A First Look at UAF's ALEKS Implementation
DMS/DEVM ALEKS Oversight Committee
December 11, 2014

1 Summary

UAF started using ALEKS for initial placement into math classes starting in Fall 2014. This report contains summary statistics related to the implementation of this new placement strategy. The report was compiled prior to the end of the fall semester, and hence there is no analysis of student outcomes. Rather, it contains a description of the events that occurred leading up to the start of the semester: when did students take the test, did they take advantage of the learning modules, how did they place, and so forth. Data used in this report came from statistics available from the ALEKS web site, as well as the DMS assessment database, which is based on raw data provided by PAIR.

Briefly, we make the following observations:

- The student population can be broken into three groups of approximately equal size: those who place at a level ready to start a technical bachelor's degree (precalculus or better), those ready to start a non-technical bachelor's degree, and those placing into a very elementary developmental-level math class.
- First-time UAF students placed into DEVM 050 at a substantially lower rate than under the past placement policy.
- First-time UAF students placed into DEVM 060 and DEVM 105 at a modestly higher rate than under the past placement policy. There was also a mild boost to MATH 200 enrollment.
- Approximately one quarter of students opt to take more than one assessment in an attempt to improve their placement. A substantial majority of students who take a second assessment manage to improve their placement by at least one class.
- Around half of students place into the class they were hoping to initially enroll in. This situation improves for students who retake the assessment: upwards of 2/3 of students who retake the assessment eventually place into their desired class.
- Students took the test at an approximately uniform rate throughout the summer, with a modest bump in August before the semester started.
- The assessment can take more time than we had anticipated. Currently, the UAF ALEKS web page suggests students set aside around two hours. But students who eventually place in calculus typically require around three hours.
- The new placement system did not appear to affect the proportion of incoming students who take math in their first semester: one in ten part-time students and two thirds of full-time

students. However, the situation for part-time students may change after the end-of-semester data becomes available, and these statistics will need to be recomputed.

2 Logistics

In this report we consider students who took the ALEKS assessment between March 1, 2014 and October 22, 2014. There were a total of 1808 assessments taken by 1393 distinct students. Figure 1 shows that the number of students taking the assessment was roughly 70 students per week starting from early April and continuing on until late June. After a modest slowdown until late July, the number of assessments increased to rougly 110 per week until the start of classes. There were a total of 1143 assessments prior to August 1 and 473 assessments during the month of August.

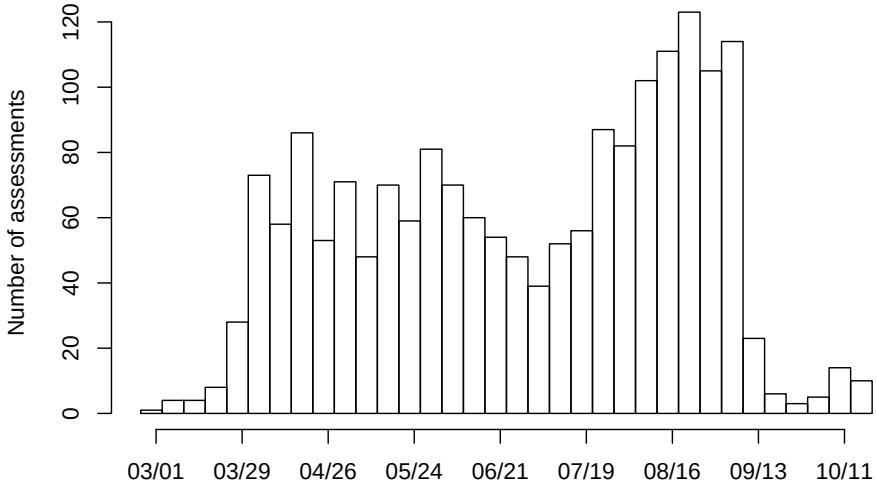

Figure 1: Assessments per week.

3 Placement

ALEKS scores are reported on a scale of 0-100. Table 1 contains the associated cut scores used for MATH/DEVM/STAT classes.

