Shrewsbury Public Schools

To: School Committee
From: Jean Marie Johnson, SHS Director of Mathematics
Re: SHS Mathematics Update Spring 2017
Date: April 19, 2017

SHS Mathematics Department Update

- **2016-2017 Curriculum Implementations**
    - **ALEKS Curriculum** - Assessments & Learning System used in collaboration with our textbook. Students are expected to work 2-3 hours per week in this online program.
    - **Core Plus Investigations** - Students investigate real-world applications of the mathematics content and construct their knowledge through investigation, collaboration and knowledge.
    - **Advanced Math II Topics** - A course designed for Grade 12 students in collaboration with Quinsigamond Community College. The course is designed to support students to qualify for credit bearing math courses upon entering college. While the curriculum is designed in collaboration with QCC, the course content will support students with placement exams at any college/university. The students who are highlighted for this course, are students who struggle with math, and especially who struggle with standardized testing.

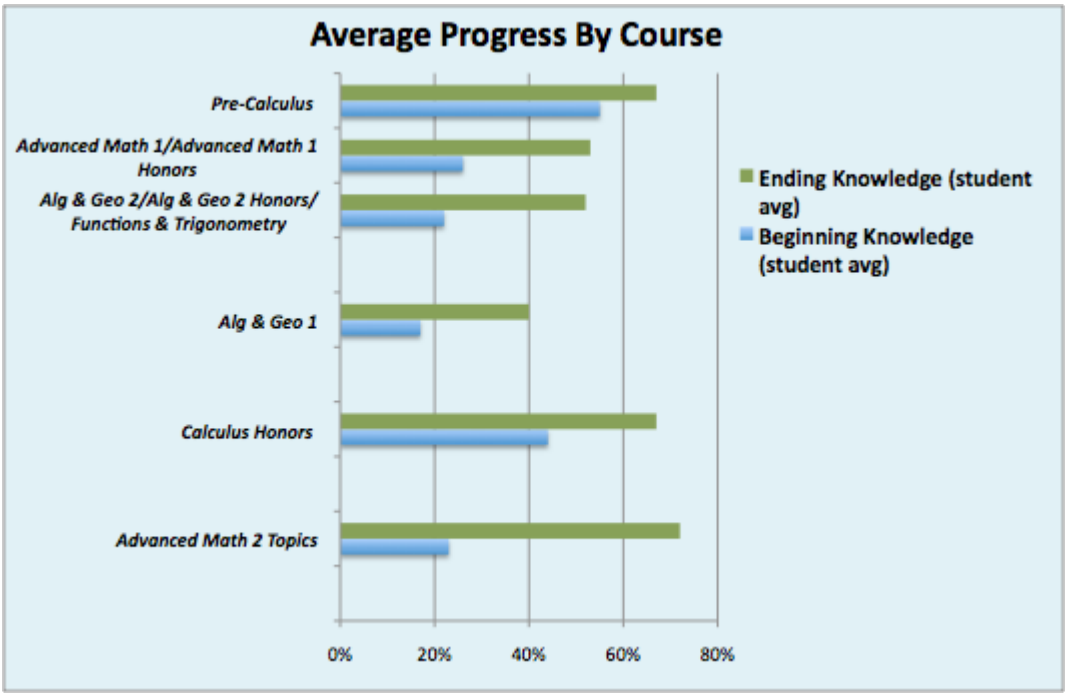
- **What is ALEKS and how are we using it?**
    - Online Assessment & Learning System implemented with 1195 students in Grades 9 - 12 in the following courses:
        - Algebra & Geometry 1
        - Algebra & Geometry 2 (A-level, B-level, Honors)
        - Advanced Math 1 (A-level, B-level, Honors)
        - Functions & Trigonometry
        - Advanced Math 2 Topics
        - Calculus Honors (2 sections - because we had enough licenses for this year only)

- The ALEKS curriculum is aligned with our Core Plus Investigations, but provides students access to prerequisite content, as well as content that extends beyond the core set of units we complete in class. We have customized our ALEKS courses to align with our curriculum.

