# ALEKS Preparatory Chemistry and Mathematics

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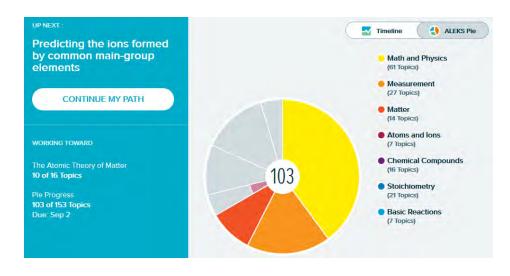


#### What is ALEKS?

#### ALEKS is an <u>a</u>daptive-<u>le</u>arning in <u>k</u>nowledge <u>s</u>paces

Designed to test gaps in student's knowledge and give students a custom-tailored course Goal: Fill Pie to 100%, Time not wasted going over things student already knows

#### Students can move forward, or backward, in their Pie



# Summer-Prep Chem – Adaptive learning for student preparation

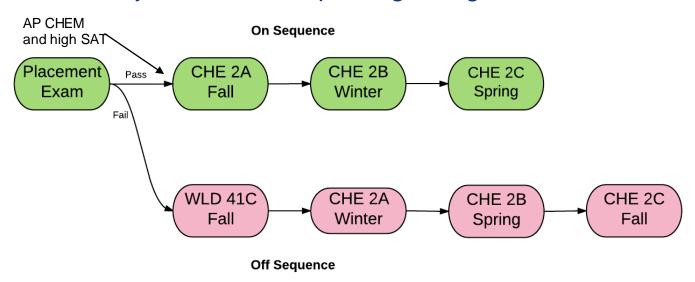
Derek Dockter, Catherine Uvarov, Alberto Guzman-Alvarez, Marco Molinaro



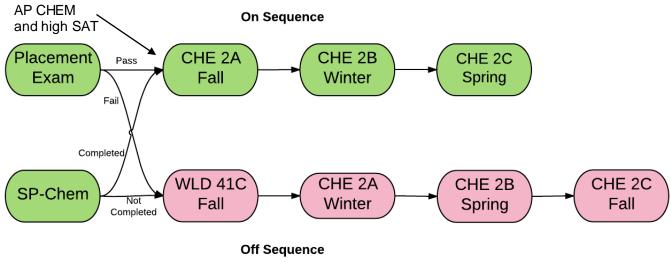


**Problem**: Upwards of 900 students yearly do not pass chemistry placement.

- Must take 3 unit, non-credit bearing course at local CC
- Changes course dynamics and impacts grading



**Proposal**: Give students the opportunity to prepare for on-sequence general chemistry over the summer by taking the SP-Chem ALEKS course.



"All in all, ALEKS worked for me simply because it guided me rather than try to force me to understand or make me feel bad for not always getting the lesson at first try. I enjoyed the fact that every new lesson was a build up from previous lessons, allowing me to understand review and learn new things at the same time. I am grateful to have experienced this program and even more grateful to the fact that it gave me a newfound respect for the subject that once was my worst nightmare."

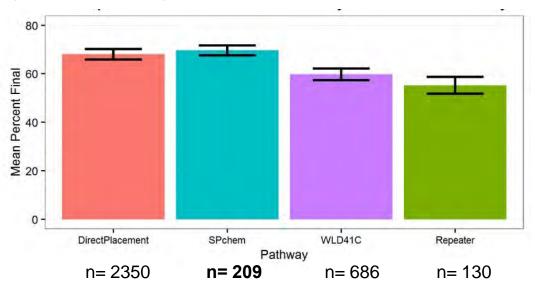
#### So how did it work...

#### Final Exam\*

No statistically significant difference between students who passed placement and ALEKS

Students who finished ALEKS:

- 9.9% higher than WLD 41C
- 14.4% higher than students repeating CHE 2A



\*SAT, URM and First Gen used as model covariates

Self-selection bias resulted in some demographic differences between samples of students who finished SP-Chem (controlled for in the analysis).

