparative fit index (CFI) was used to set a criterion to accept a valid model. Based on this criterion, the worst fit to the university's data was the six-factor model, and the best fit to the data, through the CFI and chi-square analysis was the refined model developed through confirmatory factor analysis incremental fit comparisons. Reasons the data may not fit the six-factor model are discussed. (Contains 5 tables, 1 figure, and 13 references.) (SLD)

Running head: CFA OF A STUDENT SATISFACTION SURVEY

Hierarchical Confirmatory Factor Analysis of a Student Satisfaction Survey

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Statistical Analysis and Evaluation

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Abstract

It has been suggested that the cultural differences between Appalachian students attending East Tennessee State University (ETSU) and students of other Tennessee higher education institutions may cause the latent constructs underlying student satisfaction to be developed differently. Since performance funding for state institutions is partially based on the assessment of student satisfaction, it is important that the measurement of satisfaction take into account these cultural differences and constructs, or both.

The purpose of this research was to investigate the construct validity of the Enrolled Student Survey (ESS) as applied to East Tennessee State University students. The ESS is a state recommended standardized survey for measuring student satisfaction with the educational experience. Approximately 2600 undergraduate students at ETSU were surveyed during the spring semester 1993.

The constructs proposed by the Tennessee Higher Education Commission (THEC) were compared with data-based constructs produced by exploratory factor analysis using SPSS-X. Data were analyzed using Hierarchical Confirmatory Factor Analysis in LISREL 7.2. Three data-based models were compared to the Six-Factor Theory Based Model proposed by THEC. The three data-based models were: Six Factor Inductive Model, developed via an exploratory factor analysis where the number of factors were constrained to six; Ten Factor Inductive Model, generated by an unconstrained exploratory factor analysis; and Refined Model, developed using confirmatory factor analysis incremental fit comparisons. Two criteria were used for assessing the validity of the four models: χ^2 and comparative fit index (CFI). Because χ^2 tests with large sample sizes are likely to reject reasonable models, the CFI was used as an alternate to χ^2. The criterion used for this study to accept a valid model was CFI = .90. Based on the CFI criterion, the model with the worst fit to the ETSU data was the Six-Factor Theory Based Model (χ^2 = 9181, d.f. = 1310; CFI = .75). The Refined Model had the best fit to the data (χ^2 = 2604, d.f. = 862; CFI = .94).

Since this study is based on only one sample, it was suggested that the lack of fit for the Six-Factor Theory Based Model may reflect: 1) an anomaly in the sample, 2) a difference between ETSU students and students attending other Tennessee institutions of higher education, or 3) a measuring instrument that is of dubious validity. Since the ESS is directly linked to incentive funding, further research is warranted on the validity of the instrument to ETSU and other Tennessee institutions.

Hierarchical Confirmatory Factor Analysis of a Student Satisfaction Survey

The goals of educational accountability and assessment have influenced the planning and evaluation of educational programs and curriculum in higher education since the late 1970s. This state by state campaign for quality in education began with a demand by external stakeholders for the justification of increasing higher education costs (Pike, 1993). The interest in accountability during the 1980s gained momentum because of the shift in public policy from allowing autonomous management of the higher education enterprise to an increased demand for an education partnership between the academy and state government. In 1985, only five states had accountability and assessment mandates for higher education. However just five years later, forty state legislatures had passed some form of accountability and assessment mandates (Young, 1993).

Tennessee is the front runner in the national assessment movement. Since 1979, institutions of higher learning in Tennessee have participated in an educational assessment program (Banta, 1988). At the crux of this assessment program is a ten component performance funding formula used by state higher education institutions to evaluate the quality of their education process and earn assessment points that equate into additional state funding for the institution. One of the ten components in the performance formula is a student satisfaction component. Within this component, currently enrolled undergraduate students of participating institutions are surveyed to determine their opinions and attitudes about the institution (Banta, 1988). The results of the Enrolled Student Survey (ESS) are analyzed by the Tennessee Higher Education Commission (THEC) to determine student satisfaction.

