An Investigation into Accuplacer Cut Scores for Developmental and General Education Mathematics

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Purpose

The purpose of this study was to investigate appropriate Accuplacer "cut scores" for LSU Eunice's developmental and general education (GE) mathematics courses.[1] This investigation was motivated by the fact that the College Board does not recommend cut scores for the Accuplacer Assessment System. Very simply, a "cut score" is the point at which the student places into the next level course. For example, the current COMPASS cut score for Pre-algebra Assessment is 44. A student scoring 0 – 43 places into MATH 0001 (Pre-algebra) and a student scoring 44+ places into MATH 0002 (Introduction to Algebra). Ideally, students placing into MATH 0002 with a score of 44 or above should succeed at a rate at 70% according to ACT.[2]

For LSU Eunice, a cut score for developmental mathematics between MATH 0001 (Pre-algebra) and MATH 0002 (Introduction to Algebra) was needed. The default placement for students not wishing to take the placement assessment or not meeting the cut score remains MATH 0001.[3]

The second purpose was to examine Accuplacer's elementary algebra (EA) cut score established by the Board of Regents for GE mathematics. The Louisiana Board of Regents set a score of 65 on the EA assessment as a minimum cut score for students to enter GE mathematics other than College Algebra and a score of 70 for students directly entering College Algebra. This study seeks to validate those cut scores.

The third purpose was to examine if a cut score could be established for students to place out of College Algebra and test into a higher level mathematics course. It is assumed that Accuplacer's College Level Mathematics (CLM) Assessment would be used for this purpose.

Methodology

A total of 35 institutions of higher education were examined for this study. Information on cut scores was obtained using a Google search and information obtained from the College Board. Catalogs from the institutions were then examined to determine if similar courses existed for LSU Eunice's MATH 0001 (Pre-algebra), MATH 0002 (Introduction to Algebra), MATH 1015 (Applied College Algebra), and MATH 1021 (College Algebra). Institutions without clear cut scores or courses that did not seem to match LSU Eunice's mathematics courses were eliminated from consideration. Removing institutions without clear cut scores or mathematics courses similar to LSU Eunice left a total of 23 institutions. Twenty of them were community colleges, two were four-year institutions, and one was a state system composed of both two-year and four-year. A list of institutions and their cut scores are listed in the Appendix.

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[1] ACT is ending the use of COMPASS in December 2016. As a result, LSU Eunice intends on implementing the use of Accuplacer with the spring 2017 orientations.

[2] This rate may vary depending on the situation. For example, an initial analysis may desire a 60% success rate the first semester or year and then increase the cut score as required to achieve a 70% success rate in the course over time.

[3] MATH 0001 – Pre-algebra – is LSU Eunice's lowest level developmental mathematics course.

Placement in Developmental Mathematics

As mentioned above, LSU Eunice has two developmental mathematics courses – MATH 0001 and MATH 0002 – with the default placement being MATH 0001. Whether LSU Eunice students begin the Accuplacer mathematics assessment using the arithmetic or EA assessment has yet to be decided by the mathematics faculty. Table 1 summarizes the data for the 20 institutions that had published information with 14 of them using arithmetic, 19 of them using elementary algebra, and 13 using both assessments to place students into the equivalent of MATH 0002. The remaining four institutions did not use the arithmetic or elementary algebra assessments to place students.

Table 1
Results for Placement into MATH 0002.

| Statistic | Placement into MATH 0002 | | | |
| | Arithmetic | | Elementary Algebra | |
	Low	High	Low	High
Mean	62	114	42	79
Mode	70	120	20	84
Median	66	120	46	71
s.d.	20	16	19	24
n	14	14	19	19

Table 1 indicates that the institutions studied use the top half of the arithmetic assessment and the bottom half of the EA assessment to place students into the equivalent of MATH 0002.[4] LSU Eunice's closest competitor in Lafayette places students in MATH 0002 using EA from 46-65.[5] The EA bottom score is equivalent to the median of other institutions according to the data; however, the upper score has a median of 71. Two decisions will need to be made by the LSU Eunice mathematics faculty. <u>First, should new students begin in Accuplacer's arithmetic assessment or should they begin in EA? Second, what scores should be used to place students into MATH 0002 given the EA = 65 to place into MATH 1015 and EA = 70 to place into MATH 1021?</u> The math faculty will take the Accuplacer tests at the beginning of June 2016.