1099 students were randomly sampled and invited, 209 completed and enrolled in Che2A

Demographic Population	% of Demographic Population that started ALEKS who finished	% of <u>non-</u> <u>Demographic</u> Population that started ALEKS who finished
URM	41	65
Low Income	48	62
First Generation	48	63
Gender - Female	55	59

2520 students were sent invitations 955 students accepted invitations to the course 927 took the initial knowledge check (97.1 %) 616 completed to 100% mastery (64.5%)

Demographic Population	% of Demographic Population that started ALEKS who finished	% of <u>non-</u> <u>Demographic</u> Population that started ALEKS who finished
URM	58 (257/443)	70 (359/512)
Low Income+	58 (242/420)	70 (339/486)
First Generation*	60 (332/549)	<b>71</b> (271/384)
Gender - Female	63 (457/725)	69(156/225)

<sup>\*</sup> Unknown for 13 participants

<sup>+</sup> Unknown for 35 participants

#### **ALEKS Summer Prep-Chem - POSTER**

#### Summer 2015 Pilot



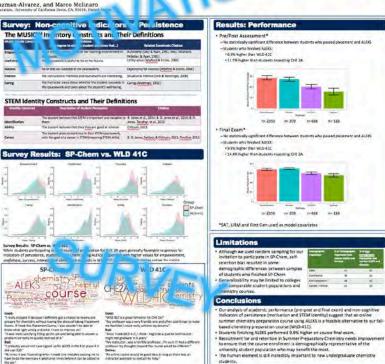
### Rethinking Remedial Chemistry: Preparing and Motivating Incoming Undergraduate Students for Success in General Chemistry Using an Adaptive-responsive Cline Chemistry Preparation Course (ALEKS)



Catherine Uvarov, Derek Dockter, Alberto Guzman-Alvarez, and Marco Molinaro

#### Introduction Consistent with high attrition rates in undergraduate STOM rationwide (Bentley and Gallene, 2005) approximately 40% of undergraduate: students who place into remedial chemistry hever erroll in general chemistry. In spite of significant attrition, there is limited research on the effectiveness of attenuative remerciation approximate. We conducted a study of an neither summer evenientary chemistry course (S2-Dhem) as an alternative to traditional chemistry remediation (W.D. 61C). V hypothesized that an online summer preparation course using ALERS, paired with email so accountability would better preciare and motivate students for (or sequence) General C Research Questions Do not use inc. has of per, lister, instruction and STotal identity) differ between SF-Dermand 10-910 in Scoral min lists or set? Students he come; SP-Cher lister (LLSS) perform as well as budents who place directly. nuderes w complete southern pulsing ALEXS; perform equally well in all sections of general stry (cities on instructions)? Samue, Data, and Timeline spring 2015, 1099 randomly sampled incoming freshman invited to participate in SP-Chem course 565 students enrolled in 5P-Chem, 274 students completed the course to 95% or higher mestery. All 1999 students invited to complete a survey, 138 students who completed SF-Drem took survey. · General Chemistry pre-post and final exam scores. . Student Demographic Information (URM, gender, SA) Math, Probability of 4-year graduation Statistical Analyses Non-inferiority tests comparatively evaluate differences in CHE 2A performance of SP-Chem and Multiple Lisear Regression used to comparatively evaluate differences in performance of SP-Chem students in various sections of CHE 24. Graphical Representations were used to represent MUSIC<sup>MP</sup> and STEM Identity Survey data Traditional Remediation vs. SP-Chem Online raditional (WLD 41C) but not towers graduation Traditional face to face course Adaptive-responsive system and university based email support. Completed at Home with flexible laught by community college Instructors on UCD campus Grade of "P" or "C" (or better) to schedule for completion. positly for general chemistry. Students must reach 95% mustery to

qualify for general chemistry.



#### **ALEKS PPL at UCSC**

Debra Lewis, Julian Fernald, Jaye Padgett UC Conference on Undergraduate Education January 2017

# Background

Starting in Summer 2015, we have used ALEKS PPL as a math placement exam

After placing, students are invited to work within ALEKS PPL and place again

#### Goals

Help incoming students place into more advanced courses in math

Without jeopardizing their performance

# Why?

Improve time to degree

Possibly improve retention and graduation rates, including in STEM fields

# Is ALEKS worth the expense?

As of 10/2016, 6085 students have assessed in ALEKS PPL

1844 students (30%) have reassessed and 1628 (27%) improved by at least one placement tier

Roughly half of students who initially placed below calculus reassessed

#### Overall improvements: placement tiers

	first	best	shift
100	1994	1002	-50%
200	1083	884	-18%
300	565	665	18%
400	1554	2313	49%
500	889	1221	37%



100: College Algebra; 200: Precalculus; 300: Calculus with Applications (Biology);

400: Calculus for Math, Physical Sciences & Engineering; 500: Honors Calculus

### Improvements by initial tier

	100	200	300	400	500
100	160 (9%)	258 (14%)	185 (10%)	434 (24%)	115 (6%)
200		22 (1%)	52 (3%)	279 (15%)	126 (7%)
300			11 (1%)	88 (5%)	49 (3%)
400	200			21 (1%)	42 (2%)