The ESS is administered during the spring semester of every odd year with 1993 as the baseline year. The purpose of the ESS instrument is to measure a Six-Factor Theory Based Model of educational experience: student satisfaction, student involvement, personal development, learning, major instruction and advising, and major curriculum. The results of each survey are summary scored within the six factors. With each survey, those institutions who improve their summary score over the previous survey administration or who score higher than the state mean will receive incentive funding from the state. Based on this connection between the six factors of the ESS and incentive funding, it is important that the validity of the ESS instrument is tested for

each of the participating institutions.

Statement of the Problem

The twenty-three institutions of higher learning that participate in the Tennessee performance funding program are a diverse group (Banta, 1988). Each of these participants are unique in their educational mission and goals, and in their approach to educating their student population: a student population that is as unique to each institution as is the educational mission of that institution. East Tennessee State University (ETSU), one of the participating institutions, is located in the upper northeast corner of Tennessee. As a regional university, 85% of the student population comes to ETSU from counties in east Tennessee. Furthermore, 66% of the ETSU student population are residents of the five counties that immediately surround the university. All of these east Tennessee counties that send students to ETSU are located in the heart of the Appalachia Southern Region (Hawk, 1993).

The impact of the Appalachian Region to the educational experience of the ETSU student is currently under investigation by the Center for Appalachian Studies and Services at ETSU. At the very most, growing up in Appalachia and being labeled as a "hillbilly" or "grit" may have such a profound impact on the self-esteem and confidence of the Appalachian student as to negatively effect their success in higher education (Speer, 1993). At the very least, the Appalachian region with its cultural diversity, close community and family relationships, and economic disadvantage may provide the Appalachian student with such a unique K-12 education experience that the subsequent higher education experience is equally unique. According to Speer (1993), Director for the Center for Appalachian Studies and Services, "some campuses are coming to realize that Appalachian students may need to be recognized as a minority group because they have been denied fair access to educational opportunities and because some of them require special assistance to succeed" (p. 21).

With the majority of students being sent to ETSU from this unique environment, it is reasonable to question the validity of the standardized ESS to the educational experience of the ETSU student. Because performance funding for ETSU and other state institutions is partially based on the assessment of student satisfaction with the overall education experience, it is important that the measurement of satisfaction take into account the cultural and educational

differences of the Appalachian student.

The purpose of this research was to investigate the construct validity of the ESS as it applied to the ETSU student population.

Research Questions

To explore the validity of the ESS to the ETSU student population, the following research questions were investigated:

1) Does the Six-Factor Theory Based Model of the ESS as utilized by THEC adequately measure the educational experience of the student population at ETSU?

2) Would another model more adequately depict the educational experience of the ETSU student population?

Literature Review

Educational Accountability and Assessment

Prior to the late 1970s, higher education in America enjoyed a level of autonomy that allowed administrators to plan and evaluate education programs and curriculum without intervention from various external stakeholders. Until that time, the only participants in planning and assessing education outcomes were those internal stakeholders that had a significant influence and control on the direction of the higher education institution. Stakeholders external to the institution, i.e. taxpayers, government officials, and business leaders, were only indirectly involved in the higher education process: taxpayers paid taxes to support the operations of the institution; government officials appropriated the tax funding; and business leaders employed the students that had successfully completed the education process. Each of these constituent groups supplied higher education with inputs and employed the outputs, or both, without interference in the process (Peters, 1994).

However, in the early 1980s this level of granted autonomy began to diminish. Increasing education costs that equated to higher tuition rates for consumers and increased funding by government, disillusionment within the business community with the higher education product (Pike, 1993), and the general malaise of distrust among external stakeholders with the ability of higher education administrators to manage the education process to a quality outcome (Peters, 1994), are just a few of the reasons for the concerted demand by external stakeholders for

educational accountability and, subsequently, the demand for assessment of the education outcome.