Decisions on Developmental Mathematics

The mathematics faculty met on June 14, 2016 and previewed Accuplacer's Arithmetic, EA, and CLM as a group. They felt that the EA assessment did not adequately reflect the material needed to be successful in GE mathematics. They also felt that the Arithmetic assessment was necessary in order to assess whether students know enough of the basics in order to enroll in the MATH 0002 course. During the assessment, LSU Eunice's competitors were also kept in mind that the math assessment and placement must not be a barrier to incoming students; however, students must be placed correctly to increase the chances of success. As a result, Table 2 summarizes placement recommendations for the developmental sequence subject to the approval of Academic Council. All LSU Eunice students will begin the mathematics placement in Arithmetic. Competitors in the region begin their students in Elementary Algebra.

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[4] Each assessment has a range from 20 to 120.
[5] EA = 65 is college ready for GE mathematics except for College Algebra. EA = 70 is college ready for College Algebra.

Table 2
All LSU Eunice students will begin the mathematics portion of Accuplacer in Arithmetic.

Arithmetic	Elementary Algebra	College Level Mathematics	Course Placement Two-Year	Course Placement Transfer
20-100	--	--	MATH 0001	MATH 0001
101-120	20-45	--	Pre-Algebra	Pre-Algebra
--	46-64	--	MATH 0002 Introduction to Algebra	MATH 0002 Introduction to Algebra
--	65-120	20-44	MATH 1015 Applied College Algebra	

Placement in General Education Mathematics

Next, is a minimum score of EA = 65 for GE mathematics other than College Algebra and EA = 70 for direct entry into College Algebra appropriate for new incoming freshmen based on this study's findings? Answering this question is the second focus of this study. In this case, the closest competitor in Lafayette was eliminated from consideration since the cut scores were determined by the Board of Regents. Removing the competitor from consideration leaves 22 institutions of higher education with the results summarized in Table 3.

Table 3
Results for Placement into GE Mathematics.

Statistic	Elementrary Algebra Score needed for entry to:	
	College Level Math	College Algebra
Mean	69	85
Mode	76	85
Median	70	85
s.d.	18	13
n	18	15

As Table 3 indicates, 18 of the institutions used the EA assessment for placement into GE other than College Algebra with the median being 70. Interestingly enough, 15 institutions that used EA for placement into College Algebra itself had a mean, median, and mode of 85. Regardless, seven of the institutions did not use the EA assessment to place students into College Algebra. They, instead, relied on Accuplacer's CLM assessment. Placement into College Algebra using CLM had a mean = 50, mode = 53, and median = 53.

Placement in Mathematics Courses above College Algebra

Finally, an investigation into placement for mathematics courses above College Algebra was conducted. As Table 4 demonstrates, six institutions used Accuplacer's CLM to place students into Pre-Calculus with a median range was from 63 to 120 (see Table 4).[6] For placement into Trigonometry, the median range was 68 to 92 for the seven institutions. <u>This information will be presented to LSU Eunice's mathematics faculty to decide if they wish to use Accuplacer CLM to directly place new students in courses above College Algebra.</u> LSU Eunice's closest competitor

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[6] The mean of 68 suggests that some of the six institutions have much higher scores to be placed in Pre-Calculus. Two institutions use 84 and 86 as the minimum to place into the course.

uses CLM scores from 99 to 120 to place students into Trigonometry. A summary list of institutions used in the study is contained in the Appendix.

Table 4
Results for Placement into Higher Level Mathematics using Accuplacer's CLM.

