Fall 2015 Outcomes
DMS/DEVM ALEKS Oversight Committee
Spring 2015

1 Summary

This report contains an analysis performed in Spring 2015 of student success rates in math classes during Fall 2014. Fall 2014 was the first semester students were placed into math classes, and hence was our first opportunity to see the effects of the new placement system.

Briefly, we make the following observations.

- There was an overall shift in enrollment away from developmental-level classes and into college-level classes.
- Pass rates for developmental-level classes were essentially unchanged from past years, with DEVM 050 being an interesting, benign, exception where pass rates declined.
- Pass rates for college-level math classes declined. However, the decline was the same or larger for students entering these classes on the basis of UAF coursework rather than on the basis of placement tests (ALEKS currently, and ACT/SAT/etc in the past). So it is difficult to ascribe this change to the new placement system. We will monitor future semesters to see if the trend persists.
- We performed logistic regression to try to determine ideal cut scores. In general, our current cut scores are too low to achieve the desired criteria, but the numbers from Fall 2014 alone are too small to confidently decide on new cut scores.
- Students who enter a class with credentials from both ALEKS and ACT/SAT/Accuplacer pass at noticably higher rates than those who enter on the basis of ALEKS alone. This observation may be useful in the future for modifying the entrance requirements for certain classes, or for identifying at-risk students requiring extra resources.

2 Enrollment Shift

Figure 1 shows how students were placed in initial math classes for fall semesters from 2011 to 2014. We are not interested in the total numbers of students in each class, since the incoming student population size changes from year to year. Rather, we indicate the percent of the incoming class that each course accepted.

At the developmental level, there is a clear story. There was a decline in enrollment in DEVM F050 and F060 and an boost to the enrollment in DEVM 105. The decline in DEVM F050 is especially dramatic. In the past we placed between 17% and 20% of incoming students at this level. In fall 2014 only 6.2% of students were placed in this lowest level class.

At the college level, the picture is similar but requires a little interpretation. In Fall 2014 we introduced a new course, MATH F194, that includes some of the student population that would otherwise have gone into MATH F107 or MATH F108. Taking this new course into account, the relative enrollments in MATH F107 and MATH F108 were largely unchanged. But there was a spike in calculus enrollment, from around 9% of new students in past years to 12.2% of students in 2014.

Notably, we also see a rise in relative enrollments in higher-level calculus classes. These rises are not associated with ALEKS, however, because ALEKS cannot be used for placement beyond MATH F200. These students must be arriving with sufficient AP scores or with calculus credit from other institutions and may reflect a shift in the UAF student body.

