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The Graduation Efficiency Index: An Alternative Measure of Time-to Degree Progress

Gary (Gary Russell) McKinney
Western Washington University

Joseph E. Trimble
Western Washington University

Jacqueline M. Andrieu-Parker
Western Washington University

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Prepared by Gary McKinney, Joseph E. Trimble, and Jacquie M. Andrieu-Parker

Introduction

Western has an access problem. While more students than ever want to come to Western, more students than ever are having to be turned away. There simply isn't the space. Fueled by the University's continued emphasis on academic excellence, regular placement among regional "best" in national publications, and the population influx known as the baby boom echo, Western has been inundated with the state's college-bound population. The Washington State Legislature, the Higher Education Coordinating Board, the Office of Financial Management—these bodies plus average citizens are hopeful that Western can address the access issue and let more students in.

One solution to Western's access problem is to get more students through the system faster; in other words, to increase the efficiency with which students earn their degrees. If impediments to efficient degree completion are removed, the flow of students through the system increases, thus allaying some of the access problem. Indeed, as long as academic excellence remains high, such efficiency would not necessarily be a bad thing. Who would not want a system of any kind to work at its most efficient?

Yet while many time-to-degree programs and policies may be talked about, investigated, and even implemented, one factor will need to remain constant: How will this increased efficiency be measured? The most well-known paradigm of time-to-degree efficiency is the years it takes a student to earn their degree, and assumes a tradition-based four years as the optimum figure. This standard is, however, woefully out of step with the times. While four years may have been a realistic expectation for students attending public universities twenty-five years ago (or even further ago), for most contemporary students earning a degree in four years is not realistic at all. There are a number of reasons.

For instance, despite the efforts to keep Washington State's public university system affordable, the costs of attending college have risen while the earning power of the parents of in-coming freshmen have fallen, from $36,500 in 1985 to $33,800 in 1994 (inflation-adjusted median parental income).[1] Fiscal realities create a different student than might have attended Western twenty-five or more years ago. Few public-university students can simply attend school; most have to work. Over 60% of Western seniors reported holding down part-time jobs while they attended school.[2]

Twenty-five or more years ago, too, students earning degrees in science did not face the numbers of required courses that science educators now consider "basic" to a student's understanding of the field. Contemporary science majors expect to take 90 to 110 credits *within* their major; in other words, practically all of a science major's upper division and a substantial portion of their lower-division credits must be devoted to courses within the major, many of them falling in sequence, fall through spring. Compared to science majors, students in the social science and humanities fields have much more flexibility: 60 to 70 credits may be required for graduation in the major, with less emphasis, also, on sequenced courses.

Moreover, twenty-five or more years ago, it was less time-consuming to become a certified teacher in the State of Washington. Today, students anticipating careers as teachers—most of whom must earn an academic degree, then spend another year earning their teaching certificate—assume that it will take them five years (or more) to complete their requirements. Even with the Woodring College of Education hard at work streamlining the curriculum, state standards still must be met, and sometimes the only way to meet those standards is to have students take more classes.

By the time just these three factors are added up—less affordability, increased academic loads for science majors, increased state requirements faced by prospective K-12 teachers--it is easy to see why the four-year standard is not at all a realistic standard for contemporary students. And these are but three of a myriad of factors changing the time-to-degree "norm." For an in-depth look at time-to-degree issues, the Office of Institutional Assessment and Testing did a lengthy study of time-to-degree issues's in its report: *Strategic Management Plans and Procedures to Improve Degree Progress and Persistence at Western Washington University* (Report 1994-03).

What then, should the new efficiency standard be? Should it be the number of *quarters* a student takes to earn a degree, the number of *credits* it takes a student to earn a degree? Both have merit. Both, along with the old-fashioned "four-years and out" standard should probably factor into the overall equation. Yet in addition, a new formula developed by researchers at the University of Washington—Gerald M. Gillmore and Phillip H. Hoffman—may be very helpful.[3] That formula is the Graduation Efficiency Index, or GEI.