Score	Course Placement
78-100	MATH 200, MATH 272
70-100	MATH 205, MATH 262
65-77	MATH 108, MATH 194
55-100	STAT 200
55-77	MATH 107, MATH 161
30-54	DEVM 105, DEVM 106, MATH 103
15-29	DEVM 060
0-14	DEVM 050

Table 1: Cut scores

We will focus on four bins:

- Calculus-ready: 78-100
- Precalc-ready: 55-77
- Late DEVM: 30-54
- Early DEVM: 0-29

Most of these categories are self explanatory, but the Late DEVM category is interesting. Students who place at this level are sufficiently prepared, so long as they do not intend to seek a STEM or similarly technical degree. The Late DEVM bin includes placement into Math 103, which satisfies the core curriculum math requirement and is the our department's preferred terminal core math class for students not needing calculus. Moreover, placement at the Late DEVM level allows access to a suite of science classes that can be used to fulfill the general education core requirements: e.g., CHEM F100X/F103X/F104X, PHYS F102X/F103X/F104X, and all of the introductory biology courses. However, this level of placement is not sufficient for General Chemistry, CHEM F105X/F106X, and is not sufficient for General Physics, PHYS F211X/F212X. Moreover, all biology majors are required to take CHEM 105X/F106X, and hence placement at the Late DEVM level can be seen as a deficiency for students who wish to pursue technical degrees.

3.1 Distribution of Assessement Scores

Table 2 shows the distribution of placement scores in these four categories. Effectively, there is an even split with one third of students placing into precalculus or better, one third placing into Late

	Early DEVM	Late DEVM	Precalc	Calculus
n	445	462	312	174
%	31.9	33.2	22.4	12.5

Table 2: Placement levels.

DEVM, and one third not prepared to start taking non-technical core classes in mathematics and science. As seen in Figure 2, the distribution of scores is remarkably uniform, with a peak near the low end of the Early DEVM category.

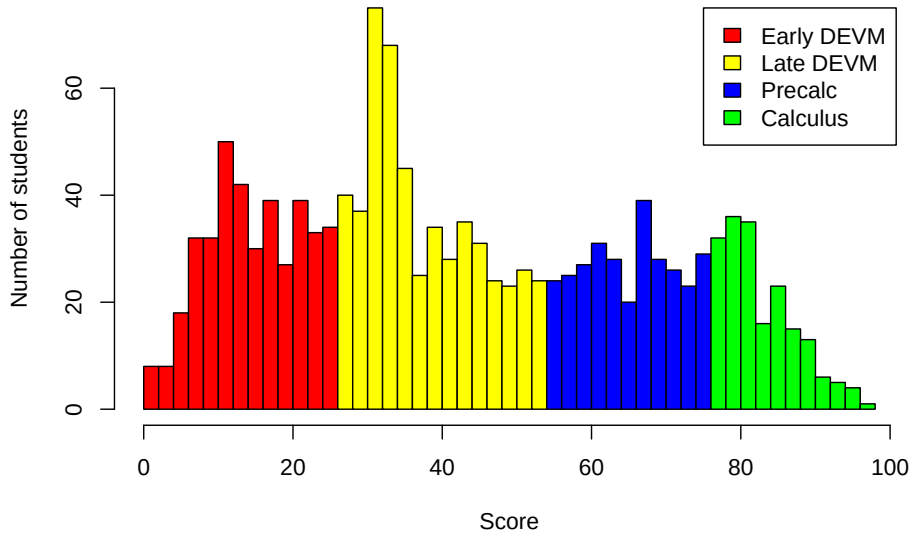

Figure 2: Achieved placement levels.

3.2 Shift in Enrollment

We looked at how first-time UAF students were initially placed, and how this compared with previous years. Figure 3 below shows the distribution of math classes taken by incoming part- and full-time students.