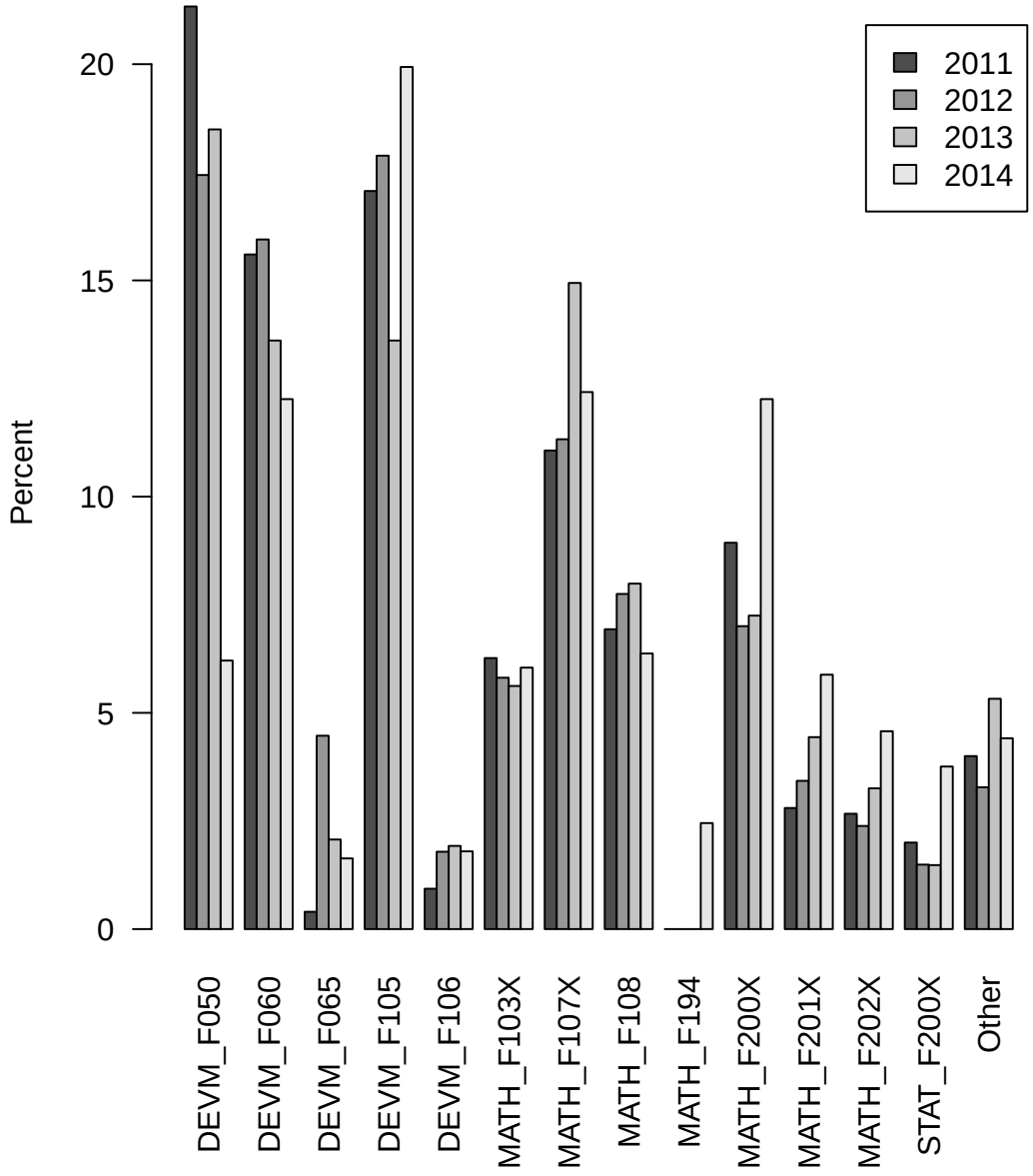

Figure 1: Fall semester enrollment in math classes.

3 Pass Rates

We gathered basic statistics on pass rates in the various math classes, deeming a grade of A, B, or C a pass and all other outcomes, including W, to be a fail.

Only students taking the course for the first time are considered. Students are broken down into two categories: those who met a coursework prerequisite, and those who did not have a coursework prerequisite but who did meet a standardized test prerequisite. Only fall semesters are considered. In fall 2014, only ALEKS (and AP scores) could be used as a test prerequisite. Students who appeared to not have a prerequisite are not considered, and students who dropped the class prior to the initial drop date in September were not included.

3.1 DEVM Pass Rates

Figure 3.1 shows success rates for three important developmental-level math classes: DEVM 050, DEVM 060 and DEVM 105. In DEVM 060 and DEVM 105 we see success rates via ALEKS placement that are comparable to the past and mildly lower than historical pass rates for students placing via coursework.

In DEVM 050 we see an anomalous decline in the success rate, which warrants further discussion. DEVM 050 is the most elementary developmental math class taught at UAF; we could not have done a better job by placing these students in a lower-level course because there is no such course. We interpret the decline as a possible indication that some of the students who succeeded in DEVM 050 under the past placement system have now been placed in more advanced classes. This conclusion is partly supported by the enrollment numbers discussed previously. Because we did not see a decline in the success rates for students placed by ALEKS in the other DEVM classes, we see this as a sign of improved placement at the DEVM level, with students placing in more advanced classes but succeeding at comparable rates to the past.