According to Boyer (1988), there were four primary reasons for the national interest in assessment. First, leaders of the assessment movement in the 1980s believed that educational assessment would be a powerful impetus to institutional change, which in turn, would equate into increased concern for education quality. It was also argued that educational assessment would provide faculty an opportunity and an avenue for reassessing curriculum on an ongoing basis. Third, educational assessment was seen as a communication mechanism that would stimulate discussion about quality in the education process and outcome. This discussion would involve all levels of administration and faculty, and would focus their attention on the needs of the customer. Finally, educational assessment would restore the confidence of external stakeholders in the process of higher education.

The reasons for pursuing educational assessment in the early 1980s, quickly became the goals of educational assessment in the early 1990s. Leaders of the assessment movement targeted goals of promoting institutional change with assessment information; stimulating interest in faculty for sweeping reforms in curricula design and implementation (Ewell, 1994); enhancing communication among internal and external stakeholders about the quality of the education process; placing a focus on customer satisfaction (James, 1994); and restoring public confidence in higher education.

However, by the mid–1990s the goals of educational assessment have not been realized in toto (Ewell, 1994). There are many proposed reasons for this lack of goal attainment; assessment information is not disseminated to important decision makers (Ewell, 1994); the fear by educational leaders that assessment will lead to homogenization of higher education (Davies, 1991); and the resentment felt by educators on the intervention of external publics into their education domain (Peters, 1994). However, the most important reason for nonattainment of goals is the difficulty with designing and developing reliable and valid standardized instruments: an instrument design that can accurately measure hypothetical constructs consistently and accurately on every campus across the state regardless of geographic and demographic differences (Banta, Rudolph, & Van Dyke, 1994; Young, 1994). A profession that is founded on the reliability and validity of

measurement is being asked to make decisions and curricular changes based on instruments that may be providing suspect data.

Performance Funding in Tennessee

The increase in interest by external stakeholders in educational assessment was a national concern that quickly disseminated into a state government issue. Each state government began, in earnest, to investigate methods of accountability and assessment for institutions of higher learning within their state. In response to the demand for educational accountability, government officials in Tennessee developed an educational assessment model for institutions of higher learning in the state. At the core of this assessment model was a performance funding formula that measured specific higher education activities and programs for quality in process and outcome, and provided a monetary bonus incentive as a reward for quality (Banta, 1988).

Prior to 1975, assessment of education quality in Tennessee was enrollment-based with an emphasis placed on quantity of students as a reflection of the quality of the program. In 1975, the decision was made by state policy makers to convert this system of enrollment-based assessment into performance-based assessment. The following year pilot projects were administered on a variety of university and college campuses across the state to test the reliability and validity of performance-based evaluation. In 1979, with the successful outcome of the pilot testing, THEC presented a guideline of performance criteria to state higher education institutions. By 1983, and the tightening of the performance guidelines, THEC committed the state to the first five-year performance funding cycle (Banta, 1988).

By 1994, and the completion of the third five-year cycle, performance funding has become an integral component in the planning, implementation and evaluation of higher education programs in Tennessee. Currently, there are twenty-three institutions of higher learning in the state that participate in the performance funding model: four technical institutes, ten community colleges, and six universities, to include East Tennessee State University, and three University of Tennessee campuses. The performance funding formula consists of ten components: peer review of undergraduate programs; placement review; accreditation; improvement actions by institution; student satisfaction surveys; major field tests; mission specific goals of the institution; general education tests; retention and graduation goals; and minority/other enrollment goals. Performance

on each of the ten components is worth up to ten points for a total performance maximum of 100 points (Banta, Rudolph, & Van Dyke, 1994).

Each point in the formula is tied to a dollar value of bonus incentive for the higher education institution. The maximum amount of bonus incentive from the formula is 5.5% of the institution's education and general budget (Banta, Rudolph & Van Dyke, 1994). Every year, each institution uses the requirements in the performance funding formula to evaluate the quality of the educational outcome. The information gathered through this ongoing assessment is forwarded to THEC, whereby, the results of the assessment are analyzed in each of the ten components, points are assigned in each component, and the bonus incentive is determined.

