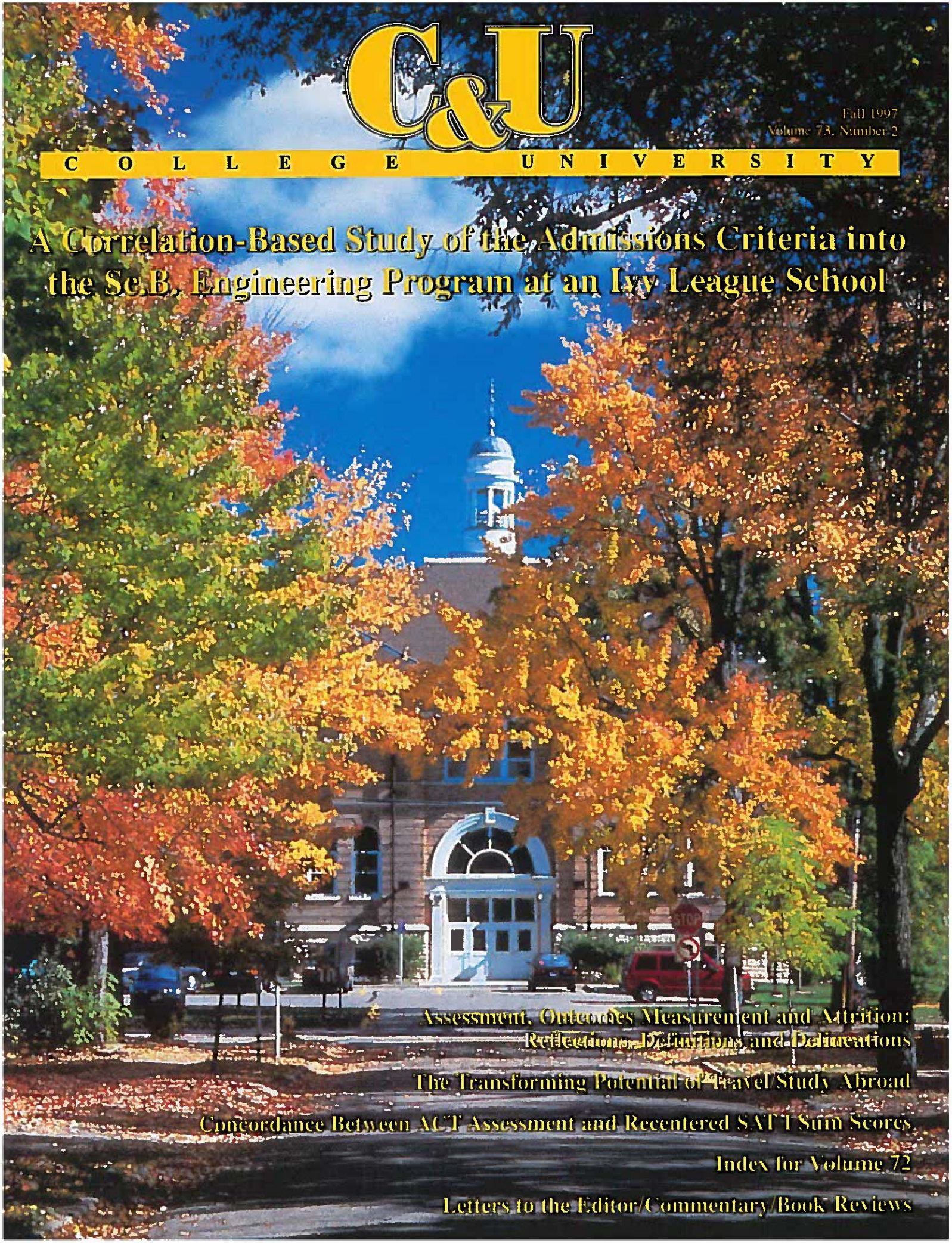
C&U
COLLEGE UNIVERSITY
Fall 1997
Volume 73, Number 2

A Correlation-Based Study of the Admissions Criteria into the Sc.B. Engineering Program at an Ivy League School



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Volume 73, Number 2

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All feature and opinion submissions must include a hard-copy original printed on 8.5" x 11" white paper and an accompanying MS-DOS or Macintosh disk.

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Essential tables and charts should be included on separate pages at the end of the manuscript. All graphics should be submitted on clean, reproducible, or camera-ready paper.

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Editorial Procedure

The editor will acknowledge receipt of manuscripts (letters are not to be acknowledged) and will forward them to members of the *C&U* Editorial Board for review. The Board will consider the appropriateness of the article for AACRAO's membership, the current needs of the professions, the usefulness of the information, the nature of the research methodology, the logic, clarity, and style of the presentation.

This review may take as long as three months, after which the *C&U* editor will inform the author of the manuscript's acceptance or rejection.

Editor's Note

Another academic year is now well underway. Is it too much to hope this will be the year in which that question perennially raised by faculty will be put to rest: "Just what is it that you do during the summer?" We all have the answer ready, possibly introduced by a stifled groan. Our own question tends to be, "Where has the summer gone?" This year the signals are mixed — the first Christmas catalog has already appeared in our mailboxes, but the summer issue of *C&U* didn't arrive until September. What happened? Something that wasn't supposed to happen, did — a hitch, a snag, and therefore a delay in the production schedule.

All of which leads into the fall issue of *C&U*. It is filled with good things. All admissions and institutional research personnel will find great value in the concordance study comparing the recentered SAT I to the ACT Assessment. They should also be intrigued by a correlation-based approach to evaluating admissions criteria. There is a philosophical/practical essay toward a delineation of the concepts of assessment, outcomes measurement, and attrition. There is an intriguing reflection on how sensitivity toward the cultures of developing countries and our international students burgeoned through travel. Letters to the editor, a commentary, and book reviews are grouped together in the style of a Forum. This issue is capped off by an index to Volume 72 (1996-1997).

Summer *C&U*. Fall *C&U*. Future *C&U*s???

There will be future issues of *C&U* only if we receive manuscripts to publish.

We need input from our AACRAO members. Many of our feature articles are based on research — you say you can't/don't do research? A recent survey of the membership disclosed that our members want *C&U* also to provide articles of the "how to" type. *Pace* all the institutional researchers, faculty, and graduate students in the country, only those of our professions can provide the type of "how to" article we desire.

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Come on, AACRAO, ***your*** journal needs ***you***!

Roman S. Gawkoski

Roman S. Gawkoski, Editor

Correction: In the Spring '97 issue of *C&U* (Vol. 72, No. 4), there was a misprint. In the chart on page 3, Academic Support and Institutional Research were listed under Private Institutions. These offices should have been listed under Public Institutions. We apologize for any confusion this may have caused.

College & University (USPS 121460) is published four times a year (summer, fall, winter, spring) by the American Association of Collegiate Registrars and Admissions Officers, One Dupont Circle, NW, Suite 520, Washington, DC 20036-1135. The annual index appears in the fall issue. The cost of the publication is included in the AACRAO membership fee. US nonmember subscription rates are $30 for one year, $55 for two years, and $75 for three years; foreign nonmember subscription rates are $40, $70, and $90.

A Correlation-Based Study of the Admissions Criteria into the Sc.B. Engineering Program at an Ivy League School

Raymond Kuo and Sumit Ghosh

Applicants to undergraduate programs at the Ivy League schools and their parents find, from time to time, the admissions process to be secretive, unpredictable, confusing, and arbitrary. In general, applicants submit scores of standardized test results, write essays, fill out lengthy application forms, include information on parental background, parental marital status, and siblings, and turn in their high school grade point average (GPA), class rank, and teacher recommendations. These, referred to as applicant profiles, are carefully examined and analyzed by a team of admissions officers who arrive at a decision having utilized a host of criteria. However, at the process' end, for those who are denied admission, the reasons for denial (or the lack thereof) leave them quite confused and frustrated. Moreover, rumors that Ivy League schools (such as Brown University) routinely deny admission to half of the high school valedictorians who apply (irrespective of whether such rumors represent statistical truths) only contribute to the confusion. Furthermore, the literature on the details of the admissions process are sparse and there appears to be little consensus relative to the criteria utilized by the admissions officers.

This paper presents a model of an admissions process in terms of the applications that encapsulate the characteristics of the applicants and the admissions officers who represent the educational philosophy of the institution. It describes a correlation-based scientific study to evaluate the proposed model, wherein the parameter design reflects the knowledge and experience acquired during the second author's tenure as an advisor to the undergraduate admissions office for the Sc.B. engineering program at Brown University between 1989 and 1992. During this period, he examined over 900 randomly selected applicants from diverse cultural and socio-economic backgrounds and geographical regions in the US and abroad and his assessments were treated as "first reads," or key evaluations. The paper develops key non-financial aid related criteria — academic and non-academic, based on those actually used in the selection of applicants into the Sc.B. (Bachelor of Science) program in engineering at Brown University. It models the biases of the admissions officers that stem from their beliefs in student profiles that would best succeed in the engineering environment at Brown, and proposes representative admissions officers for this study. The paper then synthesizes hypothetical applicants with stochastic yet representative profiles, develops a computer model of the proposed admissions process that encapsulates the interaction between the beliefs of the admissions officers and the applicant profiles, and simulates the admissions process for 10,000 engineering applicants. The admissions decision results — positive or negative — are then correlated with the respective applicant profile. Analysis of the correlations reveals that (1) admissions officer biases play a strong role in determining admissions decision outcomes, (2) applicants with strong math ability, indicated by a high math achievement test score, high physics achievement test score, strong parental educational background, high grade point average, and outstanding teacher recommendations are favored by the representative type of admissions officers who evaluate Sc.B. engineering applicants to Brown University, (3) reliance on a single criterion relative to the admissions decision may be unwise, (4) colleges and universities are justified in requiring comprehensive information on the applicants, and (5) SAT scores alone play a surprisingly minor role in the admissions decision. The findings corroborate well with actual experiences of the second author. It is pointed out that a principal aim of this paper is to help foster a logical and comprehensive understanding of the admissions process among future engineering applicants and their parents. Also, the results of the paper suggest that the admissions officers may carefully record their belief structures, normalize the field values of the applications, and develop and analyze the processed scores to generate early initial evaluations with reasonable confidence they will assist in the admissions process.

Raymond Kuo *graduated from Brown University in May 1996 with an Sc.B. degree in Computer Engineering. Since then, he has been working as an associate at Cambridge Technology Partners, an information technology and management consulting firm headquartered in Cambridge, MA.*

Sumit Ghosh *is currently an Associate Professor of Computer Science and Engineering at Arizona State University. He had previously served on the faculty of Brown University and at Bell Labs Research (Holmdel, NJ). His research interests are in fundamental problems in the disciplines of asynchronous distributed algorithms, simulation networking, and computer-aided design of digital systems.*

Introduction

McDonough (1994) observes that, among primarily upper-middle-class high school students and parents who view college as a pivotal career investment, the process of choosing colleges and preparing for admission has become extremely important. Parents are aware that attending a selective college increases one's social standing, contacts, and income potential. Today, the admissions process is often viewed as an erratic, highly competitive, chancey game over which neither parents nor students have much control. Kravets (1994) paints a vivid picture of the typical applicant's frustration and apprehension. McDonough labels the nonschool-based admissions assistance services as admissions management and describes their evolution in the 1980s and 1990s. During this period, revenues for Stanley Kaplan's SAT preparation services doubled between 1983 and 1988 and a 1987 New York State study commissioned for the National Association of College Admission Counselors (NACAC; now the National Association for College Admission Counseling) reported 20 percent of college-bound seniors used private counselors. McDonough notes that high socio-economic-status oriented students with low to moderate academic ability currently prepare for the "right" colleges in innovative ways: hiring counselors and test coaches, securing professional help with essays, and maximizing summer vacations with educational experiences and travel.

Davis (1993) notes that recently, there has been a decline in the number of applications to select universities despite a concurrent increase in the number of outstanding applications. While this has fueled a sense of overwhelming disappointment, anguish, and frustration among the outstanding applicants and their parents, the lack of detailed reasons for rejection from the admissions office has created an atmosphere of disbelief and mystery.

Karen (1991) describes the roles of academic achievement and "ascription" in the admissions process at Harvard University, as examined in 1994. Karen notes that students whose parents have attended graduate or professional schools are overrepresented among the Harvard applicant pool. Although Harvard requires the usual test scores, GPA, class rank, etc., and while an applicant with a stellar academic background has a high chance of being admitted, having a family connection to Harvard, being black or American Indian, having attended an elite prep school, being an athlete, and hailing from the local area significantly affect one's probability of admission. Karen's analysis reveals huge differences in the achievement test averages among admitted applicants; athletes, those with family connections or prep school backgrounds rank significantly lower academically than others.