In previous years, roughly 1/3 of part-time students placed into DEVM 050, our lowest level math class. This year, less than 10% of students were placed at this level, and there was corresponding boost to enrollment in DEVM 060 and DEVM 105. We will be very interested in determining if this shift in enrollment results in a similar or better level of student success than in past years. If this is the case, the new placement system will have saved these students a semester at the DEVM level. An alternative explanation is that these students were over-placed, and we will detect this by

higher failure rates than in the past. We have received anecdotal reports that placement into DEVM 105 resulted in students being better prepared than past years, so we are cautiously optimistic that the boost in DEVM 105 enrollment was warranted. We will need to verify this quantitatively in the spring after final grades have been reported.

For full time students, we observe a similar, but less dramatic, shift away from DEVM 050 toward DEVM 060 and DEVM 105. There is perhaps a modest boost in calculus (MATH 200) enrollment, but the enrollments are also comparable with 2011. Finally, we note with curiosity the trend in the last several years of increasing enrollments in higher-level calculus. The only way to initially place in these classes is via AP test scores or university transfer credit, so ALEKS is not a part of that story.

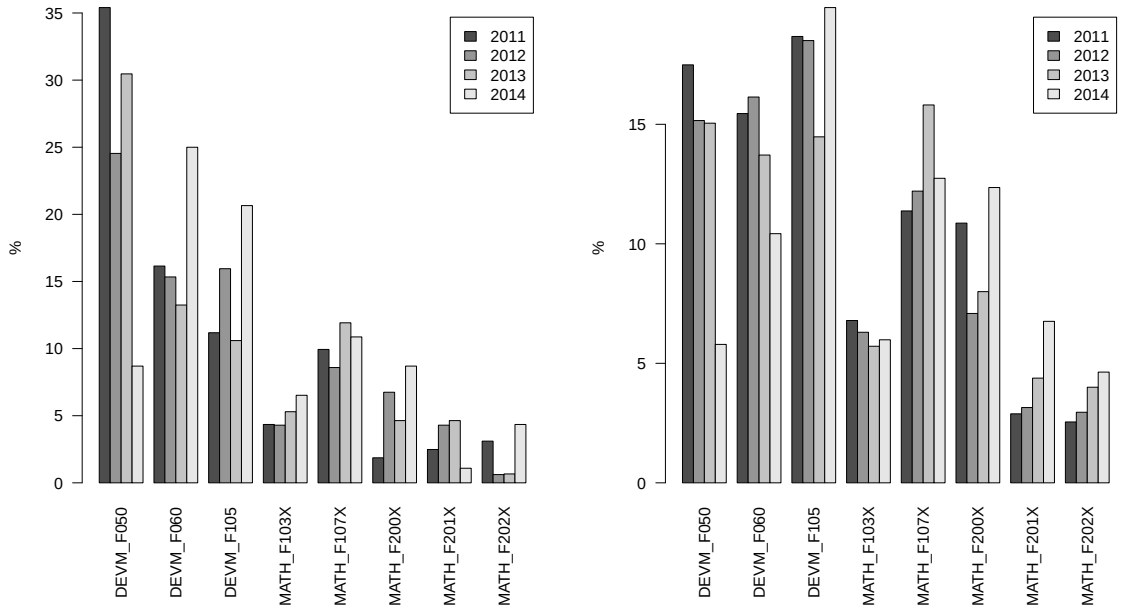

Figure 3: Enrollment in math classes by part-time (left) and full-time (right) first-time students. Note that there is a difference in scale between the two histograms.

3.3 Expected Versus Obtained Placement

	Early DEVM	Late DEVM	Precalc	Calculus
DEVM 050: Prealgebra	**44**	3	1	0
DEVM 060: Elementary Algebra	**38**	11	2	0
DEVM 105/106: Intermediate Algebra	80	**89**	20	3
MATH 103: Concepts of Math	31	**54**	15	4
MATH 107: PreCalculus	20	93	**68**	13
MATH 108: Trigonometry	4	6	**9**	2
MATH 161: Algebra for Business	10	11	**18**	5
MATH 200: Calculus I	3	22	73	**89**
MATH 262: Calculus for Business	2	1	7	**6**
MATH 272: Calculus for Life Science	1	0	1	**2**
MATH 201: Calculus II	0	1	6	18
MATH 202: Calculus III	0	0	1	3
I don't know	206	159	71	25
Other	14	12	20	4

Table 3: Desired math class versus final placement. Rows are desired class; columns are achieved placement; entries are numbers of students. Rows are grouped from Early DEVM through Calculus and beyond. Underlined entries correspond to students with outcomes matching expectations.