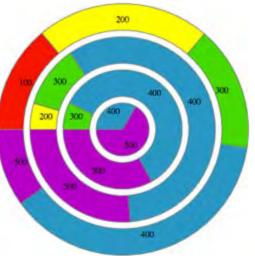
100: College Algebra

200: Precalculus

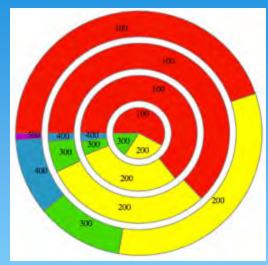
300: Calculus with Applications (Biology)

400: Calculus for Math, Phys Sci & Eng

500: Honors Calculus



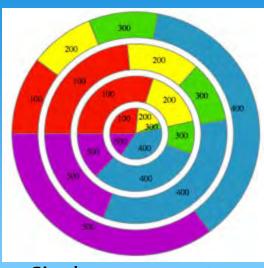
#### Assessment by ethnicity



Multiple: initial placement



Multiple: best placement



Single assessment

Outer ring: Asian

Second ring: White/Caucasian

Third ring: Hispanic/Latino

Inner pie: All others

100: College Algebra

200: Precalculus

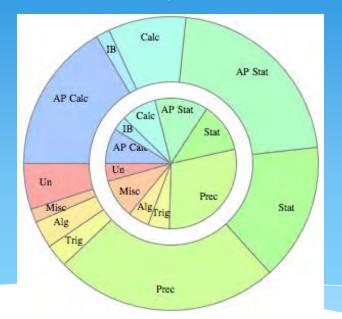
300: Calculus with Applications (Biology)

400: Calculus for Math, Phys Sci & Eng

500: Honors Calculus

#### Last pre-UCSC math or statistics course

From an informal survey of students enrolled in a "first year" math course in Fall 2016



BC Calc Calc AP Stat Misc Prec AP Stat Stat

Inner: enrolled in College Algebra
Outer: enrolled in Precalculus

Inner: Calculus with Applications (bio)
Outer: Calculus for Math, Phys Sci & Eng

#### ALEKS builds skills & confidence

Students can dive into an ALEKS session at any time, do a few problems, and resurface

Control over timing of practice and assessment reduces stress

Common format for practice, progress checks, and assessment helps desensitize anxiety-prone students

#### Academic outcomes

How do students who re-place into a course do compared to those who placed there to begin with?

- → No difference in course grade or pass rate, once demographic and academic prep were taken into account
- → Likewise no difference in outcomes in subsequent math course

Comparison of Enrollment, Mean Grade Points, Pass Rates, and % B or Above Rates in Math Courses Fall 2014 vs. Fall 2015

	1	V	A STATE OF THE OWNER,	Grade nt*	Pass F	Rate**	% B or	above
	Fall 2014	Fall 2015	Fall 2014	Fall 2015	Fall 2014	Fall 2015	Fall 2014	Fall 2015
Math 2	537	262	2.17	2.47	75.0	78.2	39.1	50.0
Math 3	1063	695	2.42	2.59	79.7	73.2	47.2	43.9
Math 11A	380	442	2.15	2.65	73.2	79.9	28.4	55.4
Math 19A	471	805	2.81	2.73	87.3	83.4	54.8	46.3
Math 20 A	36	43	2.51	2.73	75.0	86.0	52.8	39.5

### Reassessment activity

#### Reduce the redness!



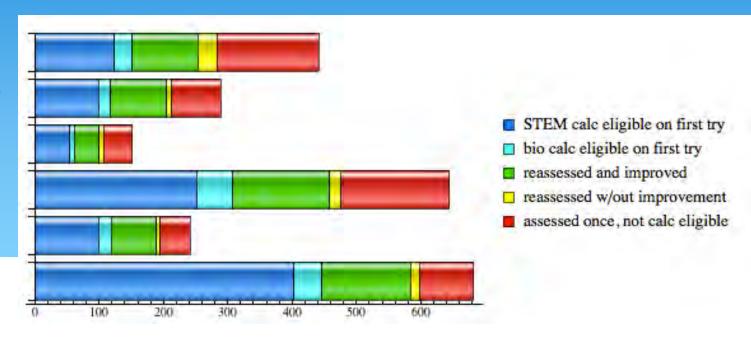
Hispanic, non-EOP

White, EOP

White, non-EOP

Asian, EOP

Asian, non-EOP



#### Goal: increase reassessment

Efforts to improve outreach, advising, etc so that more students who could benefit actually reassess

#### **ALEKS at UCSB**

Darby Feldwinn, Carl Gutierrez-Jones, Linda Adler-Kassner, Steven Velasco, and Margarita Safronova UC Conference on Undergraduate Education January 2017

# Background

UCSB has two first year chemistry classes: general chemistry (~2000 students) and honors general chemistry (~60 students).

