A Statistical Analysis of Valparaiso University's Math Placement Process

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Introduction

All incoming students at Valparaiso University participate in a math placement process, which begins with a questionnaire that asks students to self-report their high school GPA, ACT/SAT scores, and previous math classes taken. Based upon the questionnaire, students are assigned a math pre-placement level of 0, 1, 2, or 3, with 0 corresponding to placement into MATH 110: Intermediate Algebra and 3 corresponding to placement into MATH 131: Calculus I. However, since the questionnaire is based upon self-reported data, the data is sometimes inaccurate, which may place students into math courses for which they are not prepared to succeed. A score of NP stands for "no placement," which occurs when there is insufficient data. Using actual admissions data for the Fall 2022 freshman cohort, I analyze the accuracy of the self-reported data and the math pre-placement levels. This research serves as the basis for a new process of calculating math pre-placement levels directly from admissions data.
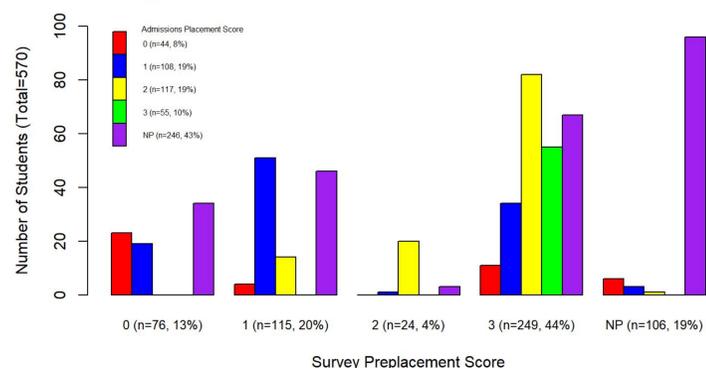
Although all students receive a math pre-placement level, students also have the opportunity to take a math placement assessment through the ALEKS software in order to try to raise their placement level. I investigate the correspondence between the pre-placement levels and the ALEKS assessment scores in order to determine if the cut-off values should be re-calibrated. I also analyze what percentage of students are able to complete math review modules through the ALEKS software and successfully raise their placement level. Furthermore, I calculate the average time that successful students spend in the ALEKS software system so that the University can more effectively advertise this opportunity to incoming students.

Math Pre-Placement Levels

The table below displays the correspondence between students' pre-placement levels based upon the self-reported survey data versus based upon official admissions data. One of the largest discrepancies is the higher percentage of NP's when using admissions data due to many students not reporting their ACT/SAT scores in their application in accordance with the University's test optional admissions policy.
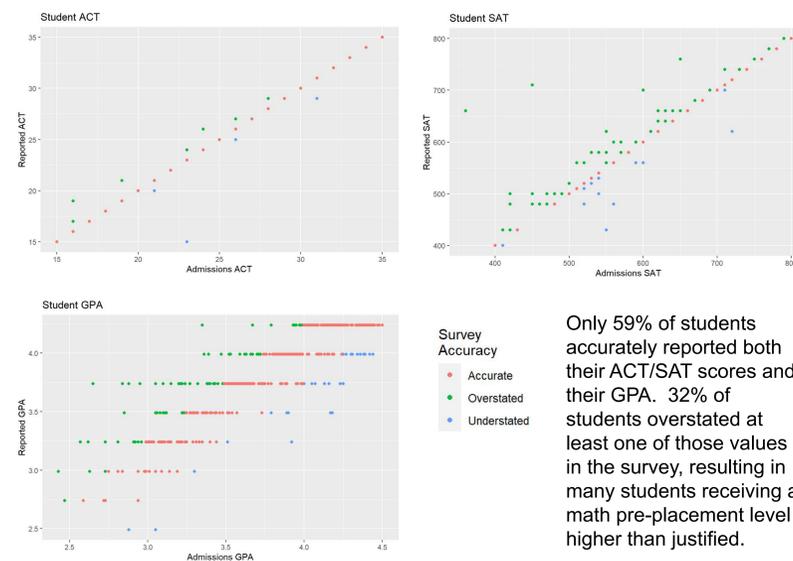
Based upon Self-Reported Survey Data	Based upon Admissions Data					
	0	**1**	**2**	**3**	**NP**	**Total**
0	23 (4%)	19 (3%)	0 (0%)	0 (0%)	34 (6%)	76 (13%)
1	4 (1%)	51 (9%)	14 (2%)	0 (0%)	46 (8%)	115 (20%)
2	0 (0%)	1 (0%)	20 (3%)	0 (0%)	3 (1%)	24 (4%)
3	11 (2%)	34 (6%)	82 (14%)	55 (10%)	67 (12%)	249 (44%)
NP	6 (1%)	3 (1%)	1 (0%)	0 (0%)	96 (17%)	106 (19%)
Total	44 (8%)	108 (19%)	117 (19%)	55 (10%)	246 (43%)	570 (100%)