The process of admission to engineering programs at universities and colleges, including Ivy League schools such as Brown, is elaborate and extensive. Applicants, typically high school students in their senior year, are required to submit a comprehensive package that may include their (a) transcripts from grades 9 through 12, (b) recommendations from three or four teachers, one or two preferably from the areas of mathematics, physics, and chemistry, (c) SAT Verbal and Math subscores, (d) ACH scores in Math-II, Physics, Chemistry, History, English, etc., (e) Advanced Placement (AP) test scores in Chemistry, Computer Science, etc., (f) evaluation from the school's guidance counselor with a statement relative to class rank, (g) a school profile listing the percentage of graduates going into four-year degree programs, (h) a handwritten essay describing an important experience in the applicant's life, (i) an essay describing the applicant's special aptitude and reasons for pursuing engineering, (j) a duly filled standard application, (k) a rank-ordered list of program/degree choices of the applicant, (l) parental educational and employment background and marital status, (m) background on siblings' education, and (n) interview with an appropriate person related to the university. Other factors may be utilized in the admissions process but are not considered in this study. These include the parents' ability to pay all or part of the tuition, citizenship or immigration status, payment of application fee or waiver, the state of origin of the applicant (Gose 1994) and, where appropriate, the psycho-educational characteristics of a recovering student (Bratter and Parker 1994). Applications are accepted either in November, under the early decision program, or in January as regular admittances.

Once an application folder is complete, it is assigned for review by the admissions officers, with the goal that every applicant is reviewed by at least three officers. The guidelines for the reviews differ greatly, ranging from an orally transmitted set of rules that constitutes the school's tradition to the complete discretion of the admissions officer. Given that there is appreciable turnover among admissions officers, this may result in wide variations of assessments. While one officer may deem an applicant a straight accept, another officer may completely reject the application. The expectation is that with three semi-independent reviews for each application, a consensus is likely. Although the general rule in evaluating the individual factors continues to be uniform (*i.e.*, an essay with many grammatical and spelling errors reflects poorly on the applicant while high ACH scores and strong letters of recommendation speak highly of the student), the overall decision process is many times more complex.

The problem of determining a set of criteria, defining them with meticulous

care, and utilizing them in the college admissions process is a difficult one and is generic to all colleges and universities. McManus (1991) reports that in 1988-89, 1,088,223 high school students took The College Board's SAT while some 855,000 students took the ACT Assessment. She notes that some admissions offices are known to focus entirely on these test results to the exclusion of other factors in making admissions decisions. SAT's underlying philosophy may be stated as, "...the idea of comprehensive examinations in which students would not be asked to repeat the facts that they had learned in school but to demonstrate an understanding of the relation of discrete facts to one another, to generalize the facts into working principles, and to apply them to new and unexpected situations..." (Jacobs 1995). This philosophy is sharply contradicted by an internal study in the late 1970s and early 1980s, conducted by the Division of Engineering at Brown University (Dobbins). The study observed a high positive correlation between the Math-I ACH score and success in engineering while the correlation with the SAT Math and Verbal scores was nil. A 1974 American College Testing program study examined the then Scholastic Aptitude Test and found that it "offered virtually no clue to capacity for significant intellectual or creative contributions in mature life" (Nathan 1995).

Fields (1993) reports that in a survey, colleges and universities ranked the following relevant factors — the difficulty of the class, the student's average grade, the counselor's recommendation, the teacher's recommendation, the student's class rank, SAT or ACT score, depth of excellence in a co-curricular activity, the student's application essay, leadership, and employment. Other factors cited as relevant include on-campus interviews or interviews with alumni, and the rating of the high school.

Talley and Mohr's (1993) research shows that 68 percent of college admissions officers surveyed favor weighting high school grades based on honors or AP. They also report that grade point average, courses taken, and rank-in-class, in that order, were the most important factors influencing the outcome of the admissions process.

In analyzing the current admissions process, Peacock (1993) notes that it is more of an art than science. During the prolonged period of evaluation, biases and inconsistencies resulting from mood swings and changes in expectations often develop in the admissions officers and lead to unwise decisions. Often, the admissions officers develop a rating system which is determined not by a systematic process but the individual officer's desire to admit an applicant regardless of academic and personal strengths. Peacock hypothesizes a fictional institution and proposes to assign weights of 75 percent to the academic and 25 percent to the personal qualities. The academic record is evaluated from standardized tests, grade point average, and course rigor using the relative weights — 40 percent, 40 percent, and 20 percent, respectively. As further refinement, minimum acceptable subscores are set for each of the three components of academic record, *e.g.*, minimum acceptable SAT or ACT score, and minimum acceptable grade point average. The personal rating is organized through a five-point scale where scores of 5 and 1 imply "significantly exceeds all expectations" and "significantly short of expectations," respectively. The final score for the applicants, according to Peacock, would encourage consistency, objectivity, efficiency, and fair decisions.

The frequent lack of clear, consistent, and concise reasons underlying a non-admit is amplified by Sturgeon (1994). While every rating process is subject to some ambiguity and uncertainty, it is imperative that the process adheres to some rules of logic and fairness, has a firm foundation in the facts, can be systematically verified or refuted, and is subject to periodic revision. Sturgeon reports that the root of the problem is that there are two major strands in thinking in admissions: one holds that rating applicants is an art, the other contends that it is a science. To the first set of thinkers, believers in "People Person," those who consider admissions as a science are cold and calculating and ultimately unconcerned with the individual. To the second set of thinkers, the People Person is emotional, illogical, and unconcerned with facts. Sturgeon claims that there are important strengths and weaknesses on both sides of the issue and that both points of view must be reflected in the final decision for it to be logical and meaningful on the whole.

McDonough and Robertson (1995) report on the significant evolution in the college admissions process over the past three decades, note the significant expected increase in the number of college going students in the early 21st century, and call for professional standards for admissions officers. Given the increasing trend towards visualizing admissions officers as specialists in marketing and computers, McDonough and Robertson suggest that the officers need to improve their background in education, to understand and believe in colleges' educational philosophies, and to participate more with the faculty in shaping the college curriculum.

With the exception of Barbeau (1986), none of the previous efforts reviewed for this paper engage in an objective and scientific evaluation of the role of the relevant factors in the admissions process. They focus primarily on surveys, frequently from admissions officers and teachers, and infrequently from parents and applicants. Furthermore, none of the efforts reviewed for this paper report any detailed study of the special requirements for the arts, sciences, or

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engineering disciplines. This paper focuses on the admissions process for the engineering discipline, presents a correlation-based study to uncover the key criteria, and evaluates them with reference to actual experiences at Brown University. The remainder of the paper is organized as follows. The next section presents a correlation-based approach to evaluating admissions criteria; the third section describes an implementation of this approach which is then subject to test with 10,000 synthetic engineering applications, *i.e.*, where the relevant factors, (also termed fields in this paper) are synthesized stochastically; the fourth presents an analysis of the results; and the last section offers some conclusions.

A Correlation-Based Approach to Evaluating Admissions Criteria

Intuitively, it would seem that an applicant with very high math and physics skills as reflected by high ACH scores is likely to succeed in engineering. However, to base the admissions decision solely on these scores may be unwise because success requires both academic and personal qualities. One can probably find many cases where applicants with high ACH scores failed to succeed in engineering. As evident from the literature, there is neither a consensus nor a scientific rationale underlying which relevant factor(s) must be examined in arriving at a decision. The admissions officers who read and analyze applicant folders tend to differ dramatically in their views of what combination of application traits — academic and personal — constitutes success. While some may place heavy emphasis on the SAT Verbal score, others favor the SAT Math as the leading indicator.

This paper proposes an underlying model of the admissions process and a statistical correlation-based mechanism to examine the validity of the model. The key relevant factors utilized in arriving at the admissions decision include the SAT Math score, SAT Verbal score, PSAT Math score, PSAT Verbal score, ACH Math I score, ACH Math II score, ACH Physics score, ACH Biology score, ACH Chemistry score, ACH English score, AP Math score, AP English score, AP Computer Science score, AP Biology score, AP Chemistry score, AP Physics score, Math recommendation letter, Humanities recommendation letter, GPA, class rank, number of students matriculated from the school, college father attended, degree father earned, college mother attended, degree mother earned, college sibling attended, and degree sibling earned.

In the proposed model, every admissions officer's evaluation of an applicant reflects his/her own philosophy of education and his/her understanding of the college's underlying educational philosophy. The officer's philosophy manifests itself in a series of beliefs relative to each of the relevant factors which collectively determine his/her evaluation of the applicants. In this paper, for an officer, a number between 0 and 100 is assigned to each of the fields. A 0 for a given field implies that the officer places neither value nor relevance on this field relative to the admissions process. In contrast, a belief of 100 reflects that the officer gives significant importance to this field. A belief of 50 implies average importance assigned by the officer to the field in question. An officer's evaluation of an applicant consists of multiplying the values in each of the fields of the application by his/her corresponding belief values and generating a cumulative sum, termed processed score. Once an officer has determined the processed scores for all of the applicants, he/she sets a cutoff threshold, and arrives at the final admittance decision based on whether the applicant's processed score exceeds or falls short of the threshold.

While the absence of a consensus and an unambiguous set of criteria to test the accuracy of the decisions in the literature is noted, this paper proposes the following scheme to evaluate the proposed model. First, a set of 10,000 applicant profiles is synthesized wherein the value of each of the relevant factors is determined stochastically. This constitutes a representative and unbiased applicant pool which, presumably, includes all types of college applicants. Second, for each applicant, a raw score is computed as the cumulative sum of the values of all of the fields. Third, for each admissions officer and in increments of N (= 50) applicants, the raw scores of the applicants are correlated against the corresponding processed scores, and the correlation coefficients and levels of significance are computed. That is, a correlation coefficient is obtained for the first 50 applicants, the subsequent coefficient is determined for 100 applicants including the first 50, the next coefficient is determined for the previous 100 applicants plus 50 new applicants, and this process continues until the final correlation coefficient that accounts for all 10,000 applicants is determined. Last, the successively computed correlation coefficients are plotted through a correlation graph and analyzed for insights into the admissions process.

The design of the educational beliefs of the admissions officers reflects both reality and the admissions-related experience of the second author. Although the set of beliefs is unique to each admissions officer, a few of the officers, termed type I, reflect the purely math-and-science oriented type who place great emphasis on math and science scores only. Another set of officers (type II) reflects the type that places strong emphasis only on verbal and English scores. The third set of officers (type III) emphasizes values that strike a balance between science and math achievement and the applicant's parental support which, in turn, is reflected by the par-

ents' educational background. Personal experience at Brown suggests that type III admissions officers are most successful in admitting applicants who are most likely to succeed in engineering, type I officers are second, while type II officers are least successful.

In this study, a total of 20 officers was selected to constitute a representative set of engineering admissions officers. They are characterized by the following philosophies: Officers 0 and 1 are solely mathematics oriented, officers 2 and 3 are solely verbal oriented, and officers 4 and 5 are solely oriented towards math and verbal abilities. Officers 6 and 7 emphasize the applicant's family background only, officers 8 and 9 are not mathematics, verbal, or background oriented. Officers 10 and 11 emphasize mathematics, verbal, and background only, and officers 12 and 13 are mathematics and background oriented. In contrast, officers 14 and 15 are verbal and background oriented. Each of officers 16 through 19 is interested in a single criterion — respectively GPA, class rank, school reputation as reflected by the number of students graduating from the school and attending college, or SAT Math score.

The correlation coefficient is a widely used statistical measure to investigate the relationship, dependence, or association between two variables. In an effort to bring objectivity into the admissions process, this paper examines the correlation graphs for the large, representative, and unbiased applicant pool subject to the representative set of admissions, ranging from those whose admissions-related decisions create successful future engineers to those whose decisions are unlikely to create future engineers. The paper hypothesizes that, in general, most of the fields that constitute an application are composed of mathematics-related fields. Therefore, those admissions officers with a strong bias towards math are likely to reveal a stronger correlation and thus, the selected individuals are better candidates for admission to an undergraduate engineering program. Conversely, admissions officers with a strong bias towards verbal and a weak bias towards math are more likely to reveal a weak correlation.

Implementation

The proposed model is implemented in C/C++ for a Unix platform and is compiled, debugged, and executed on both a Sun Sparc 10 workstation and a linux-based Intel 486/DX2 66Mhz workstation. The program is approximately 1200 lines long. For every admissions officer, the execution of 10,000 applicants requires 15 minutes of wall clock time.

For each of the fields, the maximum and minimum possible values are known. The SAT standardized test scores range from 200 to 800, the AP test scores vary between 1 and 5, and the traditional GPA ranges from 0.0 to 4.0. The recommendation letters are scored from a low of 1 to a high of 5. The class rank is assumed to vary from 1 to 99. The colleges attended and degrees earned for both parents and siblings are rated from 1 through 5, with 5 referring to the best universities in the nation and the highest degrees (Ph.D., M.D., D.B.A., LL.D., or equivalent).