As part of the placement process, students complete a survey that includes questions about their math background and the course they are hoping to take at UAF. Table 3 shows how actual placement compares with desired placement. For the Late DEVM and Calculus bins, roughly half of students who wish to place at these levels do, with the the remainder generally placing one level below. The mismatch between expectation and outcome is similar but larger at the Precalculus level.

3.4 Prequesite Type and Students Without Prerequisites

There are two principal methods one can use as a prerequisite for a math class: either take a placement test, or take a prerequisite class. Additionally, there will inevitably be a number of students who take the class without a known prerequisite. For example, instructors have the purview of allowing students to enroll regardless of formal prerequisites. Figures 4 and 5 show the proportion of students using these three entry methods for a number of our most significant entry-level classes. Overall, ALEKS had little impact on the number of prerequisite-less students, and these levels hover at about 5-10%. We did observe, however, a decrease in the proportion of calculus students enrolling without a prerequisite, and a corresponding bump in the number of students taking the class via a placement test score. Previously, calculus had the highest levels of prerequisite-less students, and these levels are now in line with other classes. Math 107 now has the highest proportion of prerequisite-less students, but these levels did not change significantly post-ALEKS.

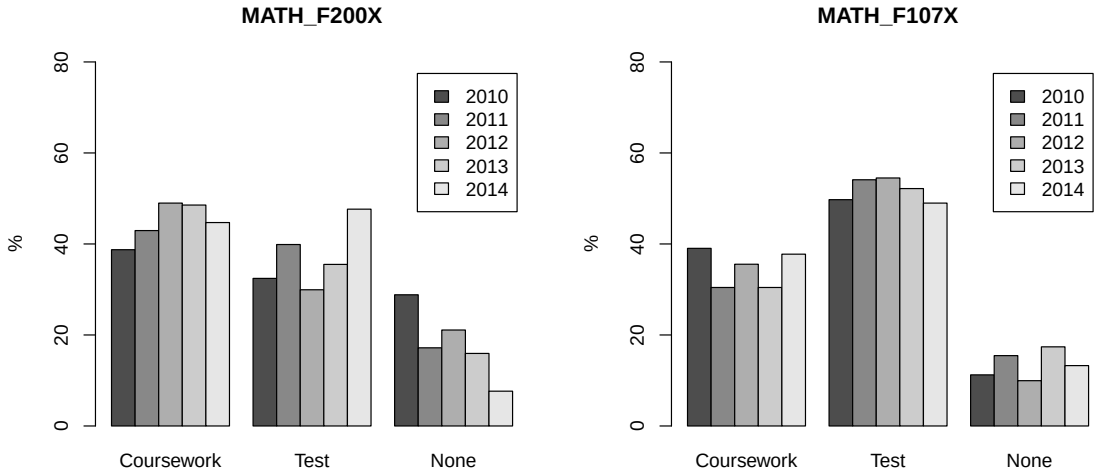

Figure 4: Placement method in MATH F200X and F107X.