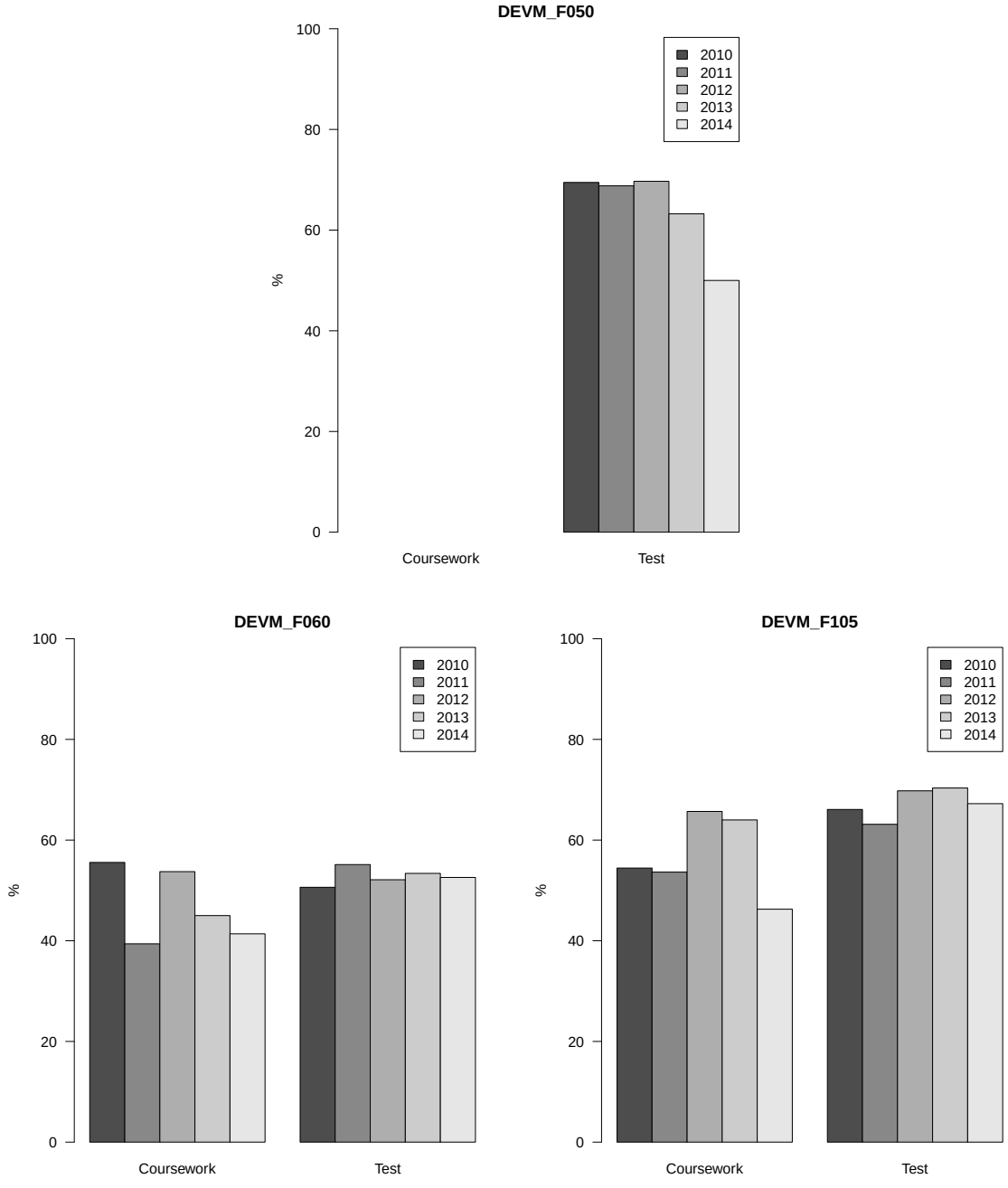

Figure 2: Success rates by placement type for DEVM classes.

3.2 MATH Pass Rates

Figure 3 shows success rates over the last five years for two principal introductory college-level math courses: MATH 107 (Functions for Calculus) and MATH 200 (Calculus I). There were declines in the success rates in both of these classes in 2014, especially in calculus. However, the declines in calculus success rates were even more pronounced among students who entered on the basis of coursework rather than test scores. We take this as evidence that factors other than placement were responsible for the 2014 declines, and that data from a single semester is especially susceptible to these effects.

We also looked at success rates for just the "F" sections of these courses, which are traditional classes (as opposed to online classes or those taught away from the UAF main campus) to see if standardizing to this body of students might provide more consistent data. Figure 4 shows these results, where we see a mixed story. Now calculus success rates in 2014 are comparable to previous years for students placing via ALEKS, with modest declines for students placing via coursework. On the other hand, we see poorer success in 2014 for students placing into Math 107 F sections via ALEKS, and comparable success rates for those placing by coursework.

The overall picture here is inconclusive, and we await more data.