Table 1: The Belief Structure of the First Ten Admissions Officers

beliefs	0	1	2	3	4	5	6	7	8	9
satMath	90	80	30	30	80	85	20	30	3	1
satVerbal	30	20	80	95	85	90	20	20	10	1
psatMath	80	80	20	20	70	75	10	25	20	1
psatVerbal	20	20	75	80	70	85	10	10	10	1
achMathI	90	95	30	20	95	95	30	20	30	1
achMathII	95	95	30	20	95	100	20	10	20	1
achPhy	80	80	20	10	80	70	25	30	10	1
achBio	70	70	20	15	70	70	10	20	30	1
achChem	60	60	30	10	80	60	15	10	10	1
achEng	50	30	95	90	90	90	20	30	20	1
apMath	95	90	30	30	80	80	40	20	15	1
apEng	30	40	95	95	85	85	20	30	1	1
apCS	70	60	10	20	60	70	30	10	14	1
apChem	70	70	10	10	70	70	10	10	15	1
apBio	80	60	10	10	70	70	30	5	12	1
apPhy	80	80	10	10	80	80	20	5	1	1
mathRec	90	95	15	10	90	90	4	5	10	1
humanitiesRec	30	40	90	85	90	85	20	5	20	1
GPA	50	70	80	70	70	70	20	10	10	1
numMatr	30	20	30	10	20	10	30	10	1	1
rank	80	80	85	90	80	70	10	20	10	1
collegeFather	50	40	20	25	10	20	90	80	20	1
degreeFather	30	30	30	10	10	20	90	100	10	1
collegeMother	50	40	20	30	10	10	90	90	20	1
degreeMother	30	30	30	20	10	10	90	100	10	1
collegeSibling	50	40	20	30	10	5	90	100	20	1
degreeSibling	30	30	30	20	10	5	90	100	10	1

The individual scores for each of the fields of all 10,000 applications are stochastic. They are generated through the use of the linux-pseudo-random number generator, "drand48," which accepts the minimum and maximum bounding values for the respective field as its arguments. The generated pseudo-random value is restricted to lie within these bounds. The use of drand48 is intended to ensure that the scores in the college application fields are evenly distributed and reflect an unbiased applicant pool.

Given that the absolute values of the different fields of an application are bounded by different ranges, the computation of the raw score by merely summing the values will fail to assign equal emphasis on each of the fields. Therefore, every field value is first normalized to a range between 0 and 100, utilizing the following conversion formula:

$$\text{Normalized Field Score} = [(rawAppFieldScore - rawAppFieldMin) \div (rawAppFieldMax - rawAppFieldMin)] \times 100$$

Upon receiving a normalized application, the admissions officer computes the processed score, utilizing his/her beliefs. The processed scores are propagated back to the admissions office and the officer awaits a subsequent normalized application. This process continues until every officer has generated processed scores for all 10,000 applications. Corresponding to every officer, the admissions office correlates the processed versus raw score for every applicant as the application is read and evaluated. The correlation values are generated progressively as groups of 50 applications are evaluated by the officer until the officer in question completes the evaluation of all 10,000 applications.

Table 2: The Belief Structure of the Second Ten Admissions Officers

beliefs	10	11	12	13	14	15	16	17	18	19
satMath	90	80	80	80	10	1	1	1	1	100
satVerbal	80	70	10	5	90	100	1	1	1	1
psatMath	90	90	70	70	10	1	1	1	1	1
psatVerbal	70	80	20	5	90	90	1	1	1	1
achMathI	80	85	95	95	5	10	1	1	1	1
achMathII	70	80	90	95	5	10	1	1	1	1
achPhy	90	70	80	80	10	10	1	1	1	1
achBio	70	90	80	70	10	1	1	1	1	1
achChem	80	96	70	70	10	1	1	1	1	1
achEng	70	100	10	10	100	100	1	1	1	1
apMath	90	100	80	90	20	15	1	1	1	1
apEng	99	80	5	10	90	90	1	1	1	1
apCS	100	90	60	70	10	10	1	1	1	1
apChem	70	88	70	80	30	20	1	1	1	1
apBio	80	99	80	70	20	10	1	1	1	1
apPhy	70	77	70	90	10	20	1	1	1	1
mathRec	60	89	95	100	30	10	1	1	1	1
humanitiesRec	90	90	1	1	100	100	1	1	1	1
GPA	70	70	70	60	80	1	100	1	1	1
numMatr	80	80	20	20	20	10	1	1	100	1
rank	60	90	80	70	80	80	1	100	1	1
collegeFather	70	80	90	80	100	90	1	1	1	1
degreeFather	80	90	90	100	90	90	1	1	1	1
collegeMother	90	70	90	90	80	80	1	1	1	1
degreeMother	80	80	90	90	90	90	1	1	1	1
collegeSibling	70	90	90	80	80	100	1	1	1	1
degreeSibling	90	80	90	90	90	100	1	1	1	1

Simulation of the Proposed Approach and Performance Analysis

As indicated earlier, 10,000 applicant profiles are synthesized wherein the value of each of the relevant factors is determined stochastically. The deliberate choice of the large number of applicants aims at providing confidence in the correlations and the results of this investigation. Indeed, the "level of significance" associated with the correlation values are given by *alpha* = 0.01 implying that the correlations are statistically "significant." Presumably, the applicant pool is also representative and unbiased and includes all types of college applicants.

Every officer maintained a list of 27 beliefs, each corresponding to a field of the applications. The criteria include an applicant's SAT scores, ACH score, background, etc., and are detailed in Tables 1 and 2.

Thus, in this investigation, college applications are modeled through 27 representative criteria while admissions officers are modeled by their belief structure, *i.e.*, their individual beliefs in the relative importance of each of the 27 fields, derived from their own and the relevant university's educational philosophies. Of the 27 beliefs, 15 are math oriented, 5 verbal oriented, and 6 are family background oriented. Given that an overwhelming number of the 27 beliefs are mathematically oriented, this paper projects that admissions officers with math emphasis would yield higher correlation values relative to those with other emphases.

Figure 1 presents the correlations obtained for all 10,000 applicants corresponding to Officer 0 through Officer 3. While the behaviors of the correlation graphs for the first 50 to 1,000 applicants

Figure 1: Correlation of Processed Versus Raw Scores for 10,000 Applicants for Officer 0 Through Officer 3

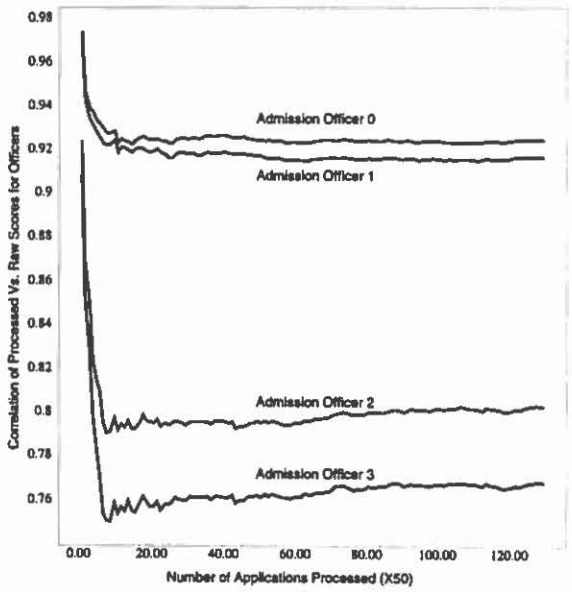
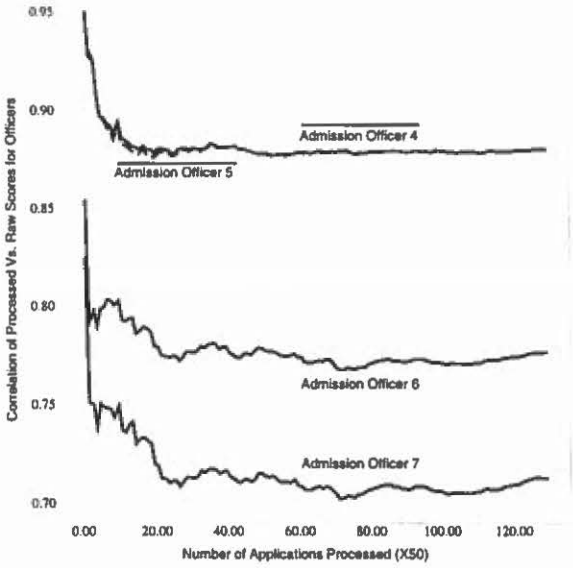


Figure 2: Correlation of Processed Versus Raw Scores for 10,000 Applicants for Officer 4 Through Officer 7



appear unsettled, they quickly settle down to steady and relatively constant values for the remainder of the 10,000 applicants. It is observed that the steady state correlation value of the graphs for Officers 0 through 1, both math oriented, approximates 0.925, reflecting strong correlation between the processed and raw scores. The steady state correlation values for Officers 2 and 3, both verbally oriented, are 0.8 and 0.76, respectively — significantly lower than those for the math oriented admissions officers.

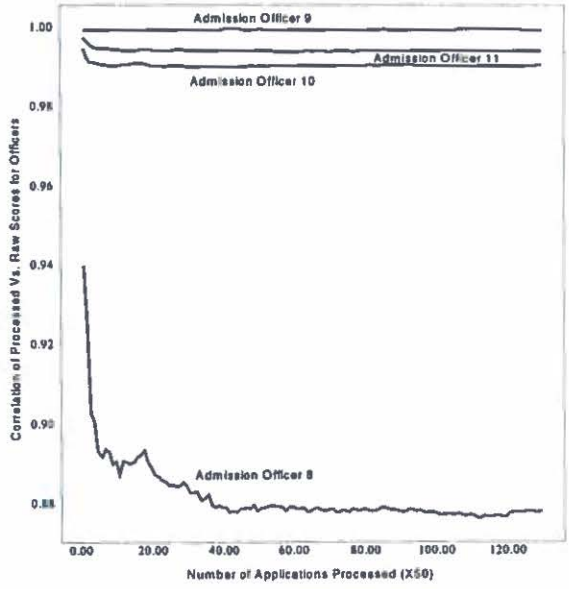
Figure 2 reveals that the correlation graphs corresponding to Officers 6 and 7, both of whom emphasized only the family background, reflect smaller values of 0.770 and 0.771, respectively. In contrast, the steady state correlation values for Officers 4 and 5, who favor math and verbal abilities, is relatively high, at 0.870. Furthermore, a comparison of the graphs in Figures 1 and 2 reveal higher correlation values for officers with solely math emphasis as opposed to those with emphasis on math and verbal.

The graphs in Figure 3 correponding to Officers 10 and 11, both of whom emphasize math, verbal, and family background, reflect high correlation values of 0.986 and 0.987. While Officer 8's belief for all of the fields are uniformly low, those for Officer 9 are consistently 1. Clearly, the raw and processed scores for Officer 9 track one another, generating a correlation value of unity, while the correlation value for Officer 8 is 0.88. Given the uniform beliefs of the officers across all fields and the lack of discrimination between them, the two latter correlation graphs do not convey meaningful insight into the admissions process.

Figure 4 reveals that for Officers 12 and 13, who place strong emphasis on math and family background, the correlation values are consistently high — 0.92 and 0.91. For Officers 14 and 15, who emphasize verbal and family background, the correlation values are relatively lower, at 0.835 and 0.76, respectively.

Figure 5 reveals that the correlation values for the graphs are consistently very low, ranging from 0.24 to 0.26. Each of the Officers 16 through 19 emphasizes a single criterion, namely GPA, class rank, school reputation, or SAT math, respectively. Clearly, reliance on a single criterion, regardless of whether it relates to math or verbal ability, may be unwise for the purpose of admissions decisions. Colleges and universities are therefore justified in requiring comprehensive information on the applicants including the different criteria enumerated in this paper.

Figure 3: Correlation of Processed Versus Raw Scores for 10,000 Applicants for Officer 8 Through Officer 11



Summary of Findings

For the large, representative, and unbiased applicant pool, the steady state behavior of each of the correlation graphs is significant. First, Figure 5 reveals that the results obtained corresponding to a single factor differ significantly from those where a number of factors are utilized, and may not imply a reliable basis for decision. Second, the correlation values in Figures 1 through 4, corresponding to different combinations of factors involving math, are uniformly high. Third, the very high correlation values for officers 10 and 11, coupled with the above observation, corroborate this paper's hypothesis that a predominant number of the fields that constitute an application are composed of mathematics-related fields. Evidently, ACH scores in Math, Physics, and Chemistry, and many of the other criteria require extensive mathematical manipulation and knowledge. The corroboration underscores the fact that mathematical manipulation plays a surprisingly strong role in today's society. Last, it has also been the second author's experience that officers with math emphasis are the predominant evaluators of engineering applications at Brown University. Informal tracking of students from admission through graduation reveals that the students identified by them are most likely to emerge as successful engineers. Thus, mathematics-related fields and the family background appear to be the key factors in predicting successful engineers. This paper suggests that as an aid to the admissions process, and not as

Figure 4: Correlation of Processed Versus Raw Scores for 10,000 Applicants for Officer 12 Through Officer 15

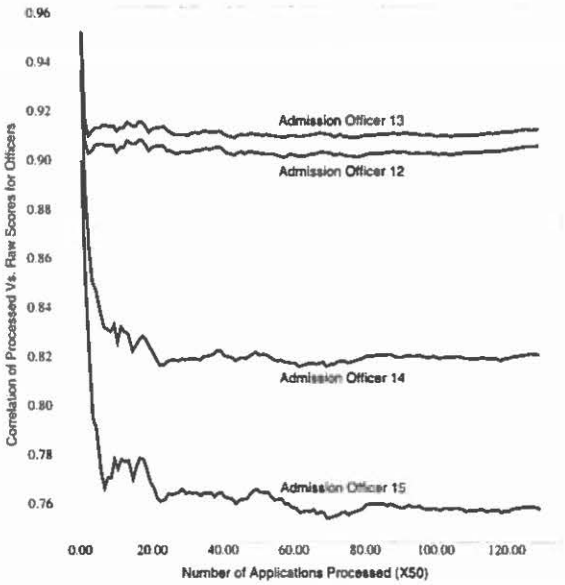
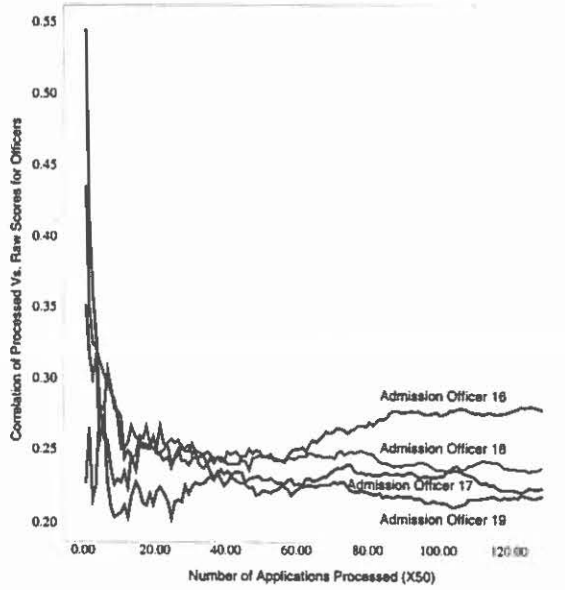


Figure 5: Correlation of Processed Versus Raw Scores for 10,000 Applicants for Officer 16 Through Officer 19



a substitute, the admissions officers may record their beliefs in the computer, automatically generate the processed scores for the applications, and compare the scores with their independent assessments to detect any anomaly in the decision process.