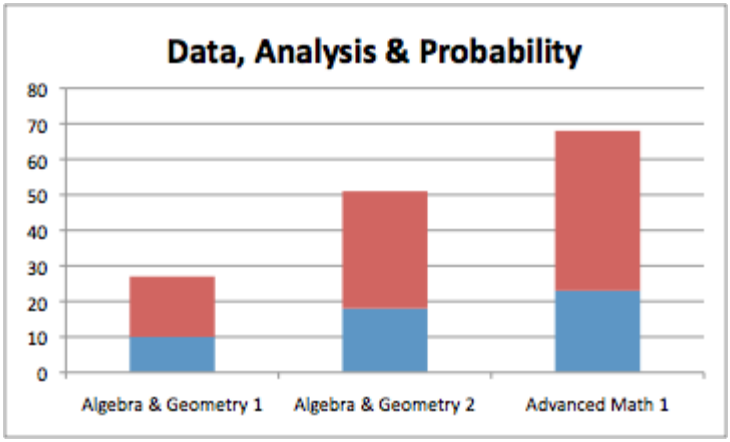
Sample ALEKS Curriculum

ALEKS Only	Core Curriculum + ALEKS
Fractions (10 topics)	U1 Linear Eq & Systems (92 topics)
Probability and Stats (64 topics)	U2 Understand Quantities (18 topics)
Order of Operations (39 topics)	U3 Exponents & Radicals (89 topics)
3D figures (58 topics)	U4 Quadratic Functions (58 topics)
Unit 0 Real Number System (30 topics)	U5 Function Families (23 topics)
	U6 Coordinate Geometry (17 topics)
	U7 Nonlinear Functions (18 topics)
	U8 Trigonometry (23 topics)

- We provide students with at least one hour of in-class time/support with ALEKS. They are given time goals of 2-3 hours of ALEKS per week. The total amount of homework (including ALEKS) should not be more than 2-3 hours per week.
- The students work on a learning path that is determined by assessing their current knowledge. Students are not all working on a given topic at the same time. After students have demonstrated progress, ALEKS will automatically generate a knowledge check assessment to determine mastery. Their learning path is continually changing based on their performance. The average percent gains in each course is shown below.



- The differentiation provided by the program is a unique feature compared to other programs we have used in the past.
- Students receive immediate feedback as well as support when they make mistakes.
- Many districts (including us) have struggled with implementing the new expectations for Data, Analysis & Probability into the core curriculum math courses (prior to senior level Statistics courses). Because of ALEKS, we have students studying these topics, even though we may not be formally studying them in class. This would traditionally be the last unit of study in our courses - we have not been able to fully complete it since the 2011 frameworks were implemented. The graph below shows the current progress on this standard, since the initial assessment.



