# AC 2008-1469: FEEDBACK THROUGH CRITICAL INDICATORS OF STUDENT PERFORMANCE: CONTRIBUTING TO THE ASSESSMENT OF HIGH SCHOOL EDUCATION

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# Feedback through critical indicators of student performance: contributing to the assessment of high school education

## Abstract

The data obtained and developed by the Office of Institutional Research and Planning (OIIP) of the University of Puerto Rico at Mayagüez (UPRM) since its foundation in 2001 has allowed for the creation of a strong student information system and the development of a series of critical indicators (CI) of their performance. This database includes the student performance at the high school level: high school grade point average (GPA) and scores of the College Entrance Examination Board (CEEB) and their performance at the university level (e.g., grades, GPA, retention and graduation rates, among others.)

This work presents a model for the development of a feedback mechanism to the high schools that send students to our Engineering School based on the critical indicators. This effort will promote continuous improvement at the high school level and at the university level. If the feedback mechanism shows a major problem for specific academic areas, the university and the school can develop strategies for improving the teaching-learning process for the specific subjects. The critical indicators used in the model will be analyzed for the high schools by geographic region and type of school (private or public). Initially the critical indicators will include: high school GPA, the ratio between students applying and students admitted per high school, retention and graduation rates, and grades obtained in general education courses such as, Mathematics, English, and Spanish, among others. The objective of this feedback system will be to influence positively the high schools in producing better educated students who can succeed in the engineering college of our university. The expected outcome is that both educational systems, the university and the high school, will improve through this process.

## Background

Since 2001, the Office of Institutional Research and Planning (OIRP) of the University of Puerto Rico at Mayagüez (UPRM) maintains data on student academic performance (SAP). With this data, the office can develop a series of critical indicators. With these critical indicators a system can be develop to relate SAP with the high school of origin of our students. This system will help us identify the high schools that do a good job in preparing their students for our university and those that require improving the teaching methods. This system will permit the identification of the high schools on a regional and island wide basis.

It should be noted that other input variables and their predictive capabilities for university success have been examined by several authors These include studies of students' high school rank and a measure of the quality of his/her high school <sup>(1)</sup>, pre-college preparation, recruitment programs, admissions policies, financial assistance, academic intervention programs <sup>(2)</sup>, among others.

Preliminary development of the core idea presented in this paper was discussed by the authors in a previous conference. In this case the concept of an expected loss function using as variables the graduation GPA, average time to degree, and graduation rates were used to rate the high

schools that send students to our university. Nevertheless no connection was established in this previous work with the performance of the students in their high schools.<sup>(3)</sup>

#### **Introduction and Justification**

The information on student academic performance that is kept in our database includes data of the students' performance in their high schools of origin (e.g., general grade point average, and results from the entrance examinations). Our database also contains the grades our students have obtained in our university, the graduation rates, and the retention rates, general grade point average as well as specific grade point average in the area of specialty. In previous studies conducted by our office, the academic community has identified a number of issues that require further analysis. Through these discussions the need for the development of critical indicators of students' performance has emerged as a way to measure performance of our students and their high schools of origin. The critical indicators can be shared with the high schools for them to use this information as part of the assessment process.

As it is shown in Figure 1, a process or system of assessment uses as a measurement of effectiveness the evaluation performed by the end user. In our particular case the university evaluates their students' performance and this becomes a measurement of the degree of success of the high schools of origin in preparing their students for our university.

Our office, OIRP, has the data and is in the process of establishing the procedure to analyze it in a systematic way and make it available to the high schools that send us students. This procedure will provide the high schools with information that will help them assess their teaching methods and this better prepare the students for the university. This procedure will permit the high schools to establish continuous improvement base on a continuous flow of information from us.



Figure 1. Supplier and Receptor Model of our academic performance model with critical indicators.

As shown in Figure 1, the preliminary critical indicators are: high school GPA, the ratio of applicants/admitted for each high school, the first year GPA, and the university graduation GPA, the retention and graduation rates per academic program, and the GPA of general education university courses (e.g., Mathematics, Spanish and English, among others). The objective of the system is to influence in a positive way the public and private high schools that supply us students, offering them indicators of the performance of their students in our university. These indicators will allow the high schools to evaluate the quality of their teaching procedures. Collaborations among the high schools and the university to define better teaching techniques and the material that should be covered. The critical indicators can be obtained by type of school (public and private) and geographical location. The system will produce a wellness index so that the high schools can compared each other.

Some of the possible information that can be provided by our proponed system is presented herein. Figure 2 shows marginal distributions of high school GPAs and the first year GPAs for the years 1990-2005 of admitted students to UPRM. As can be notice, high school GPAs are usually high, while the first year GPAs follow a normal tendency. Our system will be able to identify high schools with high GPAs that result in high first year GPAs. These high schools that prepared their students well for success in our university can be used as models for other schools that do not perform as well. This point is illustrated in Figure 3.



Figure 2. Marginal Distributions of High School GPAs and First Year GPAs at UPRM



Figure 3. Marginal Distributions of High School GPAs and First Year GPAs at UPRM for two hypothetical high schools

#### **Description of the Components of the Project**

The potential users could be the parents of our applicants, the Department of Education of the Commonwealth of Puerto Rico, public and private school teachers, counselors and principals as well as our Admissions Office. The system has to be flexible to fulfill the needs of individual parents as well an institutional users.

Our office has data available four our students that measures their performance in our institution as well as data from the students' performance in their high school used for the admission process. The key to the new data base is to connect at the student level these two sets of data. The information will be available in our web site (<u>http://oiip.uprm.edu</u>)

#### Evaluation of Two High Schools using a subgroup of Critical Indicators

The execution of the students in our institution could be summarized using several critical indicators in a single graph. Bar graphs for a subgroup of five critical indicators are shown Figures 4 and 5. These CI are: First Year Retention Rate, Graduation Rate, GPA in all Math courses taken, GPA in all the Spanish courses taken, and GPA in all the English courses taken. These indicators, for the school under consideration, are presented against the median for all schools to establish a comparison between the schools. In Figure 4, an actual school, labeled School A, showed above median behavior for all indicators. Figure 5 presents a case, School B, for which certain indicators are well below the median for all schools. By looking at these "dashboards" schools could definitely identify areas of opportunity in which they can focus their efforts. Many other critical indicators can be used in these dashboards such as: time to degree, college graduation GPA, ratio of courses attempted to courses approved among others.



Figure 4. High school (School A) with performance above the median.



Figure 5. High school (School B) with performance below the median.

## Conclusions

This system will prove to be essential for the assessment of our public and private high school system. The critical indicators of the performance of our students as a function of their school of origin should be used by the high schools to assess their performance. This system can be extended to measure the performance of other universities that send us our graduate students.

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