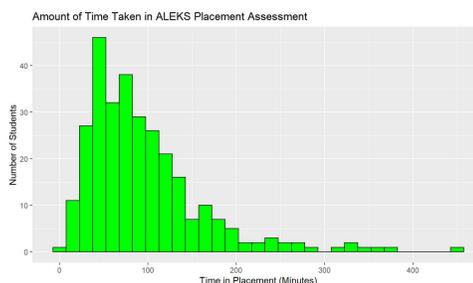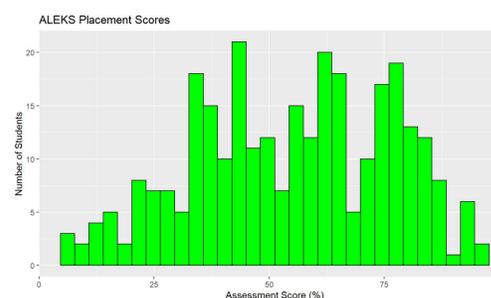Preplacement and Admissions Placement Scores from Fall 2022

Self-Reported Accuracy

	ACT	SAT	GPA	Overall
Accurate	115 (91%)	229 (64%)	488 (81%)	355 (59%)
Overstated	7 (6%)	114 (32%)	80 (13%)	190 (32%)
Understated	4 (3%)	13 (4%)	33 (6%)	56 (9%)

Student ACT, Student SAT, Student GPA

Survey Accuracy: Accurate, Overstated, Understated

Only 59% of students accurately reported both their ACT/SAT scores and their GPA. 32% of students overstated at least one of those values in the survey, resulting in many students receiving a math pre-placement level higher than justified.

ALEKS Math Placement Assessment

# of ALEKS Assessments Taken	Student Count
0	295 (50%)
1	259 (44%)
2	32 (5%)
3	3 (1%)
4	1 (0%)

ALEKS Placement Scores

Amount of Time Taken in ALEKS Placement Assessment

Exactly half of the students in the Fall 2022 freshman cohort opted to take the ALEKS math placement assessment, with only 6% taking the assessment multiple times. The median amount of time it took a student to complete the ALEKS placement assessment was 1 hour 19 minutes, while the average amount of time was 1 hour 35 minutes due to the right skew of the time distribution.
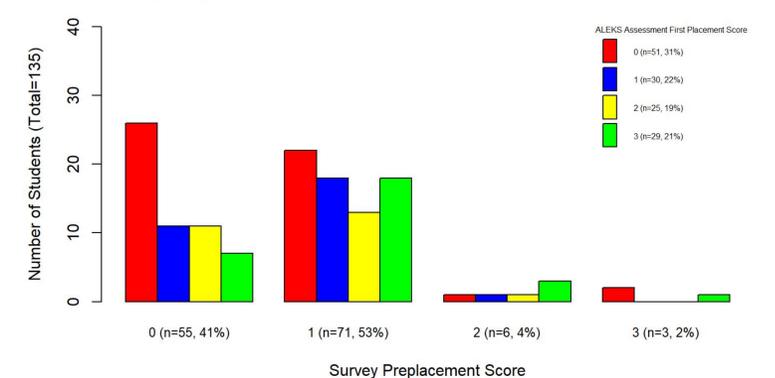

Raw scores on the ALEKS assessment range from 0% to 100% and are converted to the math placement level using the cut-offs in the table below.

Math Placement Level	ALEKS Range	Student Count on First Attempt	Student Count on Last Attempt
0	0% - 44%	114	101
1	45% - 59%	56	53
2	60% - 74%	63	67
3	75% - 100%	56	68

The result from the ALEKS assessment overrides the student's math pre-placement level. The table below displays the correspondence between students' pre-placement levels based upon the self-reported survey data and their math placement levels after taking the ALEKS assessment for the first time.

Placement Level based upon First ALEKS Attempt	Pre-Placement Level based upon Self-Reported Survey Data				
	0	**1**	**2**	**3**	**Total**
0	26 (19%)	22 (16%)	1 (1%)	2 (1%)	51 (38%)
1	11 (8%)	18 (13%)	1 (1%)	0 (0%)	30 (22%)
2	11 (8%)	13 (10%)	1 (1%)	0 (0%)	25 (19%)
3	7 (5%)	18 (13%)	3 (2%)	1 (1%)	29 (21%)
Total	55 (41%)	71 (53%)	6 (4%)	3 (2%)	135 (100%)

Survey Preplacement and ALEKS first Placement Scores from Fall 2022

Conclusions and Future Work

Valparaiso University ultimately decided to move away from the self-reported survey data for determining math pre-placement levels. There were many students in the Fall 2022 freshman cohort who were placed into math courses for which they did not have the necessary background knowledge due to inaccurately reporting their ACT/SAT scores and GPA in the survey. Starting with the Fall 2023 freshman cohort, all incoming students will automatically receive a math pre-placement level calculated based upon the information they submitted in their application. Using admissions data to determine the pre-placement levels is not only beneficial for ensuring students are placed into the appropriate math courses for which they are prepared to succeed, but is also beneficial for simplifying the process and increasing retention.

The analysis of the ALEKS assessment data revealed that very few students are taking advantage of the opportunity to retake the assessment multiple times after completing review modules. However, the data shows that of the students who do retake the assessment, many are able to successfully raise their math placement level. Future work could analyze student grades in freshman-level math courses to determine if the cut-offs for the placement levels should be recalibrated.