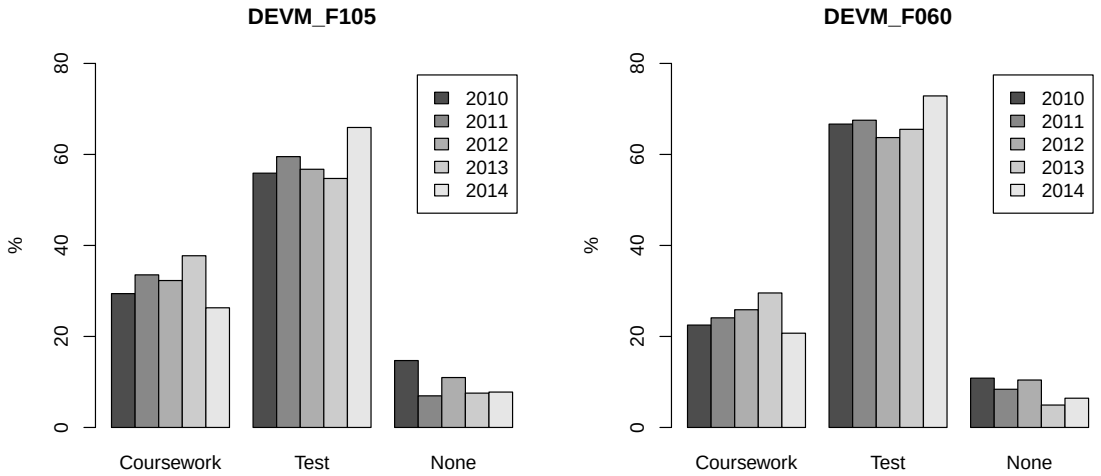

Figure 5: Placement method in DEVM F105 and F060.

4 Improvement in Subsequent Assessment

A compelling feature of ALEKS is that it permits students to spend time in learning mode and then take a second assessment. Table 4 shows that about a quarter of students opt to take advantage of this feature.

	1	2	3	4	5
n	1071	251	57	8	6
%	76.9	18.0	4.1	0.6	0.4

Table 4: Frequency of ALEKS attempts.

We wanted to see the extent to which students who opted to take more than one assessment improved their scores enough to result in a better placement category. In a number of cases we observed that students took less than one hour in their initial assessment, and we interpret these events as indicating the student discovered that the assessment required more time than the student had anticipated, and the assessment was abandoned. That is, these first attempts do not represent a genuine effort. In an effort to capture a better picture of the benefit of multiple assessments, the analysis below only includes students who took at least one hour in their initial assessment. Without this exclusion, the benefit of repeated assessment would be exaggerated.

As seen in Figure 6, students who retook the assessment raised their scores by an average of 45 points of 100 possible. In most cases, the improvement was sufficient to raise the student from one placement category to another. Table 5 shows how students promoted themselves by retaking the exam. For example, of 61 students who initially placed at the precalculus level, 50 managed after retaking the exam to place themselves into calculus. Similarly, of 99 students initially placed at the Upper DEVM level, 75 of the students who retook the assessment placed at better than a DEVM class.

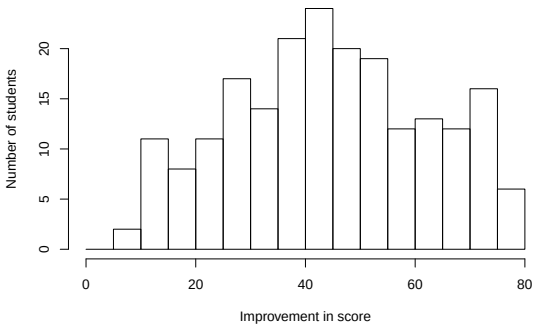

Figure 6: Improvement in ALEKS score from first to best assessment.

Students who take more than one assessment have outcomes that are more in line with their expectations than students who do not. Table 6 shows that generally two thirds of students who retake

	Early DEVM	Late DEVM	Precalc	Calculus
Early DEVM	10	32	3	1
Late DEVM	0	24	63	12
Precalc	0	0	11	50

Table 5: Starting vs final ALEKS placement. Rows are initial placement category. Columns are final placement category. Table entries are numbers of students.

the assessment subsequently place at the level they were hoping to. Moreover, virtually all students desiring a late DEVM class achieve this outcome. These results should be compared with Table 3, which showed that for the general population, less than half of students take a class at their desired level.

Given the previously noted mismatch between student expectations and placement levels, it is unclear why more students do not opt to avail themselves of the ALEKS learning modules and subsequent assessments. One possible conclusion is that the new placement scheme provides students possessing greater initiative a means of bettering their situation. The notion of 'grit' or 'resilience' then becomes part of the metric of how we place students into their first math classes. Nevertheless, it may be beneficial to advertise the benefit of multiple assessments more emphatically.