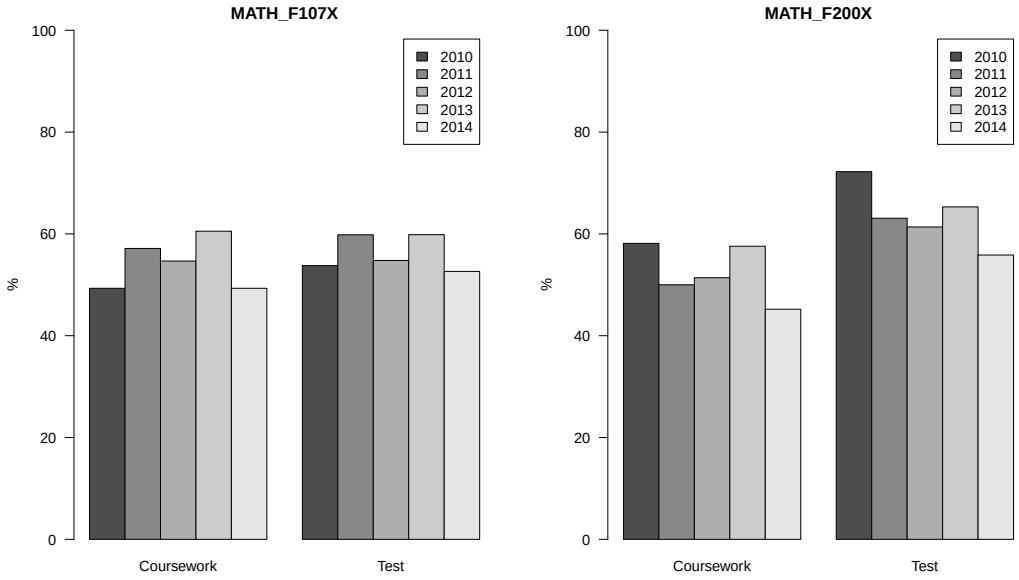

Figure 3: Success rates by placement type (all sections).

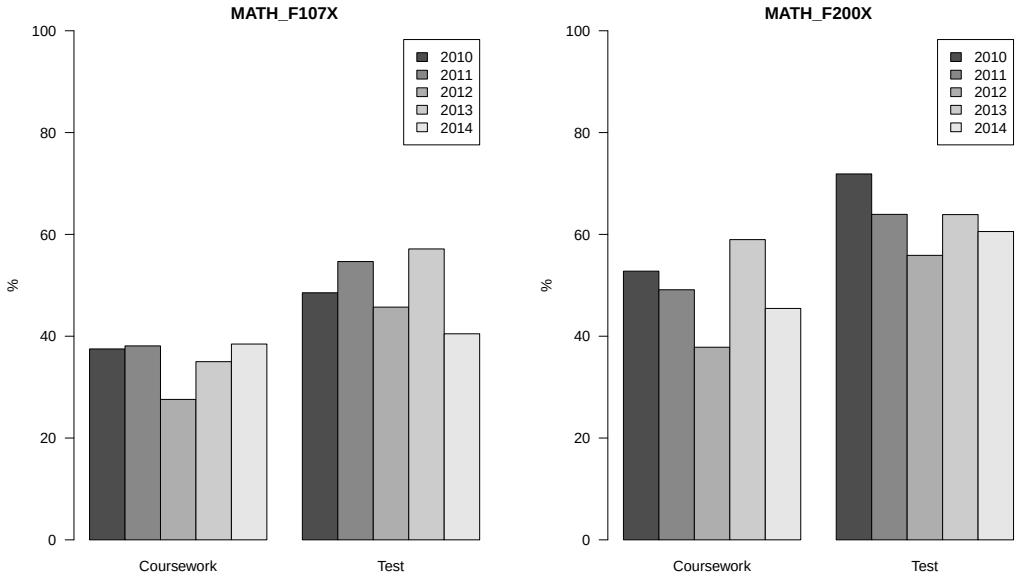

Figure 4: Success rates by placement type (F sections only).

4 Logistic Regression

We performed logistic regression analysis similar to an analysis performed in Spring 2013 for the older placement test policy. The goal of logistic regression is to decide on a cut score ensuring a desired probability of a certain outcome. We looked at two criteria:

1. Given placement at a given score, the student has a 50% probability or better of earning a B-.
2. Given placement at a given score, the student has a 75% probability or better of earning a C-.