Education in Appalachia

According to DeYoung (1988), the educational preparation of students in rural schools differs from the educational preparation of students in urban schools. For example, a stronger bond exists between the community and the rural school than between the community and the urban school. Because of this strong bond between community and school, and because of the traditionally conservative values of families in rural areas, the curriculum of the rural school is continually scrutinized by the religious leaders of the community. Also, teachers in rural schools have different occupational interests and career ambitions than those who teach in the urban school. Finally, for many rural students college is not an option.

Appalachia shares these characteristics with other rural schools in America with one very important distinction: the severe economic disadvantage of the Appalachian region. Because of the poverty gap in Appalachia and the continued decline of the rural economy, there exists an inequality of educational opportunity for Appalachian students that does not compare with students of other rural areas nor students in the urban environment (DeYoung, 1988). Those Appalachian students who do choose college come to campus academically unprepared for the rigors of higher education; socially unprepared for the academic culture, processes, and procedures; and emotionally unprepared for the ridicule by college associates of the Appalachian heritage (Speer, 1993).

Interestingly enough, in spite of all the differences between the Appalachian rural school and the urban school, past educational reforms made in rural education have been based on

educational research performed in the urban school environment. It has only been within the last decade that educational researchers have addressed the need to research the Appalachian rural school and design educational reforms that are specific to that environment (DeYoung, 1988). Many of the urban school reforms that were incorporated into the rural environment simply have not worked. Urban reforms, such as the consolidated school and centralized staffing, were not confluent with the community/school relationship of Appalachia.

How does the discussion of the unique Appalachian education experience effect higher education? If it is reasonable to assume that there are differences in the K-12 setting because of environmental differences between Appalachia and urban than it is equally reasonable to assume that there are differences in the higher education experience of a student population that is predominantly Appalachian compared with an urban student population. Educational researchers have discovered that urban reforms do not work in the Appalachian rural school. Therefore, it can be suggested that urban reforms will not work for a higher education institution that is predominantly Appalachian. Furthermore, it can be argued that the standardized assessment instruments designed by THEC within the confines of the urban experience may not be valid to the educational experience of the Appalachian student.

Method

The ESS instrument, as administered in spring 1993, was a seventy-seven question measurement of customer opinion and attitude. The instrument contained eight demographic questions and sixty-nine questions directly related to the satisfaction of the student with their academic, cultural, and social educational experience. Included in those 69 questions, were 16 questions directly related to educational services, such as admissions, financial aid, registration, the campus bookstore, and career placement. Because THEC did not use these 16 questions in forming their six factor model, these questions were excluded from the confirmatory analysis in this study. Therefore a total of 53 questions were used to determine the structure of the ESS for the ETSU student. These questions were scaled using a three to five point Likert-type scale.

This instrument was designed by THEC to measure six factors of the student's educational experience; student satisfaction, involvement, personal development, learning, major instruction and advising, and major curriculum. Each of the 53 questions were targeted by THEC to measure

one of the six constructs. There was one qualitative question at the end of the survey which asked students to briefly comment on their experiences at ETSU. (Those qualitative responses were analyzed by the Office of Outcomes Assessment at ETSU and are not included in this research.) It is important to keep in mind, that the ESS did not test a student's level of achievement, but instead was, and is currently, a measurement of the student's attitude about their level of achievement.

East Tennessee State University is a comprehensive regional university offering more than 100 fields of study to approximately 12,000 students. The typical student attending ETSU in the fall of 1992 entered the university with an average ACT score of 20.6, compared with the University of Tennessee, Chattanooga ACT score of 21.8: an institution of comparable size and educational mission. Of the nine public institutions of higher learning in Tennessee, ETSU ranked eighth in the entering ACT score of freshmen, with the University of Tennessee, Knoxville ranked first with an ACT score of 23.0 and Tennessee State ranked ninth with a score of 18.8. Approximately 47% of first-time freshman at ETSU were enrolled in developmental and remedial courses in the fall of 1992, compared with the state average of 33.9%. (Roaden, 1994).