The GEI is a formula that puts a different slant on efficiency, using the idea of class space as its basis. A part-time student, for instance, really takes up no more class space than a full-time student. Though the part-time student will more than likely not graduate in "four years," it does not mean that the student's presence in the system is creating inefficiency. If the part-time student earns 180 quarter credits and a degree, as does the full-time student, each has been as efficient as the system gets, since 180 quarter credits is the minimum credits necessary for a degree at most Washington State public universities. Neither student, part-timer or full-timer, has taken up any more class space than was absolutely necessary during the course of their studies.

Indeed, with programs such as distance learning, with satellite campuses emphasizing evening courses, with higher education trying to meet the educational needs of more diverse populations (not just ethnically diverse, but also diverse in age and other demographics such as work history, etc.), it is important to have measures of efficiency that are meaningful for current realities. As a matter of fact, "the State of Washington's Higher Education Coordinating Board has accepted the GEI as one of the common Accountability Indicators, at the urging of four-year public institution Provosts."[4]

The Graduation Efficiency Index (GEI)

The Graduation Efficiency Index (GEI) takes into account the following four variables:

- The total number of credits that have been earned
- The number of courses that have been dropped (leaving empty seats) or repeated (taking up empty seats)
- The minimum number of credits required by the major for graduation
- The number of credits that have been transferred

The GEI is intended to be a "single, easily computable index of the efficiency with which students move through the higher education system..."[5] The formula used to compute the GEI for *each graduate* is as follows:

$$GEI = \frac{\text{Minimum Required Credits for Degree - Transfer Credits}}{\text{Sum of 10th Day Credits}} \times 100$$

Besides a measure that may be more harmonious with contemporary trends in higher education, the GEI has the following advantages:

- It varies from 0% to 100%, and is easily interpretable.
- It takes into account the varying credit requirements within majors.
- It can be used at all degree levels where there is a standard and acceptable minimum number of required credits for degree.
- It can be computed for subsets; thus is a valuable research tool.
- It can be easily tracked over time to assess the effects of programs intended to improve time-to-degree.

Total Credits Earned

This figure is as self-explanatory as it is important. Efficiency as explained by the GEI hinges on how many credits students take before earning a degree. The nearer to the minimum, the higher the efficiency.

Total Credits Required for Graduation

Each academic major would supply this variable, based on the official institutional catalog. For instance, in the State of Washington, most public universities use the quarter system, and the most common minimum number of credits required for graduation within majors is 180--though this is not always the case. Some majors require more.

The Number of Courses Dropped or Repeated (Tenth Day Credits)

The "tenth day" standard was a compromise figure chosen by University of Washington researchers to fit the add/drop patterns and regulations that coincided best with their school. They chose a time at which if a student dropped a course there would not be much likelihood of another student filling the space, whereas at an earlier date the vacated space would in all likelihood be filled. There would be, of course, the chance that a student could add a course after the tenth day, also that a student might drop before the tenth day and not have their space filled. For UW researchers, there was an additional practical purpose to utilize the tenth day: it was a figure that afforded the easiest access to "clean" data. These sorts of concerns could be tailored to meet similar needs and concerns at individual schools, and should not be a problem "if the institution is internally consistent and is not comparing itself with others that use alternative definitions."[6]

Transfer Credits

Transfers credits obviously need to be a part of any index of graduation efficiency. The issue is not whether to use them, but how. While transfer credits are readily available to researchers, they do not explain any inefficiency brought by students to the institution they graduate from.

University of Washington researchers figured two ways to use the transfer credit variable. In the first—shown above—the figure is subtracted from the numerator. "So doing effectively assumes that the efficiency at the transferring institution is best estimated by the efficiency manifested at the graduating institution..."[7] Again, that formula is:

$$GEI = \frac{\text{Minimum Required Credits for Degree} - \text{Transfer Credits}}{\text{Sum of 10th Day Credits}} \times 100$$

In the second usage of the transfer credit variable, the figure is added to the denominator. When computed this way, the efficiency is always higher. "It implicitly assumes that the transfer work was done with 100% efficiency and that all inefficiency is at the graduating institution."[8] Thus the alternative formula would look like this:

$$\text{alt GEI} = \frac{\text{Minimum Required Credits for Degree}}{\text{Sum of 10th Day Credits + Transfer Credits}} \times 100$$

Thus a student with 90 transfer credits who graduates with 100 "tenth day" credits in a degree program requiring 180 credits has a 90% efficiency as calculated by the proposed GEI [(180 - 90) / 100], but has a 95% efficiency as calculated by the alternative GEI [180 / (100 + 90)]. The two formulae are equal, of course, if there are no transfer credits.