	Early DEVM	Late DEVM	Precalc	Calculus
DEVM 050: Prealgebra	**1**	0	0	0
DEVM 060: Elementary Algebra	**2**	2	0	0
DEVM 105/106: Intermediate Algebra	1	**14**	2	2
MATH 103: Concepts of Math	0	**8**	2	0
MATH 107: PreCalculus	0	11	**20**	4
MATH 108: Trigonometry	0	2	**2**	0
MATH 161: Algebra for Business	0	1	**1**	0
MATH 200: Calculus I	0	3	26	**41**
MATH 262: Calculus for Business	0	0	0	**2**
MATH 272: Calculus for Life Science	1	0	0	**0**
MATH 201: Calculus II	0	0	0	6
I don't know	4	14	19	8
Other	1	1	5	0

Table 6: Desired math class versus final placement for students who take more than one assessment. Rows are desired class; columns are achieved placement; entries are numbers of students. Rows are grouped from Early DEVM through Calculus. Underlined entries correspond to students with outcomes matching expectations.

5 Incoming Students Who Choose to Take Math

We wanted to know if the new math placement system had any impact on whether students decided to take a math class in their first semester at UAF. Tables 7 and 8 show the number of incoming full- and part-time students and the proportion who opt to take a math class in their first semester. These numbers have been stable for the last several years and, at least among full-time students, there has been no impact. With part-time students, the data is not yet sufficient to draw a conclusion. Enrollment numbers at the start of the semester for part-time students are always substantially lower than at the end of the semester: part-time students often only take a class that starts after the semester add-drop period. Hence the apparent drop in part-time enrollment between 2013 and 2014 will likely be compensated for when the end-of-semester numbers become available. It is unclear if the corresponding number of students who take a math class will also increase when the end-of-semester data is known. If not, there will have been significant drop in the number of part-time students taking math classes, and it will be important for us to follow up and see what actually occurred.

	n_{in}	n_{take}	%
2011	914	589	64.4
2012	813	508	62.5
2013	804	525	65.3
2014	811	518	63.9

Table 7: Proportion of full time incoming students taking math.

	n_{in}	n_{take}	%
2011	1552	161	10.4
2012	1546	163	10.5
2013	1220	151	12.4
2014	850	92	10.8

Table 8: Proportion of part time incoming students taking math.

6 Time Spent in Assessment

We conclude this report with some observations on the amount of time required to complete the ALEKS assessment. As seen in Table 9, students who wish to place at precalculus or better can expect to spend about three hours on the assessment.

Early DEVM	Late DEVM	Precalc	Calculus
0.92	1.78	2.36	2.94

Table 9: Mean time (in hours) spent in assessment vs. outcome.

These times are somewhat longer than the two hours we had anticipated, and we need to adjust our informational materials.

Figure 7 shows the actual time spent in assessment for all attempts. Interestingly, the distributions are visibly similar for time spent on an initial attempt and time spent on final assessments. Section 4 documented how students who take multiple assessments improve there scores, and we see here that they are doing this without taking longer at the test. We take this as evidence of less rustiness and improved skills.

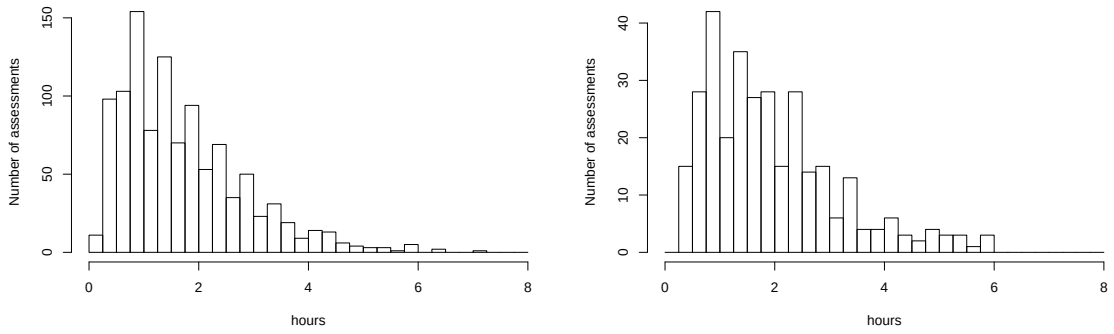

Figure 7: Time spent in initial (left) and final (right) assessment. Histogram on right only includes students who took more than one assessment.