Conclusions

This paper has presented a correlation-based approach to model and evaluate an admissions process into an undergraduate Sc.B. engineering program. The results are compared against the actual experiences at Brown University over a three year period. The paper synthesizes hypothetical applicants with stochastic yet representative profiles, develops a computer model of the proposed admissions process that encapsulates the interaction between the beliefs of the admissions officers and the applicant profiles, and simulates the admissions process for 10,000 engineering applicants.

Analysis of the results reveals that (1) admissions officer biases play a strong role in determining the admissions decision outcomes (2) applicants with strong math ability, indicated through a high math achievement test score, high physics achievement test score, strong parental educational background, high GPA, and outstanding teacher recommendations are favored by the representative type of admissions officers who evaluate Sc.B. engineering applicants to Brown University, (3) reliance on a single criterion relative to the admissions decision may be unwise, (4) colleges and universities are justified in requiring comprehensive information on the applicants, and (5) SAT scores play a surprisingly minor role in the admissions decision. Although it focuses on engineering admissions, conceivably the ideas in this paper may be extended to other disciplines including arts and

sciences. Last, it is noted that not all students actually admitted to the Brown engineering program fulfill the criteria outlined in this paper.❖

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Assessment, Outcomes Measurement, and Attrition: Reflections, Definitions, and Delineations

Dr. Al Johnson

One need not immerse oneself to any great degree in the literature on college student assessment, outcomes studies, and attrition research to realize that these areas of inquiry are still very much in the process of being defined as legitimate avenues of educational research. Attrition research began in earnest about a quarter of a century ago with Astin (1974), Cope and Hannah (1975), Tinto (1975), Pascarella and Terenzini (1978), Johnson and Hutchinson (1980), while efforts to develop models for assessment and student outcomes studies are more recent with Astin (1991 and 1993), Light (1992), Angelo and Cross (1993), Banta and Associates (1993), Ewell (1985 and 1988), and many others. Despite this volume of literature, there is still a good deal of ambiguity in the way the terms assessment, outcomes measurement, and attrition are defined for research purposes. For example, the National Association of Student Personnel Administrators (NASPA 1995) recently published a booklet titled "Successful Student Outcomes Assessment." In this short work, NASPA included a partial inventory of available instruments currently in use for assessment and outcomes research. The title of NASPA's publication implies that the terms assessment and outcomes are, if not interchangeable, then at least similar enough so as to require no further delineation regarding the precise meaning of these terms. This notion is further reinforced when one examines carefully the inventory of assessment/outcomes instruments NASPA selected for its partial inventory. That list included more than 27 instruments which addressed topics as diverse as scholastic aptitude, vocational interests, career paths, concepts of work, capacity to realize opportunities, extracurricular activities, critical thinking, judgment, confidence, sexual identity, and a host of other subjects. The diversity of subject matter which these inventories purport to measure implies, that regardless of its emphasis, all student research is, in effect, de facto assessment research. And yet not all researchers would agree. For example, Mentkowski (1994) recently observed that educators must somehow "connect assessment with teaching and learning." She views the assessment process as an altogether different exercise from outcomes research. Her view, which is shared by others, is that outcomes studies, strictly speaking, should address academic and intellectual growth, an emphasis manifestly different from assessment which is often used to imply data gathering.

Despite the ambiguity in how these research areas are presently defined, there is little doubt that educational administrators recognize the value of the assessment process largely because this research enables them better to understand the students they seek to educate. They also understand that data gathered under the rubric of student assessment and outcomes studies have the potential to mitigate student attrition by anticipating which students a-priori have a demonstrable likelihood of failing to complete an academic program. In a larger context, when institutions establish carefully defined assessment programs, they are in effect demonstrating their interest in learning as much as they possibly can about their students and their students' needs. This in turn reassures legislatures which allocate funds in support of public higher education, governing boards which approve budgets for private institutions, and an increasingly skeptical public that institutions of higher education are committed to maximum effort, that they are in fact trying to maximize the likelihood of graduation for each student. At a time when an investment *in* higher education is so closely correlated in the public's mind with the value *of* higher education, institutions are seeking to do everything possible to maintain and increase graduation rates, thereby justifying the very considerable investment that the cost of a college education represents.

Toward that end, the purpose of this reflection is three-fold. First, observations are offered on how assessment, student outcomes studies, and attrition research terminology might be more clearly defined and made more useful to consumers of this research. Second, the suggestion is made that these three areas of inquiry, each distinctive in and of itself, are nonetheless, highly interrelated phenomena. Finally, in operationalyzing definitions and outlining a recursive research model, this paper highlights how one small liberal arts university is currently thinking through the process of implementing a longitudinal assessment program including student outcomes studies and student attrition research.

When administrators plan assessment programs, they must distill the term assessment into its component parts.

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Broadly defined, assessment consists of three highly interrelated phenomena each of which has its own distinctive characteristics. The first of these components is assessment itself. According to the 1992 *American Heritage Dictionary of the English Language*, the word *assessment* means to determine the value of something or to determine its significance or its extent. In higher education, this would imply data gathering; specifically, gathering various kinds of descriptive data on the students who comprise the institution's clientele. The term assessment should therefore be carefully defined to mean the collection or assembly of data—demographic, vocational, personal, for example. To employ the term in this way enables researchers to differentiate assessment from other measurement activities. These data can then be used in a variety of ways, perhaps none more important than assisting institutions in learning who their students are as well as what their students' needs are.

The first stage of the assessment exercise is to establish a baseline of data. These data sets should include information on 1) incoming freshmen, 2) sophomores and juniors who can be operationally defined as continuing students, 3) graduating seniors, 4) graduate students, 5) alumni whose graduation date was within five years of the date of the survey and finally, 6) alumni whose date of graduation was more than five years ago. To accomplish this phase of the research, one approach (there are many others) is to use the National Center of Higher Education Management Systems (NCHEMS) *Student Opinion and Information Survey* (SOIS) as a survey vehicle. These instruments are specifically designed to collect information, not to measure academic outcomes. In addition, these surveys are easy to administer, clearly understood by the students who complete them, and easily tabulated for analysis. NCHEMS survey instruments enable the researcher to establish comprehensive group profiles which reflect, among other things, students' experiences, expectations, aspirations, specific goals, and their evaluation of the institution and its services. In addition to telling institutions just who their students are, these surveys also summarize additional information reflecting the overall quality of the association between the students and the institution, something all academic and student affairs administrators want to know. In addition, these group profiles can also serve as a valuable foundation upon which strategic planning might be based. In short, the initial phase of the assessment process should be a relatively easy exercise of collecting extensive descriptive data on the institution's clientele. All other things being equal, it seems a perfectly reasonable way to begin the assessment process. In defining assessment in this way, institutions are able to differentiate this activity from student outcomes measurement and attrition research which constitute separate and obviously related, collateral activities.

To begin the second phase of research, institutions should identify a group of students on whom baseline data reflecting rudimentary academic skills can be established. Those students should be asked to complete a set of examinations which measure verbal and quantitative abilities. The collection of such information is, of course, commonplace at many institutions. As elsewhere, these baseline data enhance academic advising and program planning. But these data have an additional purpose.

Students who participate in this phase of the study can then be tracked to determine whether or not they have acquired the skills in English and mathematics that institutions seek to instill in their students. Pre- and post-designs are particularly appropriate for this purpose. During their first two years, these students will take a variety of typical freshman and sophomore English and mathematics courses. Pre- and post-test analysis can determine whether a statistically significant difference can be identified between students' initial scores and their subsequent scores on alternate versions of, for example, the ASSET examination published by ACT. If statistically significant pre to post differences for these dependent groups are found, institutions may conclude that the intervening coursework did, in part, contribute to those differences. Such results, however, speak only to elementary English and mathematics skills, not to the broader issue of higher order relational and abstract thinking.

As long as the variables used in outcomes measurement are very narrowly defined and easily quantified, it is not a particularly difficult matter to test and retest groups of students to determine whether or not academic objectives are being met. Scores on standardized math and English tests are a case in point. However, more substantial outcomes measures, specifically those which test for the acquisition of critical thinking skills and complex problem solving, are much more difficult to identify.

In order to determine whether or not certain higher order academic skills have been acquired by students, institutions must first determine exactly what they are attempting to impart to students through the process of education. Most faculty would agree that basic skills in English and math are desirable outcomes of the education process. But beyond this basic agreement, faculty are often quite polarized regarding their opinions on what characterizes an educated person. Variations of the often repeated themes of thinking with clarity, achieving depth and breadth in a field of knowledge, acquiring the capacity to grapple with moral and ethical problems, distilling complex problems into their component parts, and learning to appreciate the process whereby knowledge itself is acquired continue to be discussed as desirable traits for educated persons to possess. And herein lies one of the central problems with academic outcomes studies. Not only must each institution decide what it wishes to impart

to its students, it must also devise ways to determine whether those objectives have been met. It is a widely accepted truism that the more sophisticated intellectual behavior becomes, the more difficult it is to quantify and measure. It is equally true that the primary reason higher order reasoning skills are often not part of student outcomes research is that university faculties simply cannot agree on what should be taught and how such skills, whatever they are perceived to be, should be measured.

In discussions at the University of Great Falls, which focused on how one could determine whether or not graduates were reflections of what the faculty wanted them to be, it became clear that our perceptions of what constituted an educated person were quite disparate. We also agreed that, if left unaltered, our various notions of what an educated person should be would preclude any long-term meaningful student outcomes research. If we could not agree on curricular content, how then could we begin to think through an outcomes process? Responding to this impasse, we began a two-year long dialogue on reconfiguring the core components of our undergraduate curriculum to bring about some common agreement on what comprised a relevant and rigorous course of undergraduate study. Only by establishing common goals were we able to reach some consensus on what our graduates should know. And only then could we undertake a meaningful dialogue on how to begin to structure measurement instruments to tell us if the goals we had set for students were being realized.

It appears then, that student outcomes research has not only the potential to tell an institution not only a great deal about its students' intellectual achievements but also a great deal about the faculty who educate them. This then, is the real value of student outcomes research and what sets it apart from simple assessment. Outcomes measurement which gauges real intellectual depth and breadth is only possible when faculty share a common vision regarding what intellectual characteristics are desirable and how those skills might be measured appropriately.

The third component of the assessment triptych addresses student attrition research, the goal of which is two-fold. The first task is to develop predictor equations which identify students who fit a "high risk" profile. The second goal is dictated by the results of the first; it entails the design and implementation of

programs to decrease the likelihood that a particular student will become an attrition statistic. How is the first goal to be accomplished? Each institution should develop its own set of predictor equations using assessment and outcomes data on students who have graduated compared to those who have not. Multivariate statistics, especially multiple regression and discriminant analyses, are particularly useful in this area of research. Once predictor models have been developed, assessment and outcomes data can then be used to predict into which category — persisters, voluntary withdrawers, or academic dismissals — any given student's profile suggests he or she is likely to fall. Demographic variables, prematriculation academic variables and other measures can be used to isolate the best predictors of subsequent academic standing. Once students are identified as high risk, institutions can intervene with tutorial programs, counseling, remedial work, and the like to attempt to mitigate what initially might seem to be a dismal outcome.