University of Washington researchers prefer the first formula, since "the alternative version systematically overestimates the efficiency of transfer students."[9] Most institutional researchers are confident that transferring adds inefficiency. For instance, the alternative formula assumes that all transfer credits counted toward graduation—which is hardly the case. Indeed, figures from many of Western's studies indicate that the transferring process was one of the stronger influences on increasing the total number of credits at graduation. Moreover, UW researchers found that when calculated with the proposed formula, native and transfer efficiency averages are relatively equal.

Using the GEI

To run GEI analyses on Western Washington University graduates, the records of all students who graduated between fall quarter, 1993, and spring quarter, 1994 were utilized. The total number of cases was 1755. Most graduates were female (57.3% females vs. 42.7% males). Most graduates were white (90.5%). Most graduates earned BA degrees (70.8%). Most graduates were classified as transfers (57.9%). (See Table 1.)

Table 1: Demographics
GEI Analysis of 1994 WWU Graduates
(in percentages)

Gender	
Male	42.7
Female	57.3
Ethnicity	
African-American	1.5
American Indian/AK Native	1.1
White, non-Hispanic	90.5
Hispanic	4.3
Asian-American/Pacific Islander	4.3
Degree (all)	
BA	70.8
BAE	12.4
BFA	0.1
BMUS	0.7
BS	16.0
Degree (BA or BS only)	
BA	84.0
BS	16.0
Admit Status	
Native	42.1
Transfer (30 credits +)	57.9

Students not included in this study were those who earned more than one bachelor's degree. Also, students who did not graduate with their class were not part of this analysis—for reasons that have to do with the two basic methods used to assess graduation rates and efficiency. The first method is to establish a cohort of in-coming students (starters) and track how long it takes them to earn a degree, using a criterion such as number of academic years or quarters a student needed to graduate. In other words, to work from the beginning through to the end. The second method is to establish a cohort of graduates (completers) and study their history, using similar criteria—the number of academic years or quarters or, in the case of the GEI, the number of credits earned—to establish efficiency. In other words, to work from the end result backwards. Which is better? Probably neither. The utilization of both, however, may offer the most amount of salient information to the time-to-degree discussion.

From the records of students who graduated from Western in 1994, a GEI was computed for each student. **The average GEI for all the cases in the sample was 82.4%.** Is this good? It's hard to know without a reference point, and thus far, because the GEI is a new measurement tool, there is no internal reference point, while the University of Washington's findings are, currently, slightly different from Western's (how the UW affixes native or transfer status, for instance, is different than at WWU). However, one can see that if a GEI was computed every year, it would be a very clear internal indicator of efficiency over time. As programs and policies meant to increase time-to-degree efficiency are implemented, the GEI should rise. If the programs and policies are not effective, one would expect the GEI to remain the same, or fall.

Yet there are other analyses of interest. **The average GEI for native students (first-time, in-coming freshmen) was 86.5%; the average GEI for transfer students was 79.4%.** An analysis of variance was computed and indicated that this finding was statistically significant, $F(1, 1751) = 122.22$, $p < .0001$. Though it should be mentioned that with these sorts of tests the large number of cases (well over 1700) aids in the finding of statistical significance, the finding is echoed in other assessment studies. For instance, OIAT report 1994-03 indicated that transferring credits was one of the stronger factors contributing to the total time to graduation, adding between 1.1 and 1.7 quarters to a transfer's total versus native students.[10] Also, findings taken from the OIAT's alumni survey database indicated that 15.1% of the class of 1991 had lost credits ("a great deal" or "quite a bit") when transferring to Western. Moreover, from data analyses of the "Close-in Study" of students entering Western in the fall, 1994, transfer survey respondents indicated they had completed fewer credits per quarter—1.26 fewer in their first quarter, 1.88 fewer in the second, and 1.48 fewer in the third—than native students.