The target population for the ESS administered at ETSU were all undergraduate students enrolled at ETSU during the spring semester 1993. The cluster sampling method was chosen to ensure that the sample was representative of the total ETSU population. According to the Office of Outcomes Assessment at ETSU,

> A random sample was drawn of 25 percent of the 1000 and 2000 level classes in the General Education Core and 25 percent of the 3000 and 4000 level classes from each college. The sample was drawn from a stratified population of on-campus day classes, all evening classes and classes conducted at off-campus sites. ETSU was required to survey at least 15 percent of all undergraduate students. To compensate for attrition and students enrolled in more than one surveyed class, 25 percent of all classes were surveyed. Courses which could not be surveyed in a class setting, such as student teaching/internship/co-op courses were excluded. The surveys were administered by each department in the sample. A total of 28.6 percent (2634) of the undergraduate students completed the survey (Burnley, 1993, pg. 6).

As mentioned, ETSU was required by THEC to administer the survey to 15% of all undergraduate

students. However, in awarding points in the customer satisfaction component, only the data from those students with 25 or more credit hours at the time of the survey, not to include hours taken in the spring semester of 1993, were used to determine the satisfaction of students with ETSU.

In March 1993, the ESS was administered to students that were in those classes chosen in the sampling procedure. In most cases, the class instructor administered the measurement and delivered the completed instrument to the Office of Outcomes Assessment at ETSU. There were a few situations in which a representative from the Office of Outcomes Assessment administered the exam at the request of the instructor. The questionnaire administrator gave minimal directions to respondents prior to taking the exam to avoid influencing the attitude of the student. Data collection for the ESS took approximately one week to complete. After data collection was completed, a graduate assistant in the Office of Outcomes Assessment manually input the data into a micro-computer database and electronically sent the data to THEC for analysis. A copy of the data was kept with the Office of Institutional Research at ETSU for further analysis.

Analysis

The analysis of the ESS is based on a series of four models. The first three models are first–order confirmatory factor analysis models[1]. The first model was derived from the theory upon which the ESS is based. It is this model (Six-Factor Theory Based Model) that serves as the criteria for assessing performance and distribution of incentive funding relative to that assessment (see Table 1 for a description). The second model (Six–Factor Inductive Model) was developed via an exploratory factor analysis where the number of factors was constrained to six (see Table 2). The third model (Ten–Factor Inductive Model) was generated from an unconstrained exploratory factor analysis that yielded (based on eigenvalue > 1) 10 factors (See Table 3). The fourth model, (Refined Model) was developed using CFA incremental fit comparisons. The outcome of this process was a model with 44 observable indicators (as opposed to 53 for the other models), 16 first order factors (ηs) and 7 second order factors (ξs). Figure 1 provides an in depth summary of this model's specification. Additionally, more restrictive "null" models were calculated for both Σs (one of rank 53 and one of rank 44)[2].

Two criteria were used for assessing the validity of the four models. First, χ^2 tests for

each model and the difference between the models was used. Because χ^2 tests with large sample sizes and complex models are likely to reject reasonable models, the comparative fit index (CFI) was used as an alternative to χ^2. This index compares hypothesized models with a heavily restricted (and thus bad fitting) null model. The rule of thumb is that acceptable models must have a CFI value of at least .90.

Results

Table 4 contains a summary of results. The Six–Factor Theory Based Model, as proposed by THEC, was a poor fit to the data, (χ^2 = 9181, d.f. = 1310; CFI=.75). The Six–Factor Inductive Model was a better fit (χ^2 = 8718, d.f. = 1310; CFI=.77), but this model still represented a very poor fit. The Ten–Factor Inductive Model represented a substantial improvement over the previous models (χ^2 = 5739, d.f. = 1280; CFI=.86). Since this third model is less constrained than the previous two, it will always fit better in terms of χ^2. Yet a comparison of this model to the Six–Factor Theory Based Model indicates a significant incremental difference in terms of χ^2 (difference in χ^2 = 3442, d.f. = 30, pvalue < .001) and in terms of CFI values (.86 versus .75). Nevertheless, the Ten-Factor Inductive model does not meet the threshold CFI value for valid models.