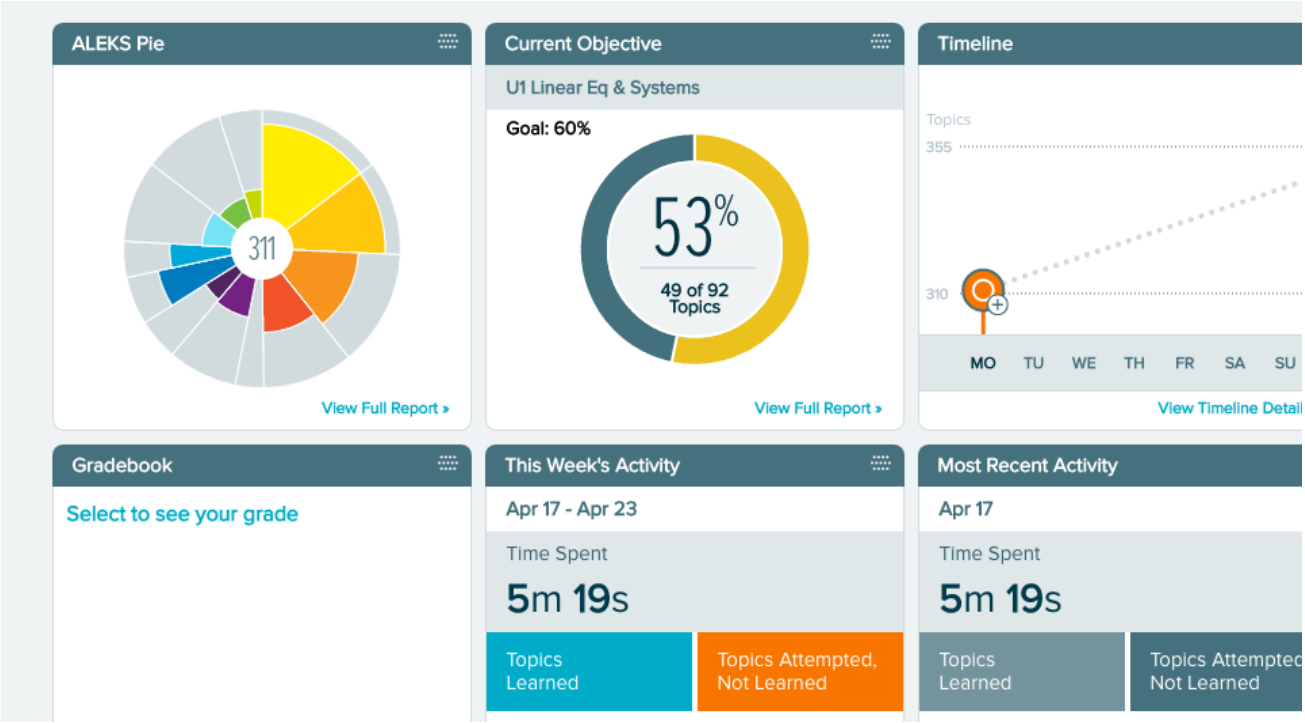
- Courses have been created for struggling students to help bridge the gap between their current and expected knowledge.
  - We have students in Algebra & Geometry 1, who have come to us from other countries and limited schooling, and we are now able to offer support to help them build a foundation for success with the high school curriculum.

        - We have students who have come to us from other countries as well as private schools who tested into Algebra & Geometry 1 - mostly because the programs they came from were so different. With the ALEKS program, we have been able to challenge these students and prepare them for courses more aligned to their abilities, as they have become acclimated to our program.
            - We have two ELL students who will move from Algebra & Geometry 1 this school year, to Advanced Math 1 Honors next school year. ALEKS has helped us to support and prepare these students for the recommended course (typically Algebra & Geometry 1 students would move to Algebra & Geometry 2, A-level).
    - Courses have been designed to challenge advanced learners and allow them to expand their knowledge beyond the core curriculum.
        - We currently have 10 freshmen identified who are on the path to take a junior level course for 2017-18, because they've had the opportunity to co-study Algebra & Geometry 2 Honors and Advanced Math 1 Honors this year.
        - We have students who are moving from A-level to honors for 2017-18 and we are able to provide them access to the curriculum they were not able to study this year because they were in A-level. Students will have access to ALEKS over the summer to continue to prepare for next school year.