Accordingly, it seems fair to say that transfers are somewhat less efficient at earning their degrees than natives. Yet while reasons for this trend may abound, the GEI cannot point out what those reasons may be. GEI analyses can only indicate areas where degree efficiency differ from one another.

Turning to analysis by degree, **the average GEI for graduates earning a BA degree was 83.9%, while the average GEI for graduates earning a BS degree was 74.7%.** Once more, an analysis of variance was computed and indicated that this finding was statistically significant, $F(1, 1751) = 111.54$, $p < .0001$. Again, it is not the purpose of this report to speculate on why, though at

least one reason has been mentioned above (the higher number of credits that must be earned within the major for those students pursuing a BS degree).

Finally, a two-way interactive analysis of variance was computed that compared both admit status (native or transfer) and degree category (BA or BS). Findings from this analysis indicated the following average GEI's:

Table 2: Analysis of Variance
2-way Interaction,
Admit Status and Degree Category,
Average GEI

	BA	BS
Native	87.5%	81.9%
Transfer	81.3%	68.5%

As with the findings above, the two-way analysis of variance indicated statistical significance, $F(1, 1751) = 15.36$, $p < .0001$. As Table 2 shows, transfers earning BS degrees have the lowest GEI of the four categories tested. Here GEI analysis has pointed to an area that is severely lagging in degree efficiency in relationship to other areas within our own institution. The University might ask itself what, if any, programs or policies might be implemented to increase the GEI of transfers planning to pursue a BS degree. Maybe a more finely tuned curricular articulation between community colleges and universities can be developed for potential BS majors—at least for those community college students who know they want to pursue BS degree. It would be hard for any such program to work for transfers who only decide to pursue a BS degree after they arrive at Western.

The average GEI for female graduates was 84.0%; the average GEI for male graduates was 80.3%. An analysis of variance once more indicated that the finding was statistically significant, $F(1, 1747) = 13.61$, $p < .0001$. Females were thus more efficient at earning their degrees than were males (though it should be mentioned again that an analysis of variance test run on datasets with large number of cases has a tendency to report statistical significance on seemingly small percentage differences; with half as many cases, for instance, it would be possible that a percentage difference of less than 4% might not test for statistical significance). Nonetheless, there are logical reasons why females have a higher GEI than males. For one, far fewer females than males earn BS degrees; for the 1994 graduating class, females earned 37.1% of all BS degrees, while males earned 62.9%.[11] For those females pursuing a BS degree, however, the GEI was nearly identical to that for males. (See Table 3.)

Table 3: Analysis of Variance
2-way Interaction,
Gender and Degree Category,
Average GEI

	BA	BS
Male	82.0%	75.0%
Female	85.1%	74.2%

Further analyses by gender indicated that GEI's by admit status look about what they would be expected to look like: native females are the most efficient, followed by native males, then female transfers, and finally male transfers. (See Table 4.)

Table 4: Analysis of Variance
2-way Interaction,
Gender and Admit Status,
Average GEI

	Native	Transfer
Male	85.0%	77.0%
Female	87.7%	81.2%

Tables 5 and 6 below also indicate a consistency within GEI findings: natives are more efficient at earning either BA or BS degrees, though natives of either gender are less efficient at earning BS degrees than they are BA degrees; and transfers follow a similar pattern of females earning either BS or BA degrees more efficiently than males.

Table 5: Analysis of Variance
2-way Interaction,
Natives Only Only,
Gender and Degree Category,
Average GEI

	BA	BS
Male	86.0%	82.0%
Female	88.5%	81.6%

Table 6: Analysis of Variance
2-way Interaction,
Transfers Only,
Gender and Degree Category,
Average GEI

	BA	BS
Male	79.2%	68.2%
Female	82.7%	69.0%

Further analyses of GEI averages were computed, most of which simply underscored the consistency of the findings. For instance, the more transfer credits a graduate earns, the lower the GEI—which makes perfect sense, since it has already been shown that transfers have a lower average GEI overall. Moreover, not only do native graduates have a higher GEI than graduates who transferred, but also graduates from 2-year colleges have a higher GEI than graduates from 4-year colleges or universities. Again, this makes perfect sense: graduates from 4-year colleges or universities are even more likely to get caught up in credit loss situations than transfers from community colleges.