Of the four models, the Refined Model had the best fit with the ETSU data (χ^2 = 2604, d.f. = 862 CFI=.94). This fourth model is the least restrictive, and thus it will always fit better than the first three models. Yet the Refined Model represents a statistically significant improvement in fit over the first three models in terms of χ^2 and CFI value (.94 versus .86) and it represents a reasonable fit to the data based on the CFI>.90 heuristic.

Table 5 illustrates the relationship between the individual questionnaire items and the second–order factors. These relationships are indirect effects as mediated by the first order factors. Two of the Xs, ESS questions 6 and 58, have double loadings. The remainder of the observable indicators load on only a single second-order factor, even though, the second–order factors are free

to correlate among themselves.

Thus, the Refined Model is the only model which demonstrates acceptable validity. The poorest fitting model is the Six–Factor Theory Based Model, and this model is one upon which decision making criteria are based. In other words, funding distributions and other resultant outcomes are based upon the least valid model.

Discussion

The Six-Factor Theory Based Model proposed by THEC does not adequately fit the sample selected from ETSU. The hierarchical model (Refined Model) developed from this sample provides an adequate fit. Since this study is based on only one sample, this lack of fit may reflect: 1) an anomaly in the sample, 2) a difference between ETSU students and students attending other Tennessee institutions of higher education, or 3) a measuring instrument that is of dubious validity.

Several minor differences in the factorial structure of this survey instrument were detected between the Six-Factor Theory Based Model proposed by THEC (Table 1) and the Refined Model (Figure 1) developed in this study. The major difference, however, is reflected in the factor named 'Research' (4 variables) in the Refined Model and the factor 'Involvement' (9 variables) in the Six-Factor Theory Based Model. Both factors contain four identical variables. The Refined Model, however, does not contain the remaining 5 variables in the 'Involvement' factor. When these questions were entered as an additional first–order factor or the individual questions were added to an established factor, the fit as measured by χ^2 and the goodness of fit function were significantly worse. Consequently, if the mean of the nine variables contained in the Six-Factor Theory Based Model 'Involvement' factor are used for evaluation of an ETSU student's involvement, more than 50% of that mean is determined by variables that are not related to the construct. In effect, the mean is sufficiently influenced by variables that measure no established factor. Therefore, the resultant mean of the 'Involvement' factor is of questionable validity. The purpose of this survey was to establish measures on general factors and to evaluate an institution based on improvement of those factors. However, if the factor measured is inadequately measured, what does improvement imply?

Further, if the constructs purported to be measured by this survey are valid for other institutions and the difference in constructs reflects only ETSU students, to compare the mean for

these students to those of other institutions is not valid. It is suggested that further research should be conducted using students from ETSU to establish whether the results from this sample are a one–sample anomaly or indeed reflect accurately the constructs for this population. Further research should also be conducted comparing samples from various institutions of higher education to determine if the Six-Factor Theory Based Model adequately represents them.

Table 1

Six-Factor Theory Based Model as Proposed by THEC

Latent Variable	Corresponding Questions
Satisfaction	1 2 3 4 5 6 7
Involvement	8 9 10 11 12 13 14 15 16
Personal Development	33 34 35 36 37 38 40 45 47
Learning	39 41 42 43 44 46 48 49 50 51 52 53
Major Instruction/Advising	54 55 58 59 60 62 65
Major Curriculum	56 57 61 63 64 66 67 68 69