Statistic	Placement into Pre-Calculus using CLM		Placement into Trigonometry using CLM	
	L	H	L	H
Mean	68	111	69	93
Mode	#N/A	120	#N/A	120
Median	63	120	68	92
s.d.	14	15	16	22
n	6	6	7	7

Decisions on Placement into General Education Mathematics

The mathematics faculty discussed student placement into GE mathematics at the June 14, 2016 meeting. Based on their experience with the assessments and the data generated through this study, the mathematics faculty felt that the EA assessment was not adequate to place students into Applied College Algebra or College Algebra. For example, the group missed several EA questions on purpose and came within a few points of placing into Applied College Algebra. Given their experiences, the faculty agreed to parallel the closest competitor in the placement of students (see Table 5).

Table 5
Student Placement into Developmental and GE Mathematics.

Arithmetic	Elementary Algebra	College Level Mathematics	Course Placement Two-Year	Course Placement Transfer
20-100	--	--	MATH 0001 Pre-Algebra	MATH 0001 Pre-Algebra
101-120	20-45	--		
--	46-64	--	MATH 0002 Introduction to Algebra	MATH 0002 Introduction to Algebra
--	65-120	20-44	MATH 1015 Applied College Algebra	
--	--	45-69	--	MATH 1021 College Algebra
--	--	70-120	MATH 1425 Elementary Statistics	MATH 1425 Elementary Statistics (if needed)
--	--	99-120	--	MATH 1022 Plane Trigonometry (if needed)

The recommendation to place students into MATH 1425 or MATH 1022 will be not be published for public viewing. Students who score 70 or above on the CLM assessment will be advised to

consult the Coordinator of Mathematics or the Division Head of Mathematics and Sciences for appropriate placement.

Limitations

The primary limitation for this study is that it involved only 23 randomly chosen institutions having Accuplacer cut scores published and mathematics courses similar to LSU Eunice. This in itself, may be biased in some way. Regardless, the data in this study does represent a starting point for discussion.

Conclusions

Even though the sample is limited and the mathematics faculty took each assessment only once, the perception is that

1. the use of Accuplacer's Arithmetic assessment is necessary to test students on the basics. This is consistent with current practice at LSU Eunice.
2. a score range from the mid 40s to 64 on the EA assessment may be appropriate for LSU Eunice's MATH 0002 using 65+ for students enrolling in MATH 1015 (Applied College Algebra) (see Table 1).
3. an EA score of 65 for GE mathematics other than College Algebra is five points below the median of the 70 for 18 comparable institutions (see Table 3)
4. an EA score of 70 for College Algebra is 15 points below the median for 15 comparable institutions (see Table 3).
5. a score range from the mid 40s to 120 on the EA assessment may be appropriate for LSU Eunice's MATH 0002. However, using EA for placement into College Algebra (MATH 1021) is not appropriate. Accuplacer's CLM assessment might be a better measure of college readiness for placement into the first GE mathematics course (see Table 3).
6. as Table 4 demonstrates, Accuplacer's CLM might be used to place students into a mathematics above College Algebra.
7. Accuplacer's CLM assessment may be used to place students into MATH 1425 (Elementary Statistics) coming out of MATH 1015 and MATH 1022 (Plane Trigonometry) coming out of MATH 1021 (see Table 5). These will be published as "consult mathematics coordinator or Division Head".
8. success rates will need to be examined to determine if between 60% to 70% of those placed into MATH 0002 or GE mathematics succeed the first time the course is taken.

Questions about the content of this document may be directed to Dr. Paul Fowler, Director of Institutional Effectiveness, at pfowler@lsue.edu.