Students background chemistry knowledge varies greatly for the non honors general chemistry class.

# Background

UCSB started using ALEKS in fall 2010 in all general chemistry classes (Chem 1A, 1B, and 1C)

Students are given a pre quarter assignment that is ~3% of their overall grade in the course.

The pre quarter assignment has 130 topics: math (~77%) basic chemistry (~33%).

# Research Questions

Does performance on the ALEKS initial assessment knowledge check administered in the ALEKS "summer course" serve as a predictive tool for success in Chemistry 1A?

Are there any differences in final grades among students who do and do not complete the pre-quarter assignment?

For students in the lowest quartile of the ALEKS summer course initial assessment, what correlation, if any exists between students' ALEKS use and students' final grades?

# Study Group

The study group consisted of students enrolled in 2 sections of Chem 1A in the fall quarter of 2015.

	All students	Section 1	Section 2
Female	46%	46%	47%
African American	4%	4%	4%
Hispanic	26%	21%	32%
Native American	<1%	<1%	<1%
Asian	30%	36%	23%
International	7%	5%	8%
Observations	598	313	285

### Previous Performance

	All students	Section 1	Section 2
ALEKS Summer Course Initial Assessment (% of Topics Known)	59%	61%	58%
High School GPA	3.98	3.99	3.97
Reading	605	612	596
Writing	621	630	610
Math	646	659	633

### **ALEKS Statistics**

	All students	Section 1	Section 2
% of Students Completing Summer Assignment	90%	89%	91%
ALEKS Topics Learned Per Hour (Fall)	2.8	2.6	2.9
ALEKS Total Hours (Fall)	48 hours	46 hours	51 hours

#### Models

Model 1: Explores the relationship between ALEKS variables and students' academic performance accounting for previous academic performance and demographic characteristics.

Model 2: Explores the relationship between ALEKS variables and students' academic performance absent controls for previous academic performance.

How do students' percentages on the initial assessment affect students' abilities to succeed (earn a grade of B- or better) in the class?

Model 1: 0.0047 (0.012) Model 2: 0.0085 (0.0011)

Summary: For every 1% increase on mastered topics on initial assessment the probability of a student succeeding in Chemistry 1A increase by ~0.5%.

How does the summer assignment affect students' abilities to succeed (earn a grade of B- or better) in the class?

Model 1: 0.30 (0.069) Model 2: 0.39 (0.075)

Summary: Completing the summer assignment increases the probability of a student succeeding in Chemistry 1A by ~30%.

	Mean	Median
All students in Sections 1 and 2	2.46 (C)	3.00 (B)
Students Completing the AELKS Summer Assignment	2.61(C)	3.00 (B)
Students Not Completing the ALEKS Summer Assignment	1.21 (D)	1.00 (D)

# Study Group

Demographics of students in the lowest quartile.

	All students	Lowest Quartile
Female	46%	64%
African American	4%	8%
Hispanic	26%	45%
Native American	<1%	<1%
Asian	30%	18%
International	7%	<1%
Observations	598	137

### Previous Performance

	All students	Lowest Quartile
ALEKS Summer Course Initial Assessment (% of Topics Known)	59%	35%
High School GPA	3.98	3.94
Reading	605	565
Writing	621	582
Math	646	572

### **ALEKS Statistics**

	All students	Lowest Quartile
% of Students Completing Summer Assignment	90	80
ALEKS Topics Learned Per Hour (Fall)	2.8	2.4
ALEKS Total Hours (Fall)	48 hours	59 hours

How does the summer assignment affect students' abilities to succeed (earn a grade of B- or better) for students that scored in the lowest quartile of the initial assessment in ALEKS?

Model 1: 0.45 (0.24) Model 2: 0.48 (0.25)

Summary: Students that score in the lowest quartile who complete the summer assignment have an average grade 0.45 higher than those that do not.

Complete ALEKS	Did not Complete ALEKS
Summer Assignment	Summer Assignment

### Recap

The higher students score on the initial assessment the more likely they are to succeed in Chemistry 1A.

Student that complete the summer assignment are 30% more likely to succeed in Chemistry 1A that those that do not.

The positive affects seen by completing the summer assignment are magnified for the students in the lowest quartile.