Table 2

Six–Factor Inductive Model

Latent Variable	Corresponding Questions
Satisfaction	1 2 3 4 5 6 7 67 68 69
Academic Involvement	8 9 10 11 12 13 14 15
Analytical Problem Solving	44 46 48 51 53
Cultural Awareness	34 39 49 50 52 2
Personal Development	35 36 37 38 40 41 42 43 45 47
Major	54 55 56 57 58 59 61 62 63 64 56 66

Table 3

Ten–Factor Inductive Model

Latent Variable	Corresponding Questions
Satisfaction	1 2 3 4 5 6 7
Academic Involvement	8 9 10 11 12 13 14 15 16
Comprehension	42 43 44 45
Personal Development	35 36 37 38 40 41 47
Major	58 33 61 62 63 64 65 66 67 68 69
Cultural Awareness	34 39 49 50 52
Analytical Problem Solving	46 48 51 53
College Advising	54 55
Degree Requirements	56 57
Faculty Guidance	59 60

Table 4

Results of Comparative Models

Model	Non–redundant Elements of Σ	Factors	χ^2	d.f.	CFI[a]
Six–Factor Theory Model	1431	6	9181*	1310	0.75
Six–Factor Inductive Model[b]	1431	6	8718*	1310	0.77
Ten Factor Inductive Model[c]	1431	10	5739*	1280	0.86
Refined Model	990	23[d]	2604*	862	0.94

[a]Comparative Fit Index. The χ^2 for the null model with 1431 elements of Σ is 33154 (1378 d.f.). For the refined model, the χ^2 for the null model is 29553 (946 d.f.).

[b]This model was developed using an exploratory factor analysis with the the number of factors constrained to 6 (see Table 2).

[c]This model (see Table 3) was developed using an unconstrained exploratory factor analysis with standard extraction criteria (eigenvalue>1).

[d]The Refined Model has 16 first order factors and 7 second order factors (see Figure 1).

*Significant at probability of $\chi^2 < .001$.

Table 5

Total Effects of Y on Refined Model

	Satisfaction	Research Culture	Learning Personal Development	Learning Faculty	Major
Q1	.330				
Q3	.462				
Q4	.446				
Q5	.306				
Q7	.442				
Q6	.261	.176			
Q34		.433			
Q39		.529			
Q49		.401			
Q50		.404			
Q52		.444			
Q8			.462		
Q9			.683		
Q10			.430		
Q11			.681		
Q35				.374	
Q36				.441	
Q37				.416	
Q38				.441	
Q40				.416	
Q41				.455	
Q42				.368	
Q43					.420
Q44					.465
Q45					.351
Q46					.441
Q48					.381
Q51					.264

Table 5 (cont.)

Total Effects of Y on Refined Model

	Satisfaction	Research Culture	Learning Personal Development	Faculty	Major
Q53			.395		
Q54				.631	
Q55				.609	
Q59				.664	
Q60				.681	
Q58				.260	.259
Q56					.518
Q57					.532
Q61					.604
Q62					.566
Q63					.621
Q64					.673
Q65					.544
Q68					.368
Q69					.410
Q67					.295