In summary, the three activities commonly referred to as assessment, outcomes measurement, and attrition prediction are in reality separate but highly interrelated phenomena. None of the three can be meaningfully understood in isolation or without reference to the other two. As administrators and researchers continue to develop assessment programs, it will be helpful to differentiate these research activities into three specific areas so that each component is clearly defined and its relationship to the other two can be made clear. The assessment process as defined here should be the initial exercise. Periodic outcomes measurement can then be used in conjunction with assessment data to develop and refine predictor equations which can identify at-risk students. However, in order for the process to serve the institution and its students, each institution must plan its research so that it is consistent with the overall educational goals as determined by its faculty. Outcomes measurement research methodology must be drawn directly from those goals and aspirations. Models for assessment, for outcomes measurement, and for attrition prediction must be developed by individual campuses for localized use. These models must be constructed using clearly defined operational definitions of assessment and related terms. Failure to provide such definitions almost certainly guarantees continued obfuscation and ambiguity in this area of research which is so important to maximizing graduation rates.❖

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The Transforming Potential of Travel/Study Abroad

Louise Lonabocker

Travel does not merely broaden the mind. It makes the mind.
Bruce Chatwin in *Anatomy of Restlessness*

"Hello, where you from?"

"I'm American," I respond.

"Ah, very good. America Number 1."

Even with its missing verbs, this familiar exchange with the children of the street instantly and unmistakably confirms that I am indeed in a developing country. In this particular instance the country is Vietnam where I've been struck by the hospitality, good nature, and industriousness of the people I've been meeting. Would I, I muse, be as ready as are these people to put the past behind me and forge ahead as they are doing?

But how is it I find myself engaging in such a dialogue in the first place? Well, one February about twenty years ago I visited a friend who was attending graduate school at the University of Durham, England. Winter's cold was no surprise, but I was taken aback by her apartment, so cold that I could see my breath. My spirits were warmed, however, by a visit to Durham Cathedral. This lovely experience set me on the road to international travel. Shortly after Durham I became actively involved with international students and my institution's study abroad programs. I was increasingly becoming aware of places about many of which — quite possibly most of which — I felt myself relatively ignorant.

I simply had to see for myself so I made my first move — to the alluring attractions of Western Europe!

As I worked with students planning study abroad, I quickly became aware that they were choosing adventuresome destinations — like Senegal, Nepal, and Vietnam — places where they would face health maintenance and personal safety challenges unknown to the "study abroad pioneers" who went to Rome or Paris or Salamanca. One group of women I happened across left me humbled; they had been studying in Hanoi and were preparing for independent summer travel in the Mekong Delta, Cambodia, and Laos. Humbled puts it mildly. At their age I hadn't even boarded a plane!

Now the travel fat was in the international fire! Western Europe was followed by Mexico, Eastern Europe, and the developing countries of the Near East, Africa, and the Far East.

Have you ever wondered what motivates people to study/travel in such places; have you ever searched for something to say to students who are considering study abroad in places that stir your apprehension? I certainly did, but now that I'm a more experienced traveler, I know the challenges, the initial culture shock, and the surpassing rewards. I've become accustomed to many languages, immersed myself in diverse cultures, and respected varied traditions. Possibly students who are planning travel/study trips, and those who advise these students, may find the following somewhat whimsical reflections about the developing world countries of interest and perhaps of value.

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The majesty and magnitude of monuments — from Egypt to Mexico
to Tibet to Indonesia — overawe.
Monuments built during the past millenium — or two — or even five.
The building materials for which must have been transported
hundreds of miles, their construction entirely by human labor.
What marvelous determination and ingenuity of a people
who didn't (and still don't) have access to Internet!

Such spectacular scenery!
Mountain peaks reaching over 20,000 feet.
Lush tropical vegetation, rain forests, dazzling the eye and
animaled by a veritable bestiary from antelope through lion,
monkey to wildebeest, and all the way to zebra.
Oh, yes, one mustn't forget the domestic animals
roaming freely just about everywhere, even in city streets.
Appreciation of the world of God's creativity is inevitably intensified.

People's lives are governed by the natural rhythms of the day.
Most are in bed at sundown.
But beds as we Americans know them are a rarity.
Everyone is up at sunrise, that's no surprise — the alarm clock
is Islam's daybreak call to prayer when the muezzin
issues his summons over a very effective loudspeaker.

In remote parts of Asia, people bathe, do their laundry,
and defecate in the local lake, river, or irrigation ditch.
Life is lived largely outdoors.
Just as well, perhaps, for most of the housing,
one or two small rooms,
seems not substantial to my Boston eyes,
For outside the city, houses are constructed of whatever materials
may be at hand — bamboo, sheet metal, mud, even cow dung.

Because I am at risk of contracting a variety of diseases, and
Even though I occasionally speculate, "Is malaria
really all that bad?"
I tentatively accept a hotel room praying that
it contains an intact mosquito net.
And like any seasoned traveler, I won't go near an ice cube,
not even a fruit I haven't peeled myself.

A decent hotel room along the Mediterranean coast (breathtakingly
unspoiled!) of Turkey costs only $10-$20.
The shower is hand held (but hardly like the European amenity);
The water flows onto the floor and
into the drain that's in the floor;
but all too often
Sewer gas smell backs up through that drain.

The bus from Katmandu to Pokhara stops for lunch, so I approach
a makeshift restaurant where I know I should
try to conform to the table manners of the locals.
Even so, I'm still a bit ill at ease when I use my hands
to convey food to my mouth, the while
Casually observing the artful way these people have developed of
shoveling food into their mouths,
slurping contentedly, and on occasion
sneezing without bothering to cover their mouths.
It has taken a while, but I'm beginning to appreciate that
our Euro-American dining customs do not suit everyone.
Especially people who are allied so closely with nature.

I've eaten curry in Thailand, my belly blazing.
I've tried chilies, heavy perspiration floods me
(but, I'm assured, that's actually cooling).
I've never tasted pineapple so refreshingly fresh;
no gods on Mount Olympus ever savored better.
And, ah, those eggs, laid within the last hour, whose delicacy
leads me to wonder why people in industrialized societies
ever stopped raising their own chickens.

In the hill towns north of Hanoi,
I ate noodles or rice every day at every meal.
I know all too well that one native dish (pho, by name) that's
eaten every day by everyone.
McDonald's, Wendy's *et al.*, are unknown entities here.
It has not escaped my notice that many menus feature dog meat.
So when the impromptu restaurant carts almost magically materialize
on the streets at night with very fresh ingredients,
the respite is indeed welcome.
I've had a huge breakfast; cost — less than a buck.
Wolfed a substantial lunch for $1 plus.
Later dined sumptuously for under $5.
All this in a restaurant whose toilet abuts the kitchen, where
I observe several chickens, a few geese, and a pig.

The developing world's rules of the road are simply different.
The largest vehicles rule.
Drivers race at breakneck speed and pass each other
oblivious to oncoming traffic.
To us devotees of freeways and turnpikes, the infrastructure
seems so woefully inadequate because
a trip of 50 miles can consume 5 hours.

In Cairo, there's a nightmare concatenation of autos, motorbikes,
and bicycles that weave around
in seemingly chaotic fashion.
The incessant honking of horns is pure cacophony,
hardly symphony.
Pedestrians are at the mercy of all this — fend for yourself or perish!
Hold your breath when trucks and buses pass for
emission controls are nil.
No wonder the cities are polluted, and
respiratory ailments are endemic.

The Moroccan souk is resplendent with sundry colorful sights
and fragrances and smells — spices, tropical fruits,
carpets, and animals alive and dead.
Retail sales are definitely not American-simple transactions.
Visit a carpet vendor to buy a small carpet for the condo?
Hold on, not so fast!
It's just not so simple as all that!
First, a leisurely cup of tea; then begins the roll-out of a
seemingly infinitude of carpets.
Only after that do price negotiations commence,
interminable give-and-take that won't take "no"
for an answer.
Because I catch on fast, I soon find myself negotiating
price even on items that cost less than a quarter.

Customer service does not exist;
Short-changing does exist.
And no one but no one! ever seems to have any change.
That sheep you've identified as destined for holiday slaughter
accompanies both its new owner and me
aboard the minibus leaving the market.

Speaking of buses, they're all stuffed beyond belief.
Passengers exiting the bus are obstructed by the wave of people
simultaneously trying to get on.
Why, my organized registrarial mind wonders,
haven't these otherwise artful riders
figured out that this takes them twice as long?
When the bus stops in a small town, a congeries of vendors
of all types of goods and services materializes
who, while passengers move on and off,
enthusiastically push the sale of their stock of
cigarettes, bread, gum, and sliced cucumbers.
Their business is often nil — but they've tried.

Kids are kids everywhere.
Kids play sports with little or no equipment.
Imagination transforms a plastic water bottle into their soccer ball.
Badminton using shuttlecock and feet is such fun to watch
that it may become a new Olympic sport.
Ingenuity, having little, wastes nothing.

Agricultural fields line even the hillsides of Vietnam
and are farmed extensively.
So that every square inch of available land is rendered productive.
Fields are tended without the aid of mechanization —
Indeed, the most advanced technology is the water buffalo; but
I can't help noticing that women
are doing the heavy lifting.

The sounds, tastes, and aromas of Bali are excitingly exotic.
The art is in the cuisine, in the clothing, in the fields,
in the housing, in the flora and fauna.
Music and dance are distinctive and captivating.
Religious rituals fascinate —
Hindus deposit offerings of fruit and flowers for the gods
at every doorstep, sanctuary, temple, and rice field.
Tibetan Buddhists circumambulate shrines, prostrate themselves,
refill yak butter votive lamps, while immersed in
the mesmerizing chant of maroon-gowned monks
and the fragrance of joss stick incense.

Wherever I go, the people greet me graciously
and make me feel truly welcome.
They do have a different sense of time, though, so
In their attempt to be helpful, *noblesse oblige*,
a wrong answer seems better than no answer at all.

English has become the common language of travel and business.
More and more English is the language used by
natives of developing countries to communicate
even among themselves.
Often, they will urge their practice-English on me, so that
Sometimes invisibility would be a blessing.
On the other hand, how easy it is for us English-speaking travelers to get around,
Even though we've learned no more than ten words
of the native language.

Travel is simplified and enriched by other travelers.
Conversations are always easy; they
unvaryingly begin with travel talk —
Where've you been? Where are you going?
Everyone is wearing clothes unchanged for more than three days.
Diarrhea afflicts without distinction — universal commiseration!
Everyone knows precisely the location of three things:
Passport
Water bottle
Lonely Planet Guide

And it seems every child I met — well, at least in Asia and Africa —
asked for the same three things:
a coin
un stylo
un bonbon
How comes this, I wonder, to be so widely taught?

For all the above reasons, I promise myself, no compromise, that next year I'll go
to some place scoured, spotless, more familiar . . .

. . . but now it's next year . . .
And for all the very same reasons,
I have consciously, or unconsciously, disremembered by earlier promise,
And I find myself eagerly anticipating confirmation of my airline ticket
To yet another destination in the developing world,
And to the pleasure, to the real-life experience,
Of still another fascinating UNfamiliar culture.

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Concordance Between ACT Assessment and Recentered SAT I Sum Scores

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Abstract

Concordant relationships were developed between ACT Assessment and SAT I scores of students who had taken both examinations between October 1994 and December 1996. The SAT I scores are scores that students either received (SAT I taken on or after April 1995) or would have received (SAT I taken prior to April 1995) on the recentered scale that was introduced in April of 1995. Prior studies have established concordances between the SAT I Verbal + Mathematical Sum (SAT I V+M) and ACT Composite. In this study, we also provide concordances between the SAT I V+M and ACT Sum, which equals the sum of scaled scores on the four ACT subscores: English, Mathematics, Reading, and Science Reasoning.

Introduction to the Study

Many colleges and universities accept either the ACT or SAT for admission and scholarship purposes. This presumes some method of establishing an equivalency between scores on the two assessments. The Associated Chief Admissions Officers of Public Universities (ACAOPU) had asked both the ACT Corporation and The College Board to undertake such a concordance study when the Enhanced ACT was introduced. We repeated this request on the introduction of the SAT I. Since at least a full year's experience of score takers was necessary before undertaking such studies, relationship between the SAT I and the Enhanced ACT assessment has just been completed.

As is the case with many questions that appear simple, in reality a rather complicated issue is being addressed in an attempt to equate scores from different tests. We applaud the cooperative efforts and the dedication of resources necessary to accomplish this study by ACT, The College Board, and ETS. None of us, as separate universities, could duplicate the size of the sample or level of analysis.

I wish to thank, beyond the authors, Fred H. Dietrich, Vice President for Guidance, Access and Assessment Services for The College Board, and Don Carstensen, Vice President of the Educational Service Division for ACT, for their assistance in initiating this project. Specifically, in addition to the authors, we appreciate the work of James Maxey, Assistant Vice President at ACT, Richard Sawyer, Assistant Vice President at ACT, Howard Everson, Vice President at The College Board, Richard Adams, Executive Director at ETS, Gary Marco, Executive Director at ETS, Brian O'Reilly, Director of SAT Program at The College Board, Nancy Feryok at ETS, and Stephen Laue at ETS.

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Purpose

Since the early sixties, admissions officers have been interested in ACT-SAT concordance tables. Earlier research was reported by Chase and Barritt (1966), Pugh and Sassenrath (1968), Astin (1971), Maxey and Lenning (1974), Marco and Abdel-Fattah (1991), and Houston and Sawyer (1991). Along with these published studies, many institutions have in the past conducted local research studies to examine the association between ACT Assessment and SAT I scores for helping local officials use either set of scores. A study by Maxey and Sawyer (1995) was conducted to establish guidelines for using either ACT Assessment or SAT I scores to determine scholarship eligibility standards for student athletes planning to enter college in the fall of 1995. However, this study was based partly on SAT records that had been original SAT scale scores converted to recentered SAT I scores, and because of time constraints, could not include data from students who tested in the twelfth grade.