Appendix

| Institution | State | Two or Four Year | Placement into MATH 0001 | | | | Placement into MATH 0002 | | | | Elementrary Algebra Score needed for entry to: | | | |
| | | | Arithmetic | | Elementary Algebra | | Arithmetic | | Elementary Algebra | | | | | |
			L	H	L	H	L	H	L	H	College Level Math	Notes	College Algebra	Notes
Lois Rios CC	CA	2	20	75	--	--	76	120	51	67	68		68	
Riverland CC	MN	2	56	120	51	120	70	120	51	70	76		76	
Red Rocks CC	CO	2	40	120	30	83	--	--	60	84	85		85	
Mott CC	MI	2	20	64	--	--	--	--	--	--	53		80	
Piedmont CC	NC	2	20	42	--	--	50	120	20	55	55	& 53+ A	75	& 55+ A
Maine CC	ME	2	20	65	--	--	65	120	20	66	67		85	
So LA CC	LA	2	--	--	20	45	--	--	46	65	not included		not included	
Hawkeye CC	IA	2	40	62	--	--	63	102	56	96	97		117	
TMCC	NV	2	20	79	--	--	80	120	76	120	--	50-83 CLM	--	53-83 CLM
Rainy River CC	MN	2	20	70	--	--	40	60	--	--	20		87	
Pikes Peak CC	CO	2	40	120	30	84	--	--	60	84	85		85	
New Mexico CC	NM	2	23	96	31	42	97	120	43	103	--		104	
Brookdale CC	NJ	2	35	69	--	--	70	120	20	75	76		86	
Univ Alaska	AK	4	--	--	20	47	--	--	48	120	--	53+ CLM	--	53+ CLM
Maricopa CC	AZ	2	--	--	20	49	--	--	50	69	70		--	32+ CLM
Delaware CC	PA	2	25	60	20	39	67	120	41	59	60		--	53+ CLM
Miami Dade CC	FL	2	30	64	20	71	65	120	20	71	--	40+ CLM	--	40+ CLM
Nevada State	NV	4	--	--	20	75	--	--	76	84	85		85	
Hocking College	OH	2	--	--	--	--	--	--	--	--	69		69	
Washington St CC	OH	2	--	--	--	--	--	--	--	--	90		90	
SD BoR	SD	2/4	--	--	--	--	20	120	20	43	76		76	
Salt Lake CC	UT	2	--	--	--	--	35	120	20	120	55		--	55+ CLM
Vermont CC	VD	2	40	69	--	--	70	120	20	45	46		--	65+ CLM
Mean			30	78	26	66	62	114	42	79	69		85	
Mode			20	120	20	#N/A	70	120	20	84	76		85	
Median			25	69	20	60	66	120	46	71	70		85	
s.d.			11	24	10	26	20	16	19	24	18		13	

Institution	State	Two or Four Year	Placement into Pre-Calculus using CLM		Placement into Trigonometry using CLM	
			L	H	L	H
Lois Rios CC	CA	2	--	--	76	92
Riverland CC	MN	2	63	120	--	--
Red Rocks CC	CO	2	--	--	--	--
Mott CC	MI	2	--	--	70	81
Piedmont CC	NC	2	--	--	68	120
Maine CC	ME	2	--	--		
So LA CC	LA	2	--	--	99	120
Hawkeye CC	IA	2			--	--
TMCC	NV	2	84	100	--	--
Rainy River CC	MN	2	62	85	--	--
Pikes Peak CC	CO	2	--	--	55	99
New Mexico CC	NM	2	--	--	--	--
Brookdale CC	NJ	2	--	--	--	--
Univ Alaska	AK	4	--	--	60	79
Maricopa CC	AZ	2	--	--	54	59
Delaware CC	PA	2	86	120	--	--
Miami Dade CC	FL	2	--	--	--	--
Nevada State	NV	4	--	--	--	--
Hocking College	OH	2	--	--	--	--
Washington St CC	OH	2	--	--	--	--
SD BoR	SD	2/4	51	120	--	--
Salt Lake CC	UT	2	60	120	--	--
Vermont CC	VD	2	--	--	--	--
Mean			68	111	69	93
Mode			#N/A	120	#N/A	120
Median			62.5	120	68	92
s.d.			14	15	16	22
n			6	6	7	7