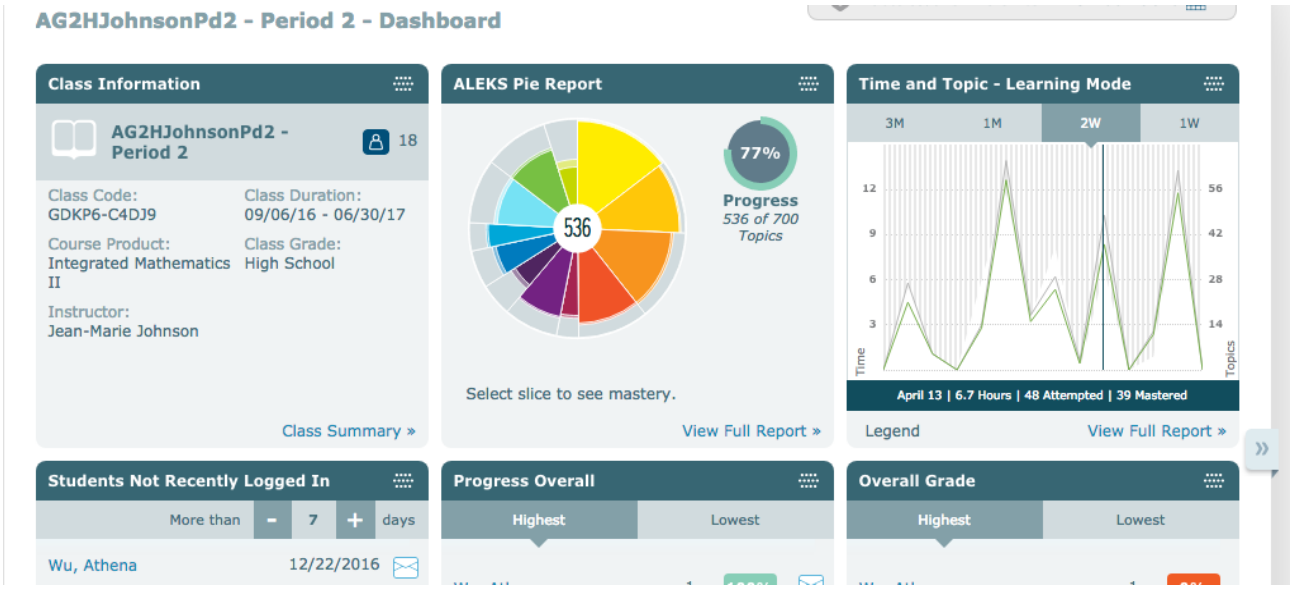
- **What have we learned?**

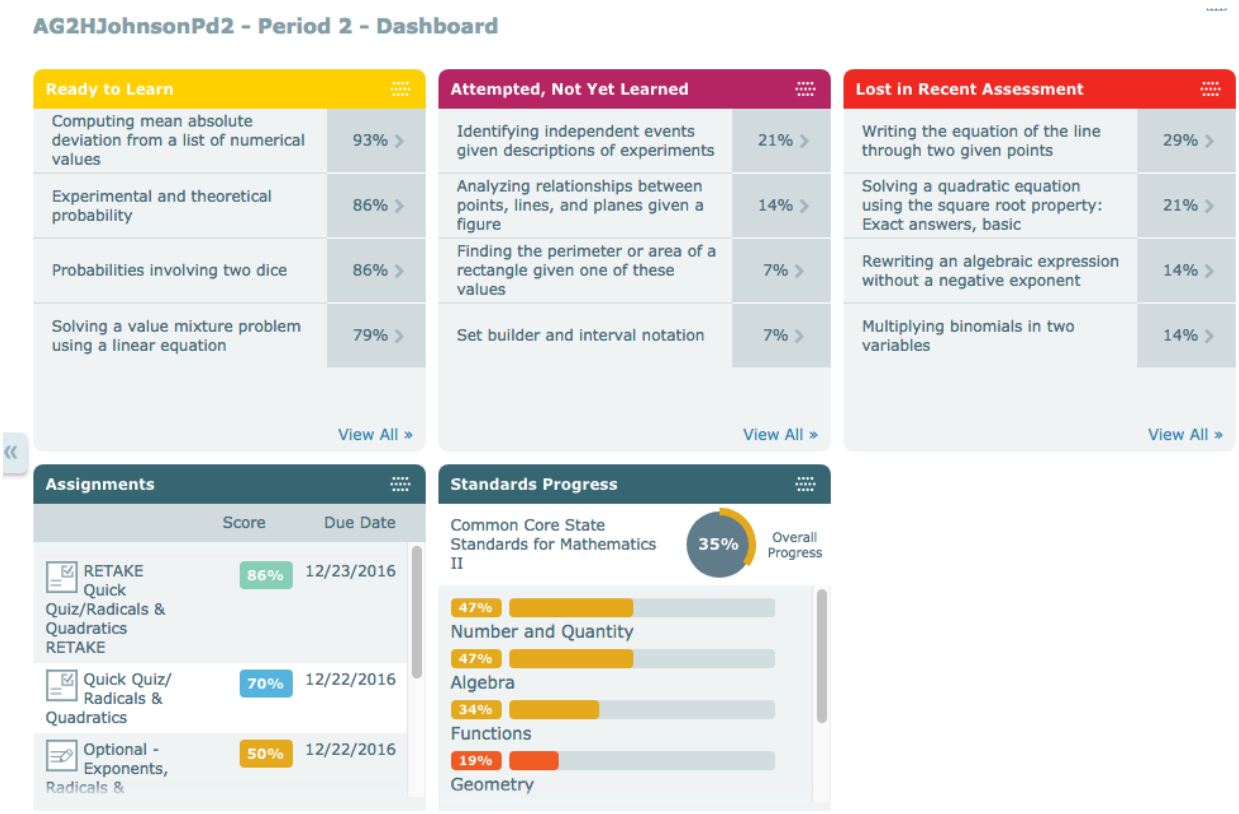
    - We have learned a lot this year about best practice implementation strategies. We are in the process of compiling and documenting some of the strategies that have helped students make progress with the program.
    - ALEKS holds students to a level of accountability they sometimes struggle with. It requires time management and students are not able to rush through their work and still demonstrate mastery. This is something we need to continue to support students with.
    - ALEKS requires a higher level of independence from students than traditional math homework. They are sometimes working on topics they have not worked on in class (if their path requires them to work on prerequisite skills or if they have advanced beyond the current topic being studied), whereas traditional homework is usually on a topic studied that day. This is sometimes an area of frustration for students, who have to access the ALEKS resources or ask for help in order to progress.