Recentered SAT I Scores

Because of high interest in both examinations and their score relationships, the Associated Chief Admissions Officers of Public Universities (ACAOPU) requested ACT, ETS, and The College Board to develop updated concordance tables. In the current study, concordant relationships were developed between ACT Assessment and SAT I scores for students who had taken both examinations between October 1994 and December 1996. The SAT I scores are scores that students either received (SAT I taken on or after April 1995) or would have received (SAT I taken prior to April 1995) on the recentered scale that was introduced in April of 1995. In either case, these recentered scores were obtained directly from each student's adjusted number right score, rather than indirectly from their scores on the original scale.

ACT Composite and ACT Sum

Prior studies have established concordances between the SAT I Verbal + Mathematical Sum (SAT I V+M) and ACT Composite. In this study, we also provide concordances between the SAT I V+M and ACT Sum, which equals the sum of scaled scores on the four ACT subscores: English, Mathematics, Reading, and Science Reasoning. The

Table 1: Frequency and Cumulative Frequency for ACT Composite and Sum Scores

ACT Composite	Frequency	Cumulative Frequency	ACT Sum
36	24	103525	142-144
35	187	103501	138-141
34	611	103314	134-137
33	1345	102703	130-133
32	2126	101358	126-129
31	3059	99232	122-125
30	4081	96173	118-121
29	4662	92092	114-117
28	5342	87430	110-113
27	6109	82088	106-109
26	6709	75979	102-105
25	6862	69270	98-101
24	7346	62408	94-97
23	7491	55062	90-93
22	7558	47571	86-89
21	7269	40013	82-85
20	6980	32744	78-81
19	6359	25764	74-77
18	5544	19405	70-73
17	4699	13861	66-69
16	3429	9162	62-65
15	2579	5733	58-61
14	1676	3154	54-57
13	953	1478	50-53
12	375	525	46-49
11	107	150	42-45
10	34	43	38-41
9	3	9	35-37
8	5	6	31-33
6	1	1	24
23.15	**Mean**		92.10
4.86	**Standard Deviation**		19.39
6	**Minimum Score**		24
36	**Maximum Score**		144

ACT Sum ranges from 4 to 144 by units of 1. The ACT Composite score ranges from 1 to 36 by units of 1, and is obtained by dividing ACT Sum by four. SAT I V+M ranges from 400 to 1600 by units of 10. SAT I V+M has 121 possible score-points, while ACT Composite has only 36. This difference in the number of scale points complicates the scaling process. Thus, it is easier to relate ACT Sum to SAT I V+M because the number of scale points is more comparable, 141 and 121 instead of 36 and 121. Presenting concordant scores between the ACT Sum and SAT I V+M is also relevant due to the decision by the NCAA to use the ACT Sum in determining eligibility for student athletes (Maxey and Sawyer 1995).

Note this paper does not examine relationships among subtests nor the invariance of these relationships across subgroups, such as clusters of institutions. Future studies are planned in these areas.

Description of Sample

Data Collection

In fall of 1996 ACT officials contacted representatives of 50 major public universities that tend to receive large numbers of ACT and SAT I score reports on the same students. In addition, efforts were made to collect ACT and SAT I scores from state agencies that had scores from both examinations on large numbers of students. ACT personnel were able to obtain test data on large numbers of students who had taken the ACT and SAT I from two large states with diverse student populations. In addition, scores were obtained on students who had sent both ACT and SAT I scores to 14 universities. Although the sample used for this study was not a random sample of all students who took both examinations, the size of the data file was over 100,000.[1]

The 14 universities and the two state education departments that participated in the study provided social security numbers and other selected information from the records of applicants for admission during the 1996-97 period. ACT Assessment and SAT I scores were obtained from the separate data files of the ACT Program and The College Board SAT Program by matching the social security numbers provided by the universities and states to the social security numbers on the data files. ACT Assessment scores came from tests administered from April 1995 to June 1996, SAT I scores from tests administered from October 1994 to December 1996. The ACT staff screened data and eliminated duplicate records. Records with one or more missing subtest scores were also eliminated, as were records containing scores from nonnational administrations of either test.

After the data were screened, a combined total of 105,544 applicants' records for ACT Assessment and SAT I scores were available from testing program files. The number of records per university ranged from 57 to 8,379. Only two universities provided data on fewer than 1,000 records.

Selection of Concordance Sample

One problem in conducting studies of this type is that students who take two college admissions tests tend to perform better on the test they take second. In addition, the magnitude of this enhanced performance tends to grow with increases in time between tests. The difference in performance may be partly the result of a growth over time in the skills tested or partly the result of familiarization with the testing situation. Whatever the reason, it can bias the results of a comparability study unless the two tests are balanced with respect to the time they were taken.

Students who took the tests more than 217 days apart were excluded from the sample (consistent with the rule employed by Marco and Abdel-Fattah 1991). Restricting the number of days between testings reduced the sample to 103,525. About 72 percent of these students took both the SAT I and ACT within five weeks of each other. However, 72 percent of the 103,525 took the SAT I before the ACT, while 28 percent took the SAT I after the ACT. On the average, the students in the concordance sample took the SAT I 15 days earlier than the ACT Assessment. This difference exceeded the 11 days reported by Marco and Abdel-Fattah.

Several approaches were considered to adjust for differences in time and order between ACT and SAT I administrations (see Appendix for details). Concordances based on the alternate approaches gave virtually the same results as concordances based on students who had 217 or fewer days between testing on the ACT and SAT I. Thus, all concordances presented in this report are based on the 103,525 students who took both tests within 217 days.

Concordance Sample Characteristics

Tables 1 and 2 contain distributions of scores on ACT Composite, ACT Sum, and SAT I V+M. As expected, the students in the concordance sample had higher average scores than the general ACT-tested or SAT I-tested populations.

[1]*The states that provided data for this study were Florida and Texas. In addition, data were provided by University of California, Duke University, Ohio State University, Ball State University, University of Illinois, Northwestern University, University of South Carolina, Texas A&M University, University of Texas, Baylor University, Rice University, Prairie View A&M University, University of Maryland, and Stephen F. Austin University.*

The average ACT Composite for the concordance sample was 23.2, while the national average ACT Composite was 21.0 (ACT 1997). The average SAT I V+M score for the concordance sample was 1071, while the national average SAT I V+M was 1013 (The College Board 1996). The percentages of males (43 percent) and females (57 percent) in the sample were typical of the percentages in the ACT-tested population (44 percent and 56 percent, respectively) and, to a lesser extent, the SAT I-tested population (47 percent and 53 percent, respectively). In terms of ethnicity, the concordance sample appeared to be representative of the SAT I-tested population, though Hispanic Americans were slightly overrepresented in the sample. For the ACT-tested population, Whites were slightly underrepresented in the sample, while Asian Americans/Pacific Islanders, Puerto Ricans/Cubans/other Hispanics, and Mexican Americans/Chicanos were all slightly overrepresented in the sample.

Table 2: Frequency and Cumulative Frequency for SAT I V+M Scores

SAT I V+M	Frequency	Cumulative Frequency
1550-1600	279	103525
1500-1540	678	103246
1450-1490	1418	102568
1400-1440	2377	101150
1350-1390	3776	98773
1300-1340	5342	94997
1250-1290	6576	89655
1200-1240	8016	83079
1150-1190	9084	75063
1100-1140	9725	65979
1050-1090	9971	56254
1000-1040	9764	46283
950-990	8886	36519
900-940	7875	27633
850-890	6513	19758
800-840	4918	13245
750-790	3420	8327
700-740	2202	4907
650-690	1356	2705
600-640	697	1349
550-590	389	652
500-540	175	263
450-490	66	88
400-440	22	22
Mean	1071.4	
Standard Deviation	194.4	
Minimum Score	400	
Maximum Score	1600	

The relationship between ACT and SAT I scores was evaluated for students taking both tests between October 1994 and December 1996, and within 217 days of each other. The concordance sample consisted of student records from two states and 14 universities. The state sample sizes ranged from 12,280 to 23,555 matched records. The university sample sizes ranged from 49 to 8,354 matched records, and consisted of students who had sent both ACT and SAT I scores to the institution as part of the admissions process. The samples for states and for institutions were mutually exclusive, so that a student was represented in either the state sample or the institution sample, but not both. The total number of student scores used in the analyses was 103,525.

Scaling Procedure

The scaling procedure used in this study was the equipercentile method. A single-group design was used in which students took both forms to be scaled (see Kolen and Brennan 1995 for a detailed discussion of equipercentile equating and single-group designs). As the name implies, the equipercentile method sets equal the scores that have the same percentile ranks in the sample. For example, the score at the 90th percentile in the ACT Sum score distribution is set equal to the score at the 90th percentile in the SAT I V+M score distribution. A problem with the equipercentile method is that where the data are sparse, usually at the extremes of the score range, the percentile ranks observed in the sample are not good estimates of the percentile ranks that would be observed in another sample (or in the full population, if that were possible). One solution to this problem is to use linear scaling methods. This was not a viable option given the curvilinearity associated with different numbers of scale points.

Another solution to this problem is to smooth the distribution, removing the irregularities so as to produce a smoothed distribution that is a better estimate of the score distribution that might be observed in the full population. This type of smoothing is called pre-smoothing because the smoothing is done before the concordance table is computed. Another approach is to post-smooth irregularities in the concordance relationship after the scaling is completed. Kolen and Brennan (1995) describe both pre- and post-smoothing approaches.

We chose not to smooth at all for two reasons: First, the sample size was very large (103,525); and second, the data sparseness problems were in the tails of the distribution, especially the lower end of the ACT scale. Smoothings that work well where the vast majority of the data are do not necessarily extrapolate well outside the bounds of the observed data. We chose to truncate the concordance tables based on the unsmoothed data at 11 on ACT Composite, 44 on ACT Sum, and 500 on SAT I V+M. Fewer than 0.1 percent of the students had scores below these truncation points.

Results

The relationships between ACT and SAT I scores were summarized for two combinations of scores: ACT Composite with SAT I V+M, and ACT Sum with SAT I V+M. Both ACT Composite and ACT Sum correlate .92 with SAT I V+M.

The results of the equipercentile scaling procedure are summarized in Tables 3 to 5. Tables 3 and 4 give the ACT to SAT I concordances; Table 5 gives the SAT I to ACT concordances. Tables 3 and 4 should be used to convert ACT scores to SAT I scores. Table 5 can be used to convert SAT I V+ M scores to either ACT Sum or ACT Composite scores.

Table 3 gives concordant scores between ACT Composite and SAT I V+M. The left column contains ACT scores ranging from 11 to 36. The next column gives the concordant SAT I V+M scores corresponding to the respective ACT score. For example, an ACT Composite score of 27 has a concordant SAT I V+M score of 1220. Note that an ACT Composite score of 18 has a concordance of 870 on the SAT I. This finding means that, in this concordance sample, there were as many people below an 18 on the ACT Composite as there were below an 870 on the SAT I V+M.

Table 4 gives concordant scores between the ACT Sum and SAT I V+M. The maximum possible sum of ACT English, Mathematics, Reading, and Science Reasoning scores is 144; the minimum possible summed score is 4. In the table, concordant SAT I scores are given for ACT Sum scores ranging from 44 to 144, a total of 101 score points. This concordance allows concordant scores to be presented to a finer degree of gradation than the concordance between the ACT Composite and SAT I V+M scores (Table 3 has only 26 score points). The concordance between the ACT Composite and SAT I V+M in Table 3 has large gaps in concordant SAT I scores for consecutive ACT scores. Gaps in SAT I scores for consecutive ACT scores are much smaller for the concordance between the ACT Sum and SAT I V+M scores. For example, Table 3 shows that an ACT Composite of 26 corresponds to an SAT I V+M of 1180, while an ACT Composite of 27 corresponds to an SAT I

Table 3: Concordance Between ACT Composite and SAT I V+M Scores

ACT Composite	SAT I V+M	ACT Composite	SAT I V+M
36	1600	23	1070
35	1580	22	1030
34	1520	21	990
33	1470	20	950
32	1420	19	910
31	1380	18	870
30	1340	17	830
29	1300	16	780
28	1260	15	740
27	1220	14	680
26	1180	13	620
25	1140	12	560
24	1110	11	500

Note: This and subsequent concordance tables are based on data from 103,525 students from 14 universities and two states who took the ACT and SAT I between October 1994 and December 1996. These tables contain scores that were achieved by comparable proportions of students who took both tests within 217 days of each other. Because the ACT and the SAT I tests have different content, concordant scores should **not** be viewed as interchangeable measures of the same combination of skills and abilities.