The scatter plot in Figure 8 shows how time spent in assessment correlates with placement, with a bulge of students taking less than one hour and earning less than 35 points. This bulge corresponds with the peaks in Figure 7. Nevertheless, one hour is not sufficient time to take the exam. The histogram in Figure 9 shows the scores achieved by students who spend less than an hour in assessment, and should be compared with the distribution in Figure 2. For most students, more than one hour on the assessment is required to place above Early DEVM.

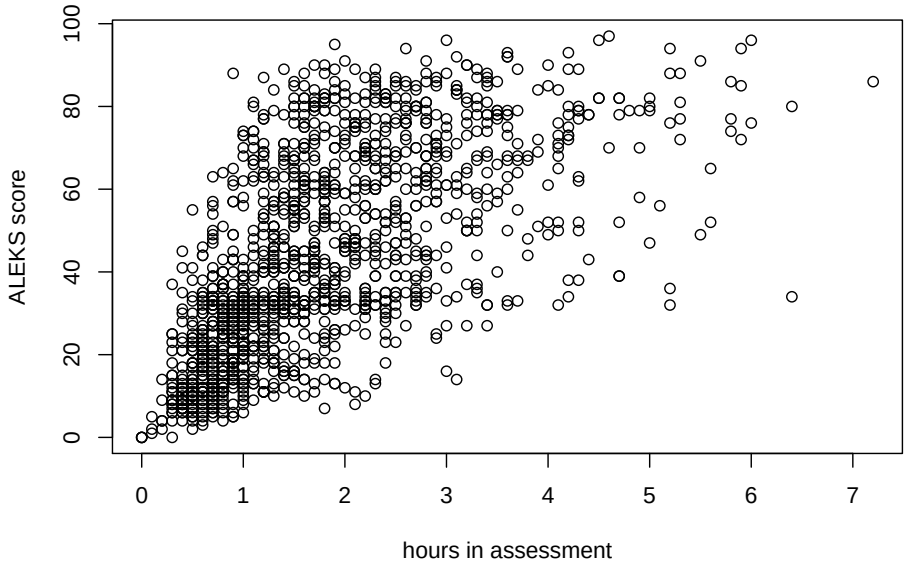

Figure 8: Placement score as a function of assessment time.

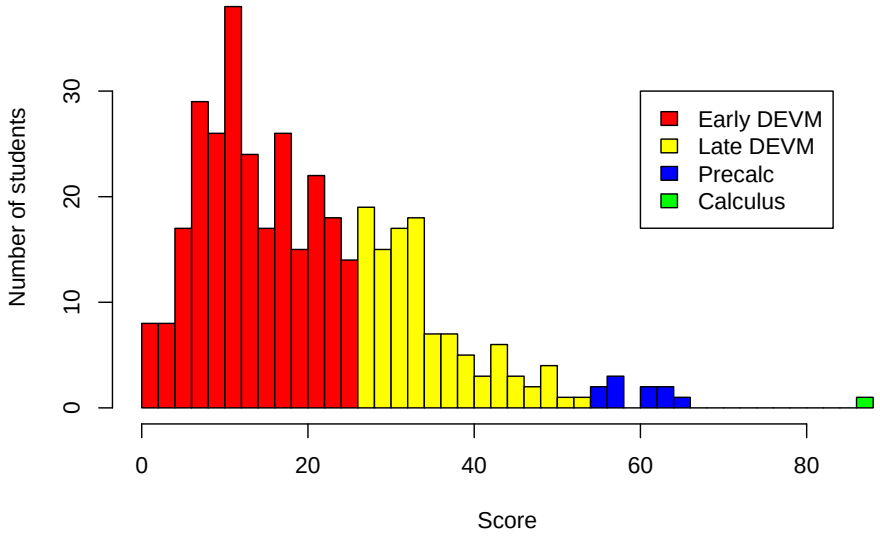

Figure 9: Placement scores for test takers taking less than an hour in their final attempt.