    - Students are getting much more review with past and current topics than they were before implementing this program. The online platform and presentation of the problems should help them with standardized testing, as they are expected to complete the problems with the same level of precision. Students must use correct vocabulary and notation when submitting work to ALEKS.
    - Student work in ALEKS generates an abundance of data. Students have access to individualized reports about their learning. Teachers have spent time this year learning how to generate reports to assess their students' progress.

Sample Student Dashboard

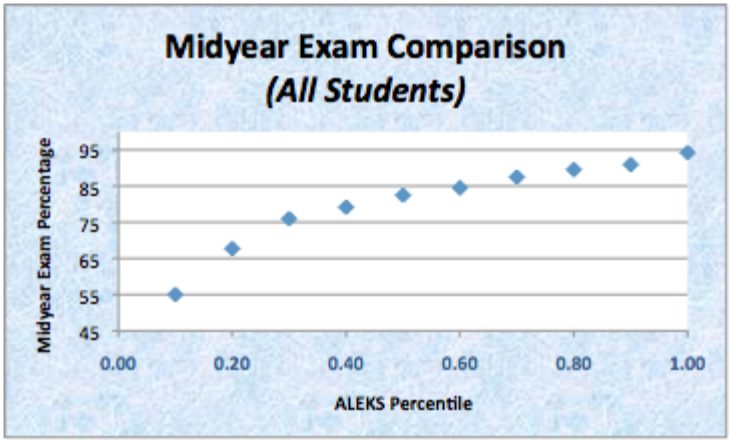


Sample Teacher Dashboard





- The overall data for this school year has shown that the teachers' implementation is consistent and student progress is consistent by course. We have also seen that students' performance in ALEKS is aligned with their performance on our midyear assessments - overall, students who made more progress in ALEKS also performed better on the midyear exam. These results were seen in all courses and subgroups.