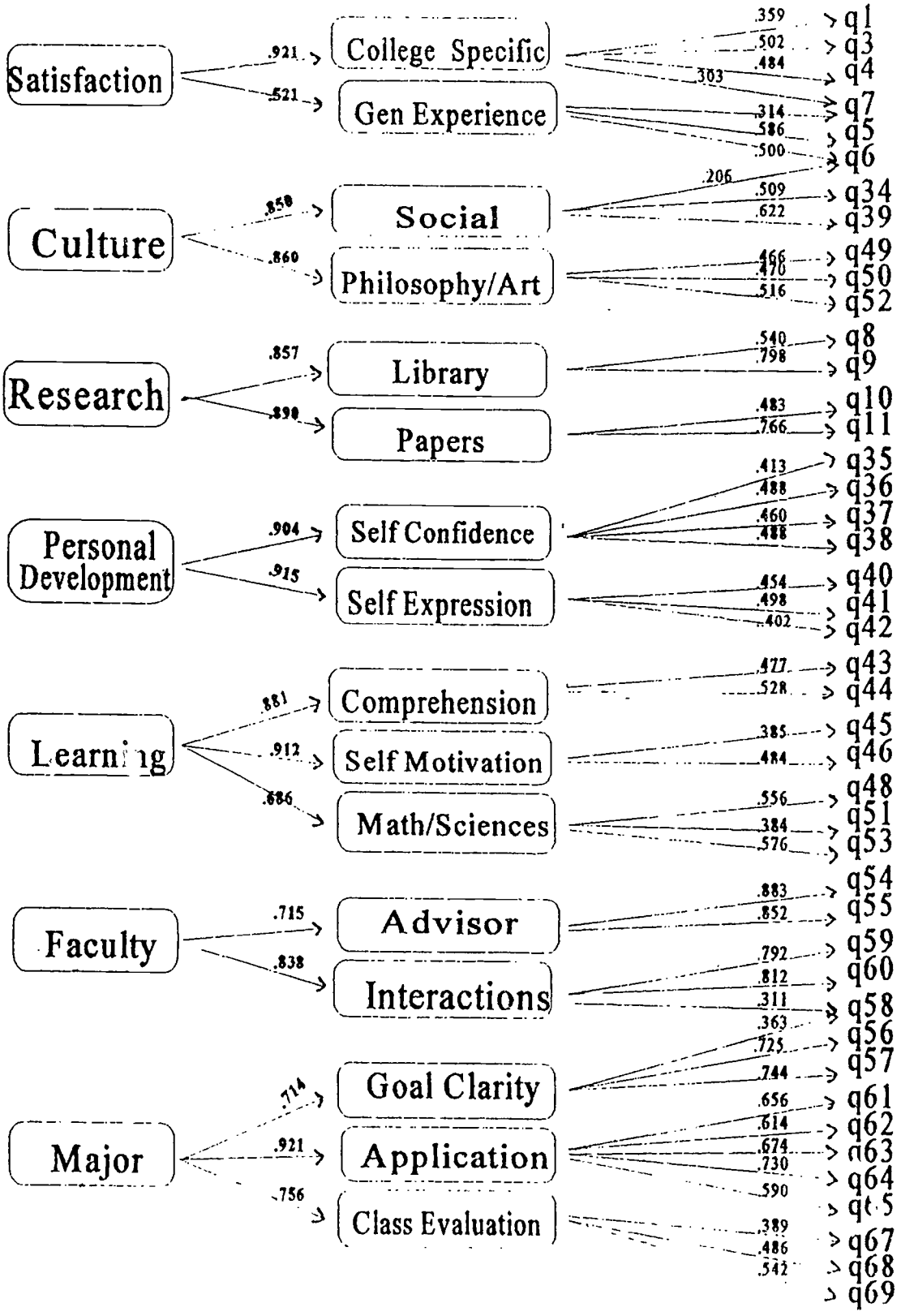

Figure 1: Hierarchical Model of the Enrolled Student Survey (Refined Model).

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Footnotes

[1]These models were assessed using standard confirmatory factor analytic procedures where (1) the variances of the ξs, the diagonal elements of the symmetric Φ matrix, are fixed at 1.0 for identification purposes, while the nonredundant off-diagonal elements of Φ (covariances among the factors) are free to correlate; (2) Θ_δ is a diagonal matrix (the errors are uncorrelated) with the diagonal elements estimated parameters, and (3) each observable indicator is free to load on only one ξ (each questionnaire item loads on a single factor.) For all three of these models, the variance/covariance matrix of the questionnaire items, Σ, has 53(53+1)/2=1431 nonredundant elements.

[2]These null models provide comparison information needed to calculate the Comparative Fit Index in Table 4. This index is robust to sample size variations, and makes allowances for changing model complexities. The null models used in this study are of the traditional form where the only estimated parameters are the variances of the ξs (diagonal elements of Φ), covariances among the questionnaire items are fixed at 0, and the error matrix, Θ_δ is constrained to be a null matrix.