Table 4: Concordance Between ACT Sum and SAT I V+M Scores

ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M
144	1600	124	1390	104	1190	84	1000	64	790
143	1600	123	1380	103	1180	83	990	63	780
142	1600	122	1360	102	1170	82	980	62	770
141	1600	121	1350	101	1160	81	970	61	750
140	1590	120	1340	100	1150	80	960	60	740
139	1580	119	1330	99	1140	79	950	59	730
138	1560	118	1320	98	1130	78	940	58	710
137	1550	117	1310	97	1120	77	930	57	700
136	1530	116	1300	96	1110	76	920	56	690
135	1520	115	1290	95	1100	75	910	55	670
134	1510	114	1280	94	1090	74	900	54	660
133	1500	113	1270	93	1080	73	890	53	640
132	1480	112	1260	92	1070	72	880	52	630
131	1470	111	1250	91	1070	71	870	51	610
130	1460	110	1240	90	1060	70	860	50	590
129	1440	109	1230	89	1050	69	840	49	570
128	1430	108	1220	88	1040	68	830	48	560
127	1420	107	1210	87	1030	67	820	47	540
126	1410	106	1200	86	1020	66	810	46	520
125	1400	105	1200	85	1010	65	800	45	510
								44	500

V+M of 1220. SAT I scores between 1180 and 1220 are not represented in the table. Table 4 shows, however, that SAT I V+M scores of 1180, 1190, 1200, 1210, and 1220 are all represented when related to ACT Sum.

Table 5 gives concordant scores between SAT I V+M and ACT Sum (and Composite). Note that the relationship between SAT I V+M and ACT Sum is inversely related to the relationship in Table 4. For example, in Table 4, an ACT Sum score of 100 corresponds to an SAT I V+M score of 1150; in Table 5, an SAT I V+M score of 1150 corresponds to an ACT Sum score of 100. However, not all possible SAT I V+M score points are represented in Table 4 and not all possible ACT Sum score points are represented in Table 5. A perfect one-to-one mapping of ACT Sum scores to SAT I V+M scores and back cannot occur because the ACT Sum and SAT I V+M have different numbers of possible score points, and because of rounding to whole numbers. Rounding effects also allow an ACT Composite score and its equivalent ACT Sum score to correspond to different SAT I V+M scores.[2]

Table 5 contains 111 unique SAT I V+M scale points (out of a possible of 121), ranging from 500 to 1600, in units of 10. Table 4 contains 101 unique ACT Sum scale points (out of a possible 141), ranging from 44 to 144, in units of 1. Table 3 contains 26 unique ACT Composite scale points (out of a possible 36), ranging from 11 to 36, in units of 1. These tables use 72 percent of the possible ACT scale points, and 92 percent of the possible SAT I scale points.

Discussion and Recommendations

This study was conducted to develop new concordance tables between recentered scores on the SAT I and scores on the ACT Assessment. With the cooperation of several institutions and two states, a large database was obtained for establishing these new concordances between the sum and composite scores for both the ACT Assessment and SAT I. Even a large database like this has its limitations.

The results are limited in that the matched sample is not representative of the entire ACT and SAT I populations, nor can it be because they are different populations. The students contained in the sample performed considerably above the average on the ACT and the SAT I. With a lower scoring sample, or one more similar in ability to the ACT-tested or SAT I-tested populations, the observed concordances might not be the same. Because not all students choose to take both the ACT and the SAT I, the relationships between ACT and SAT I test scores might be different for the population on whom data were collected and the population to whom the results of the study will be applied.

The ACT Assessment and the SAT I are not parallel in content, and their scores are not interchangeable. Although the correlation of .92 between ACT Sum (or Composite) and SAT I V+M is very high, it is important to realize that, despite this high correlation, different concordances could be obtained with different data.

In particular, users of the ACT Assessment and SAT I who have sufficiently large samples of test takers with both ACT and SAT I scores may wish to investigate the feasibility of developing their own concordance tables. It is important to investigate how similar institution-specific concordances are across different institutions and states. Studies of the invariance of concordance tables across institutions should be guided by characteristics by which institutions differ. Preliminary results indicate some variability.

Many institutions might not be able to develop the SAT I and ACT concordance tables superior to the tables developed here, whether because of inadequate samples of students who take both tests or because of the lack of appropriate data analysis procedures. Potential users of the concordance tables developed in this study are advised to make sure the characteristics and test scores of their test takers who need ACT or SAT I scores are not greatly different from those of the concordance sample. Once appropriateness has been determined, these concordance tables should be useful in relating SAT I and ACT scores to make admissions, scholarship, and similar types of decisions.

Concordance tables provide useful comparable decision points at a group level. Selection rules based on concordant ACT and SAT I scores will permit the same proportions of students to be selected, but the degree to which the same students are selected depends on the correlation between the two tests, which for the composite or summed scores is very high in this concordance sample. Because of a

[2]*Equipercentile scalings are complicated by rounding effects, in particular, and discreteness of the data, in general. Discreteness refers to the fact that scores are reported in discrete whole numbers. As a consequence, ACT scores that appear like they should correspond to the same SAT I V+M score may not. For example, an ACT Composite score of 22 corresponds to an SAT I V+M score of 1030 in Table 3, while Table 5 shows that an ACT Sum of 88 (4 times 22) corresponds to an SAT I V+M score of 1040. This apparent discrepancy is due to the fact that the equipercentile definition of equivalence presumes that discrete integer scores are rounded versions of continuous scores. For example, a 22 equals all possible "scores" between 21.5 and 22.5. In addition, traditional equipercentile procedures assume that scores within an interval, such as 21.5 to 22.5, are distributed uniformly. This inconsistency between the discreteness of the data and the model continuity assumption leads to anomalies, such as those noted for 22 and 28. This discreteness problem is greater for short scales such as the ACT Composite.*

Table 5: Concordance Between SAT I V+M and ACT Sum Scores (and ACT Composite)

SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite
1600	141-144	35-36	1380	123	31	1160	101	25	940	78	20	720	58	15
1590	140	35	1370	123	31	1150	100	25	930	77	19	710	58	15
1580	139	35	1360	122	31	1140	99	25	920	76	19	700	57	14
1570	138	35	1350	121	30	1130	98	25	910	75	19	690	56	14
1560	138	35	1340	120	30	1120	97	24	900	74	19	680	56	14
1550	137	34	1330	119	30	1110	96	24	890	73	18	670	55	14
1540	137	34	1320	118	30	1100	95	24	880	72	18	660	54	14
1530	136	34	1310	117	29	1090	94	24	870	71	18	650	53	13
1520	135	34	1300	116	29	1080	93	23	860	70	18	640	53	13
1510	134	34	1290	115	29	1070	91	23	850	69	17	630	52	13
1500	133	33	1280	114	29	1060	90	23	840	69	17	620	52	13
1490	132	33	1270	113	28	1050	89	22	830	68	17	610	51	13
1480	132	33	1260	112	28	1040	88	22	820	67	17	600	50	13
1470	131	33	1250	111	28	1030	87	22	810	66	17	590	50	13
1460	130	33	1240	110	28	1020	86	22	800	65	16	580	49	12
1450	129	32	1230	109	27	1010	85	21	790	64	16	570	49	12
1440	129	32	1220	108	27	1000	84	21	780	63	16	560	48	12
1430	128	32	1210	107	27	990	83	21	770	62	16	550	47	12
1420	127	32	1200	105	26	980	82	21	760	62	16	540	47	12
1410	126	32	1190	104	26	970	81	20	750	61	15	530	46	12
1400	125	31	1180	103	26	960	80	20	740	60	15	520	46	12
1390	124	31	1170	102	26	950	79	20	730	59	15	510	45	11
												500	44	11

high degree of correlation between the ACT Sum (or Composite) and the SAT I IV+M, the concordances in Tables 3-5 provide reasonable estimates of scores, with the exception of high and low scores on either test. However, it should be noted that although the two tests are highly related, they are not exchangeable measures because of different content and statistical specifications. Estimates of an individual student's score on either test using concordance tables will likely differ to some degree from what the student's score would be if he or she were to actually take the test. A regression-based approach, which explicitly takes the strength of the relationship between tests into account, is an alternative.

Finally, a number of significant questions remain to be answered. Chief among these questions is that concerning the subtests in each assessment. ACT has four subtests (Reading, Science Reasoning, English, and Mathematics), and SAT I has a Verbal score and a Math score. It remains to be seen how well the subscores on ACT and the Verbal and Math scores on SAT I relate to each other. The best way to link subtests across these two tests needs to examined. The interpretations attached to these linkages need to be explicitly stated. Further research is required to answer these questions and other related issues.❖

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Appendix

Marco and Abdel-Fattah (1991) attempted to remove the bias that might result from the SAT being taken earlier, on average, than the ACT Assessment via a weighting system. The weighting system used in that study weighted the students who took the ACT first in such a way as to make the total number of days between testings for this group equal to the total number of days between testings for the group that took the SAT first. Applying these particular weights reduced the mean difference in test dates in their data from 11 days to 0.

An alternative approach to the weightings used by Marco and Abdel-Fattah (1991) is to truncate the full sample by direct selection on the number of testing days between SAT I and ACT administrations. The number-of-testing-days variable can be computed directly from the administration dates for SAT I and ACT. Here, positive numbers mean the ACT was taken before the SAT I; negative numbers mean the opposite, SAT I preceded ACT. As noted earlier 72 percent, nearly three in four, took the SAT I before they took the ACT. The degree of truncation needed would be enough to ensure that the average number of days between ACT and SAT I administrations would equal 0, instead of the -15 seen in the full sample.

In terms of the Marco and Abdel-Fattah weighting approach, truncation implicitly gives a weight of 0 to any scores excluded, and a weight of 1 to scores that are included in the analyses. Unlike the Marco and Abdel-Fattah weights, which gave the greatest weights to the most extreme time differences in the group that took the ACT before the SAT I, the approach employed here completely eliminated the most extreme differences among the test takers who took the SAT I first.

Truncation resulted in a loss of 10,729 (10.4 percent) cases, all of whom took the SAT I more than 70 days before they took the ACT. This truncation resulted in an average difference in testing time of 0, as desired. The full sample (N=103,525) had means of 1071 on SAT I V+M, and 23.15 on ACT Composite. In contrast, the truncated sample had means of 1077 and 23.24, respectively. Truncation produced a slightly more able subgroup.

The truncation approach is an extreme treatment of the data for the purpose of adjusting for differences in time between ACT and SAT I administrations. As such it would be expected to produce a larger score effect than those produced by other plausible weights that could have been used. As a drastic form of sampling, truncation provides an extreme case for studying the effects on scaling of sampling with respect to differences in time between SAT I and ACT testings.

To determine whether the bias due to the time differential was large enough to require differential weighting on time between administrations, ACT Sum and SAT I V+M were scaled to each other in both the full sample and the truncated sample. For the scaling of SAT I V+M to ACT Sum, we found that reported score concordances for the two types of scaling were identical or differed by a single point, the result of rounding. For example, an SAT I V+M score of 1080 converted to a rounded score of 93 (from 92.56) in the full sample, and to a 92 (from 92.41) in the truncated sample. Since 92.56 and 92.41 differ by only .15, they are virtually the same despite the fact that they round to different integers.

For the scaling of ACT Sum to SAT I V+M, we obtained similar results, virtually identical conversions under the two types of samples, full and truncated. For most of the ACT Sum scores, truncation had no observable effect on the relationship between ACT Sum and SAT I V+M. When there was an observable effect, it was due to rounding. Hence, we concluded that the differences between the truncated and full sample analyses were small enough to ignore. We performed all subsequent analyses on the full sample, which was called the concordance sample throughout this report.

AACRAO 1998 Annual Meeting Update

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The Forum

LETTERS TO THE EDITOR

Discipline and Transcipts

Pro — A Call to Action

Quann and Ratcliff in their article "An Argument for and a Case Study of Recording Significant Disciplinary Actions on Student Transcripts" (*C&U* Spring 1997) present a powerful recommendation to address a national problem. The college campus is not a sanctuary and not all of our students are saints. Thousands of students are suspended or dismissed each year for violating their institution's code of student conduct. The transcript is a student's official academic record. The transcript is the appropriate tool to convey a disciplinary suspension or dismissal that prevents a student's ability to re-enroll.

Students should be held accountable for their actions in and out of the classroom. Smith and Fossey (1995) in *Crime on Campus* report that in 1992 within the formal boundaries of U.S. campuses, there were 30 murders, 1,000 rapes, 1,800 robberies from persons, 32,127 burglaries, and 8,981 stolen motor vehicles. Smith and Fossey state that as bad as these statistics seem, the actual number of offenses is much larger.

The authors are correct to state that disciplinary suspension or dismissal that prevents a student's ability to re-enroll on our nation's campuses requires action to appropriately share information between higher education institutions. If higher education does not address this problem, we open ourselves to federal legislation or state by state legislation that will force us to take action.

Quann and Ratcliff present a call to action by recommending that AACRAO form a task force in collaboration with ASJA, NASPA, and ACPA to study and develop a uniform policy to document disciplinary suspension and dismissal on a student's transcript. Documenting the disciplinary action on the transcript is in the best interest of the students we serve.

Gregory Stewart
The University of Akron

Con — By No Means

I read with (slightly) controlled dismay the article in *College & University* proposing using an academic transcript to communicate disciplinary actions. All of us understand that our culture faces problems of violent crime, and we want to take actions to prevent its spread on our campuses. However, AACRAOans should resist the use of an academic transcript for this purpose.