- Because ALEKS is helping teachers with the ongoing review and skill based content, teachers have been able to fully implement the Core Plus Investigations this year. Students are collaborating and investigating the mathematics content in context.
- Teachers were invited to create experiences that provided students with the opportunity to investigate ideas through more performance-based assessments. This is something we will build on for next year. The implementation of ALEKS & the new investigations became much more time consuming than we anticipated, so less emphasis was spent in this area.

- **Planning ahead**
    - We did a lot of modifying implementation practices as we learned more about the program this year. For 2017-18, there will be a set of common practices that teachers will implement. These expectations will be provided to students and parents at the beginning of the school year.
    - Because the level of accountability required for students is higher, I plan to provide more structures to support students to meet their goals. We had a limited number (15-20) of math department student interns work in classes this school year. I plan to recruit Math Department Interns (Math Support Team) for 2017-18 and also work with the Math National Honor Society to provide more support for students both in class and after school.
    - I plan to have teachers and students create more resources to attach to ALEKS topics (Screencasts, videos, notes) beyond the ones provided by ALEKS. This will provide students additional support when they are working at home.
    - I will develop and administer benchmark assessments to measure students' progress with the core course topics. We can also use midyear exam, final exam and MCAS data to create benchmarks that focus on demonstrated areas of struggle.
    - Teachers will work together this summer to create common mathematical modeling learning experiences by course for implementation next year. The goal is for students to learn how to analyze data and use it to solve authentic problems with the math they are learning.
    - Currently exploring with Nga Huynh how we can use ALEKS to support math students who need credit recovery. We would like to create credit recovery courses that are aligned with our program and will prepare students for success in subsequent courses after achieving credit recovery.
    - Since students have their ALEKS accounts through the summer, we are currently working on providing incentives to motivate them to continue their studies through the summer. We will inform parents and students of these incentives before they leave school for the summer.

- **Advanced Math 2 Topics Course** ***(Co-taught Math/Special Education)***

2016-17	17 students enrolled in the course
2017-18	24 students registered for the course

- This course is designed to support students to be able to enroll in college level (rather than non-credit bearing) math courses when they enter college. The curriculum is designed around the topics currently taught in those courses.
- The curriculum is designed in collaboration with QCC. Students are administered an Accuplacer test as well as the QCC final exams for their Math 095 and Math 099 courses at QCC. Students can place out of the non-credit bearing courses if they achieve a qualifying score on the Accuplacer (administered Spring of junior year and Spring of senior year) or on the final exams (administered during midterms and final exams at SHS).
- We do not have the data to determine the success rate for the students currently in the course. Based on the 2016 Accuplacer results, we currently have one student who has qualified for a level beyond his initial Accuplacer assessment due to performance on midyear exam.
- There are 14 students who would have placed into the Math 099 course with their initial Accuplacer. Students can either place out of the Math 099 course by meeting a qualifying score on the Accuplacer (administered at SHS on May 11th) or on their final exam (to be administered on 5/24).
- Students have demonstrated on average a 50% growth in mastery of the course topics in their work in the ALEKS program.
- The students who take this course, typically struggle with math and standardized assessments. This course is designed to provide students focused instruction and multiple opportunities to demonstrate mastery of the course content for the non-credit bearing college courses.
- The results of the qualifying exams will directly benefit students who enroll at QCC. If they choose another college, their course participation should help them with their placement exams, since the Accuplacer is a college board assessment used to determine placement at most colleges.
- Ultimately, students' experience in this course can save them money and give them a better chance at earning a college degree. Statistically, students who begin college in non-credit bearing math courses are less likely to finish their degree programs.

- **Summary**
  - The addition of the ALEKS program and the Advanced Math 2 Topics courses have the potential to have a significant impact on the SHS Mathematics program. We will continue to collect data, review practice and make adjustments to our implementation based on performance data and student feedback. It is expected that these programs will support student achievement for all levels of mathematics learners.