Tables 1 and 2 shows the outcome of the analysis for the B- criterion and C- criteria, with the columns meaning the following.

n: The number of students considered.

x_{LD}: The estimated cut score obtained from logistic regression.

$[x_{\min}, x_{\max}]$: a 95% confidence interval for the estimated cut score.

Current: The current cut score, which should be compared with x_{LD} and the range $[x_{\min}, x_{\max}]$.

We note that, in general, our cut scores are too low to ensure the desired criteria, which is not suprising given the current pass rates. However, the confidence intervals are too large to accurately decide on new cut rates. We prefer to wait and gather more data before adjusting the scores, and we note that from the point of view of data analysis, it is better to start with cut scores that are too low than to have cut scores that are too high, and therefore exclude a population that would have otherwise passed.

Table 3 contains a statistic that inicates whether an increasing ALEKS score is associated with an increasing probability of success for various courses and each of the two success criteria. Loosely, if the number in the table is less than 0.05, then we claim with 95% confidence that increasing ALEKS score is associated with increasing probability of success. The numbers in this table can be large if the relationship between ALEKS score and probability of success is weak, or if the numbers of students are too small to make strong inference. We include this table here for future reference, to see how it changes in the future when we have a larger sample size.

	n	x_{LD}	$x_{\min}$	$x_{\max}$	Current
DEVM F050	83	24.4	9.2	39.6	1
DEVM F060	104	44.3	18.1	70.5	15
DEVM F105	184	40.7	33.1	48.3	30
MATH F107X	109	83.3	64.8	101.9	55
MATH F200X	86	89.9	72.1	107.7	78

Table 1: Cut scores (50% pass with B- or better).

	n	x_{LD}	$x_{\min}$	$x_{\max}$	Current
DEVM F050	83	23.2	9.8	36.5	1
DEVM F060	104	80.4	-118.3	279.2	15
DEVM F105	184	51.5	39.4	63.7	30
MATH F107X	109	89.6	59.1	120.1	55
MATH F200X	86	108.1	62.1	154.1	78

Table 2: Cut scores (75% pass with C- or better).

	B-	C-
DEVM F050	0.0358	0.0257
DEVM F060	0.0530	0.2834
DEVM F105	0.0015	0.0052
MATH F107X	0.0205	0.0397
MATH F200X	0.1372	0.1264
STAT F200X	0.8010	0.5810

Table 3: $P(> Z)$

5 Multiple Measures

Many students come to UAF with both ALEKS and ACT/SAT scores. We can therefore analyse the extent to which combined information improves our estimates of the probability of success.

The columns of Table 4 should be interpreted as follows.

n_{match}: The number of students who met the current ALEKS and the past ACT/SAT/Accuplacer cut scores.

Match Pass Rate: The pass rate for students meeting both prerequisite criteria.

n_{mismatch}: The number of students who met the current ALEKS criteria but did not have an associated ACT/SAT/Accuplacer score. In this analysis we did not distinguish between students with no score, and students with a score that that was too low.

Mismatch Pass Rate: The pass rate for students entering on the basis of ALEKS alone without an associated ACT/SAT/Accuplacer score.

	n_{match}	Match Pass Rate	n_{mismatch}	Mismatch Pass Rate
DEVM F050	53	56.6	29	37.9
DEVM F060	38	50.0	59	54.2
DEVM F105	89	77.5	88	56.8
MATH F107X	65	56.9	30	43.3
MATH F200X	36	75.0	41	39.0
STAT F200X	9	88.9	6	66.7

Table 4: Pass rates for students meeting both ALEKS and SAT/ACT/Accuplacer vs those with only ALEKS

Roughly half of students meet both criteria, and half have credentials based on ALEKS alone. In almost all cases, the pass rate improves for students with both criteria, and we note especially the large discrepancies for MATH F200 and DEVM F105. Presumably, we could dramatically improve the pass rate in calculus (MATH F200) by insisting that students meet both criteria, but this would come at placing half of the students at a lower-level class. Alternatively, we could use a discrepancy between ALEKS and ACT/SAT/Accuplacer as a flag to determine students who need to be targeted by additional resources. The ALEKS oversight committee will include discussions concerning these observations among its activites in AY 2015-2016.