The common definitions on grades and grading practices we have worked to clarify make it almost possible to understand most of each other's transcripts. Disciplinary practices vary greatly among our institutions and are intertwined with local values, philosophies, customs, and in many cases are adjudicated by student honor councils. Common definitions of these sanctions do not exist. Students would be victims of our institutional cultures, if not our confusion.

AACRAO's *Academic Record and Transcript Guide* offers several alternative solutions to dealing with the transmittal of disciplinary information. I greatly appreciate The Quann/Ratcliff proposal that we discuss these issues. In the meantime, we have a "uniform policy." Until and unless we redefine that policy and anticipate its implications, we should not take a slide down this hill.

Polly W. Griffin
Registrar, Davidson College

The Forum

Female Academic Achievement

I wish to comment on the article entitled "Predicting the Academic Achievement of Female Students Using the SAT and Noncognitive Variables" by Julie R. Ancis and William E. Sedlacek which appeared in the Winter 1997 *College & University*. The issues raised in the article are critical to improving the opportunities for women but I believe the data are of limited use as presented because there is no control group or comparison with a sample of males. Without a comparison group, there is no way to discern whether or not the data describe women only or college students in general. If a comparison of males had been included in the research, the variables might show similar relationships for male students and this would result in the implications of the study applying to all college students. On the other hand, an appropriate comparison between male and female students could indicate where gender differences exist in particular areas and then special attention could be given to improving the learning environment for women.

David S. Bender, Ph.D.
Campus Registrar, Penn State — Berks Campus

The Forum

COMMENTARY

The Changing Characteristics of Enrollment Management at Four-Year Public Comprehensive Universities

A Statement by Charles Rickard

In my twenty-seven years in higher education, I have experienced the evolution of enrollment management from the conceptual phase to that of a multi-faceted complex enterprise. It has grown from a one-dimensional operation to a comprehensive and shared undertaking using many key university resources. I have found, through my professional experience, that to be effective in this arena requires one to be a knowledgeable practitioner, a visionary, and someone who can find solutions to the challenges of a future marked with rapid change.

A sound enrollment management program acts as a catalyst for institutional self-study and renewal, thus assisting the institution with fulfillment of its mission. Public universities, much like the private institutions before them, have been forced to re-examine their enrollment management practices due to escalating costs and closer scrutinization from legislative bodies and the general public. The value of a higher education has been called into question in recent times. We must understand that enrollment management practices can dramatically affect the desired perception of an institution.

Due to demographic shifts, dramatic increases in educational costs, uncertain job placement opportunities, and intense competition among institutions, public universities have been forced to rethink their approach to managing their enrollments. As a result, the public universities have sought the assistance of faculty, alumni, and students in their recruitment and retention efforts.

The environment that we, in higher education, find ourselves in has become increasingly more competitive in the recent past. This environment of rapid change is being driven by the desire of many institutions to reposition themselves in the higher education arena. The competition between and among the public and private sectors and among selective versus less selective institutions is evidenced by expanded recruitment efforts. Many public institutions have developed recruitment programs that mirror private institutions' activities. Plus, there is an ever increasing use of merit scholarship dollars to recruit specific students. Financial aid has become one of the most important, complex, and controversial aspects of enrollment management efforts. Tuition pricing has become a critical factor in the ability of both private and public four-year institutions to attract desired numbers of students. In addition, the use of financial aid awards as marketing and recruitment tools has expanded dramatically, with ideas like tuition leveraging becoming important strategies for enrollment managers.

Public universities have developed a new understanding of the importance of effectively "matching" the students they recruit and enroll with their respective institutions. This lends support to the retention effort, and thus enhances the graduation rate of the student body. The net result is that the institution develops alumni who believe in the future of the institution and are contributing members to its well-being. Therefore, the essence of enrollment management is to recruit the right students, retain them through providing a sound educational experience, and have them graduate and remain loyal supporters of the academy. This creates an educational environment wherein retention drives recruitment.

Although the specific goals may vary from institution to institution, there are similarities in the steps taken to enable institutions to have a greater impact upon enrollments. These various activities comprise the enrollment management matrix. Hossler (1984) defines enrollment management as "a process or activity that influences the size, and the characteristics of a student body by directing institutional efforts in marketing, recruitment, and admissions, as well as pricing and financial aid. In addition, the process exerts significant influence on academic advising, institutional research, orientation, retention, and student services."

Charles Rickard *is Associate Vice President for Enrollment Services at Kent State University, in Kent, Ohio.*

The successful public universities of this decade have established as their primary goal the academic success and personal development of all students who choose to attend their institutions. Their leadership knows about and understands the theories that may favorably affect the management of student enrollment. This is key to developing effective enrollment management strategies, programs, and services which contribute to improving the quality of student life on campus. Student characteristics and institutional values interact both in the academic and social systems of the institution, leading to a degree of academic and social integration. This theory illustrates how the goal of student success is intertwined in the development of strategies which focus both on achieving student academic success and personal development.

Public universities have become more aware that they must adopt a comprehensive approach to image building. Institutions that had serious image problems have dedicated themselves to strengthening their enrollment management efforts. They reached the conclusion that such a program affects every facet of university life and touches every important constituency of the university. Creating a healthy institutional image is extremely important to being a successful enrollment manager. The perceived quality of an institution's faculty and academic programs greatly impacts institutional image. A university's faculty contributes significantly to creating a position of strength for the institution. The faculty is the backbone of every university, as it is the faculty that delivers the academic product.

Several major thrusts have characterized the new understanding of enrollment management on public university campuses. They address the dramatic need to effectively conduct market research, to manage and interpret data correctly, to develop competitive pricing strategies, to manage the technology explosion in a productive fashion, to solidify the desired institutional image, and most importantly, to provide the necessary linkage between faculty and students.

The future, however, will require enrollment managers at public universities to implement the concept of strategic planning. This type of planning will be required because of the rapidly changing enrollment environment that institutions will continue to find themselves in during the remainder of this decade. Strategic planning is an institution-wide, future examining, participative process resulting in statements of institutional intention that match program strengths with opportunities to serve its many constituencies. The components of strategic planning consist of analyzing data on the internal operations and the external environment, matching institutional mission and strengths in order to capitalize on opportunities for positive change, and choosing the strategies that are consistent with the institution's values, are economically justifiable, politically attainable, and consistent with serving student needs.

As a progressive institutional environment is being created, a strong enrollment management program will provide the direction that helps other academic and student support offices to understand the importance of unity within the institution. Adherence to this concept strengthens the delivery of orientation, registration, financial aid, residence life, student life, academic advising, and career planning services. A unified effort on the part of these departments will dramatically assist the leadership of the institution to meet the challenges of the twenty-first century. This style develops a closeness within the university and provides for the nurturing of the university community.

It is the enrollment management program that frequently, through its research and marketing function, facilitates institutional change and a healthy financial position for the university. The public universities with vision, and which successfully reposition themselves in the marketplace, understand the vital role the enrollment management program plays in the life of the university. Mission fulfillment, institutional advancement efforts, image refinement, the attraction of outstanding students and faculty, institutional financial stability, and quality student life programming are the result of a well-conceived and soundly orchestrated enrollment management program.

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The Forum

BOOK REVIEWS

The International Guide to English Language Programs

The International Guide to Undergraduate Engineering Programs

The International Guide to Undergraduate Business Programs

The 1997 editions of *The International Guide to English Language Programs* and *The International Guides to Undergraduate Business and Engineering Programs* are indeed comprehensive educational guides of colleges and universities from around the world. The guides are intended to assist international students in determining the institution that will best meet their educational needs. Each guide provides prospective international students with detailed information including, but not limited to, course requirements, available disciplines, career options, and opportunities for studying Business, Engineering and English in Australia, Canada, New Zealand, the United Kingdom, and the United States.

In *The International Guide to English Language Programs* each college and university is profiled to offer the inquisitive student a brief but concise overview of that institution. The sections contained in the profile include Highlights, Program Facts, University and Location, Student Profile, and Expenses.

The Highlights section provides the reader with information such as class size, TOEFL preparation and examinations, and sessions offered. The Program Facts section includes the year the English language program was founded, whether the institution is public or private, on- and off-campus accommodation options, and the agencies that have accredited the program. The University and Location segment offers students insights on the population of the city, the cost of living, campus setting, and the total enrollment of the institution. Student Profile lists "Program Enrollment per Year" which does not match the title listed on the How to Read the Profiles page. This title reads "Total ESL Enrollment per Year" but contains the same information. Also included in the Student Profile is class size, average age of the students, and country of origin. The Expenses section lists costs such as application fees, room and board, tuition deposit, and health insurance.

Information on the courses that each college and university offers includes course name, dates, number of weeks that the class runs, number of hours per week, whether the level of each course is rated from basic to advanced, a brief course description, and the cost of each course.

The overall profile also provides a detailed overview of the program, general information about the institution, and the city in which the institution is located. Furthermore, students will be informed of the facilities and equipment available to them as well as the requirements and processes for admission.

The International Guide to Undergraduate Engineering Programs contains much of the same information as the *English Language* book with a few added features. Two such features are disciplines that students may choose and a brief summary of the application process and admissions requirements. The section called "University and Location" is entitled "Statistics" in the How to Read the Profiles section. In the narrative segment of this guide is an additional overview of services, facilities, and activities for international students called Support for International Students.

The International Guide to Undergraduate Business Programs lists the same categories of information as does the *Engineering Programs Guide* except "Disciplines" are entitled "Majors."

Other features that complement this series include "Programs at a Glance" which compares English programs at colleges and universities, and offers "Discipline or Major Tables" for Engineering and Business programs. "Living and studying in each country," the "Top 10 reasons to study in a country," and a glossary of terms used in the volumes completes each overview.

The guides are extremely user friendly, easy to read, and offer a good deal of information to assist potential international students in their selection of a college or university. Information for each guide may be accessed via the Education International Internet site that is multilingual. International students should find these books valuable resources that provide insight into their pursuit of that appropriate institution that will best meet their educational needs. 🕮

—Deborah J. Aiken
Community College of Rhode Island

The Forum

Creating a Safe Campus

by David Nichols

Springfield, IL
Charles C. Thomas, 1997
178 pages; hardcover $46.95,
softcover $33.95

Here is a book that should be on the required reading list for most administrators and faculty on today's campuses. The author, well-published in the field, contends that any campus, large or small, urban or rural, can become a safe campus — not free from crime, but prepared to deal with whatever crime does occur and, perhaps more importantly, able to remold itself so that in the future there is less likelihood that similar crimes will become an issue. The book provides, in concise form, a plan for taking a large chunk out of the crime wave that some claim is sweeping through the campuses of academe. The plan has been tested thoroughly, and it works. The plan, however, requires cooperation, communication, and a degree of synergy that often hinder attempts to implement it.

The layout is readable, pleasant, well-organized and well-researched (I was pleased to find my own institution, Marquette University — which has done an admirable job in attempting to apply the principles of this plan — cited in the text.) A quick summary is included at the end of each chapter, and endnotes are provided for further research.

The first three chapters present a snapshot of the current state of security and safety issues that face colleges and universities in this country. With a little historical perspective for seasoning, and the required statistics to back up general conclusions, the dynamic interaction between society at large and the campus is demonstrated. The isolation that institutions of higher education once enjoyed, or thought they enjoyed, seems to be melting away. This is especially true with respect to crime. The legal system, as well, is forcing the issue, not only by tort action (which can be expensive in more ways than the obvious), but also by legislation with all the mandates, guidelines, and other friendly help doled out by our government officials. These forces encourage a bandaid approach to security and safety: handle this incident, fulfill this mandate, put out this fire. But such a response is not advocated by the author.

Rather, a systematic collaborative approach to remediation is recommended. This approach is the subject of the last seven chapters of the book. No attempt is made to divine a single answer to all the issues. Instead, a variety of examples from a large number of institutions is presented. Occasionally, the author presents a list of alternative approaches that is exhaustive; but more often the lists are presented as a starting point for further development — something that can be molded to meet the needs of a particular institution. This cookbook approach is not presumptuous, but draws on the wealth of practical responses and fixes that have yielded promising results.

At its heart, the author's plan involves getting the institution's various appropriate offices and personnel involved in the process of creating a safe campus. With all of the dean-doms, sacred cows, and icons that are in place at most academic institutions, this can be a tough assignment. The group of faculty and administrators who give little, if any, of their creative efforts to the creation of a safe campus are not likely to be excited about becoming part of this process; instead, they may see this issue as someone else's problem. It is this segment of the population at which this book takes aim. Unfortunately, it often takes a tragedy to provide the catalyst for this process to take place. The book is prepared to whet the appetite of those with little appetite, and to present real issues that create real challenges for institutions to address. Workable resolutions are presented along with excellent references and notes.

Those in charge of a Security Department or Public Safety Department who are looking for a handbook by which to run their department will probably find this is not the book to buy. It contains relatively little in the way of new or innovative ideas, and the level of detail is critically low. However, the breadth of issues it covers taken together with the obvious need for a broad-based approach to security and safety make *Creating a Safe Campus* valuable in helping to develop consensus, or in establishing a better model before a tragedy forces the issue. The thoroughness of the research, the broad scope of topics covered, and the book's readable style make it a good candidate to become a textbook on the subject.

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