Moreover, analysis by age indicated what most people might intuit: that the older a graduate is, the more transfer credits he or she has earned, thus the lower the GEI. Certainly older graduates are likely to have the lowest GEI averages—though this finding is indicative of what statistics cannot account for: people who are rolling with life's punches while also doing the best they can to pursue their academic dreams. One would hope that in the drive for maximum degree efficiency that the original intent of public higher education is not forgotten: to make a college education available to all, even those who might founder at some point in their academic pursuits.

GEI averages were also computed for each academic department. It was expected that departments in the humanities would have high GEI's, and, indeed, some did, including: Sociology (89.5%), Political Science (86.7%), Speech Pathology/Audiology (86.1%), and Communications (85.9%). Yet high GEI's were also found for Education (88.5%), and Human Services (88.4%). The Education majors identified here are graduates in Child Development or Special Education, academic degrees offered through the Woodring College of Education whose students follow a separate course of study than students earning an academic degree and a teaching certificate through Woodring. It is the latter, not the former, cited earlier in this report as needing a minimum five years to complete their teacher's training.

As expected, low GEI's were found in science departments; for instance, in Environmental Studies (70.8%), Computer Science (70.3%), Geology (71.7%), and Biology (75.8%). Yet low GEI's were also found in Spanish (77.7%), History (78.4%), and French (78.9%). Thus it is possible, with the GEI, not only to get a sense of how efficient an institution is, but how efficient its individual components are. When listed by department, it might, over time, be possible to help improve time-to-degree efficiency by increasing departmental efficiency. It would, however, be erroneous to make departmental judgments of efficiency with just one year's findings. Like many statistical issues, it would take analyses over a course of years to get a clear picture of departmental trends. Not only longitudinal issues, but over-arching issues would need to be kept in mind for departmental GEI analyses to be productive: for instance, the many more credits a BS major has to take (within the major) versus the credits a BA major must take.

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[4] Ibid.

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[11] McKinney, G.R., Trimble, J.E., & Andrieu-Parker, J.M. (October, 1995). *A Profile of Selected Characteristics of the 1994 Western Washington University Graduating Class.* Institutional Assessment and Testing, Western Washington University, Bellingham, WA.

Table 7: Graduation Efficiency Index by Department

	Natives		Transfers	
Department	Mean GEI	N	Mean GEI	N
Art	86.8	30	82.4	51
Art History	76.3	3	60.6	4
Music	77.3	14	66.3	9
Theatre/ Dance	82.7	10	84.2	3
Human Services	90.1	9	88.1	68
Fairhaven	83.2	9	80.5	50
Environmental Science	80.3	24	66.7	55
Biology	83.7	32	69.7	41
Chemistry	82.1	15	73.7	12
Communications	89.3	24	82.8	26
Economics	82.7	17	79.6	12
Accounting	88.1	30	82.4	36
FMDS	88.7	64	81.7	85
Management	90.6	18	82.6	18
Education	91.5	19	87.3	47
English	89.5	52	81.8	70
Journalism	91.6	8	73.6	13
French	82.7	9	73.9	7
Spanish	87.8	8	67.7	8
Liberal Studies	80.4	8	74.9	11
Geography	85.6	14	79.7	15
Geology	82.0	8	62.9	9
History	84.0	28	75.0	46
Mathematics	82.6	13	74.8	16
Computer Science	81.3	8	59.3	8
Math/ Computer Science	84.2	5	73.5	2
Philosophy	86.0	3	80.8	4
Physical Education	84.9	25	73.8	25
Recreation	87.3	27	78.5	27
Health Education	84.4	11	69.2	5
Physics	73.9	2	63.2	5
Political Science	88.3	31	84.4	20
Psychology	88.2	37	84.0	78
Sociology	92.1	38	87.3	45
Anthropology	85.6	19	84.1	17
Speech Pathology/ Audiology	90.2	21	77.6	10
Technology	82.7	28	75.2	23
General Science	83.7	3	69.2	7
Social Studies	93.6	5	80.3	13
Amer Cultural Studies	90.8	2	94.3	2
Entire Population	**86.5**	**738**	**79.4**	**1017**

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Dr. Joseph E. Trimble, Director

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Sociology
MS: 9081