Enrollment Projection Model

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Executive Summary

IPAR has developed a mathematical model for projecting enrollment counts and FTEs for the current and future fiscal years. The model projects enrollment and credit hour loads on a class-by-class basis (e.g. Freshmen, Sophomores, etc) based on current enrollment numbers and predicted retention and advancement rates. New Entering Freshmen and New Entering Transfer counts are model inputs.

The Enrollment Model

Beginning in Fall 2007 IPAR developed a mathematical model to formalize projections of enrollment and FTEs. The model is based on enrollment counts on a class-by-class level along with estimated retention rates and advancement rates (Freshmen advancing to Sophomore, etc.). Specifically, the model used to estimate total credit hours taken (from which FTEs are calculated directly) for term t+1 is:

$$
\begin{aligned}
CH_{t+1} = &\left(r_F * r_F' * N_t^F + T_{t+1}^F\right) * C_F \\
&+\left(r_F * (1 - r_F') * N_t^F + r_{So} * r_{So}' * N_t^{So} + T_{t+1}^{So}\right) * C_{So} \\
&+\left(r_{So} * (1 - r_{So}') * N_t^{So} + r_J * r_J' * N_t^J + T_{t+1}^J\right) * C_J \\
&+\left(r_J * (1 - r_J') * N_t^J + r_{Sr} * N_t^{Sr} + T_{t+1}^{Sr}\right) * C_J \\
&+\left(r_G * N_t^G + T_{t+1}^G\right) * C_G \\
&+\left(r_O * N_t^O + T_{t+1}^O\right) * C_O
\end{aligned}
$$

where CH_{t+1} is the Student-Credit Hour load. Definitions of other model variables are:

N_t^F — Actual number of Freshen for current term (similarly for Sophomores, Juniors, etc).

T_{t+1}^F — Estimated number of new Freshmen entering WSU (similarly for Sophomores, Juniors, etc). This is different from the NEF count. Any student not enrolled in the previous term is considered "new" for the purposes of the enrollment model.

r_F — Estimated *Retention Rate* of Freshmen (similarly for Sophomore, Junior, etc). The term "retention" is used atypically here. This variable measures the number of Freshmen enrolled in the current term expected to be enrolled in the following term.

r_F' — Estimated non-advance rate of retained Freshmen (similarly for Sophomore, Junior, etc.) This variable measure the percent of Freshmen that are retained Freshman in the following term.

C_F Estimated average credit load of Freshmen (similarly for Sophomores, Juniors, etc.).

To break the model down a bit, the number of Freshmen in any term is the number of new Freshmen entering the system (T_{t+1}^F) plus the number of Freshmen retained from the previous term that are still Freshmen. The number of Freshmen retained is the number of Freshmen enrolled in the previous term (N_t^F) times the percent of those who were still enrolled the following term (r_F) times the percent of those who did not advance to their Sophomore year (r_F'). Putting that all together, the number of Freshmen enrolled in term t+1 is $T_{t+1}^F + r_F * r_F' * N_t^F$.

Similarly, the number of Sophomores enrolled in term t+1 is the sum of:

1. The number of new Sophomores entering the system (T_{t+1}^{So})
2. The number of Sophomores from the previous term that were retained from the previous term and remained a Sophomore ($r_{So} * r_{So}' * N_t^{So}$).
3. The number of Freshmen from the previous term that were retained and became a Sophomore ($r_F * (1 - r_F') * N_t^F$).

Junior and Senior credit hours are projected similarly to those for Sophomores. The Non-Advance rate for Seniors is set at 1. Projections for Graduate students and "Other" students (specials, etc) also have a Non-Advance rate set to 1 and are not based on other class levels (i.e. we don't consider Seniors "advancing" to Graduate status).

The formula above is only used for Fall and Spring terms and the estimated retention and non-advance rates are for Fall to Spring and Spring to Fall ignoring Summer terms. Summer counts are estimated directly from counts of past terms.

Summer counts, retention rates and non-advance rates are estimated using a moving average of the past 3 years of available data using the formula:

$$x_y = \frac{3 * x_{y-1} + 2 * x_{y-2} + x_{y-3}}{6}$$

N_t statistics are calculated differently depending on the term. Actual enrollment numbers are used when final day counts are available. For instance, when estimating current year FTEs during the spring term, Fall and Summer enrollment numbers are known and do not need to be estimated. For future terms that have not begun yet N_t is estimated using the formula above. When estimating N_t for the current term the current enrollment counts are adjusted to predict final day counts.

Handling NEF and NET Counts

NEF (New Entering Freshmen) and NET (New Entering Transfers) could be estimated from past years (or could possibly be modeled separately). However, it has been the preference of the administration to specify Fall NEF and NET counts directly. These two numbers are currently considered model inputs.

There are several factors that complicate using these NEF and NET counts in the model:

1. NEF and NET numbers are tenth day counts that do not account for attrition between tenth and final day counts
2. The Fall NET number must be distributed between classes since those students might come in as Freshmen, Sophomores, etc.
3. Some NET students come in as Graduates and "Other" but we still model fall T_{t+1}^G and T_{t+1}^O directly from data.
4. NEF and NET students are not the only students that contribute to the T_{t+1} statistics. The model considers any student enrolled in a term not enrolled in the immediately preceding term as a "new" student in T_{t+1}, not just NEF and NET students. So these counts need to be adjusted upwards to account for the model's definition of a "new" student.
5. The NEF count cannot be assigned completely to the Freshman class (NEF_{t+1}) because not all NEF come in as Freshmen (this may be a coding mistake, or PSEOs may come in with enough credits that they come in as Sophomores). About 98.5% of NEF students come in as Freshmen and about 1.2% come in as Sophomores.
6. Students who are considered NEF or NET in a term may have been enrolled at WSU in the prior term. For instance, a PSEO student in 20075 may be a NEF in 20083. Such a student would be counted twice, once in the r_O statistic and once in NEF_{t+1} if we didn't adjust NEF and NET counts for this.

To handle these issues in the model we look at historical data and for classes Freshman, Sophomore, Junior and Senior and calculate:

NEF_C' Number of New Entering Freshmen that entered in Class C and who were not enrolled in the previous term.

NET_C' Number of New Entering Transfers that entered in Class C and who were not enrolled in the previous term.

NEF Actual total NEF count for the term.

NET Actual total NET count for the term.

NEF^* Specified NEF count in model input.

NET^* Specified NEF count in model input.

N_C' Number of students enrolled in the term that are not included in NEF or NET counts and were not enrolled in the previous term.

Using weighted averages over the past three years we then estimate T_{t+1} for a class with:

$$T_{t+1}^C = NEF^* * \frac{NEF_C'}{NEF} + NET^* * \frac{NET_C'}{NET} + N_C'$$

Spring NEF and NET counts are estimated directly from historical data.