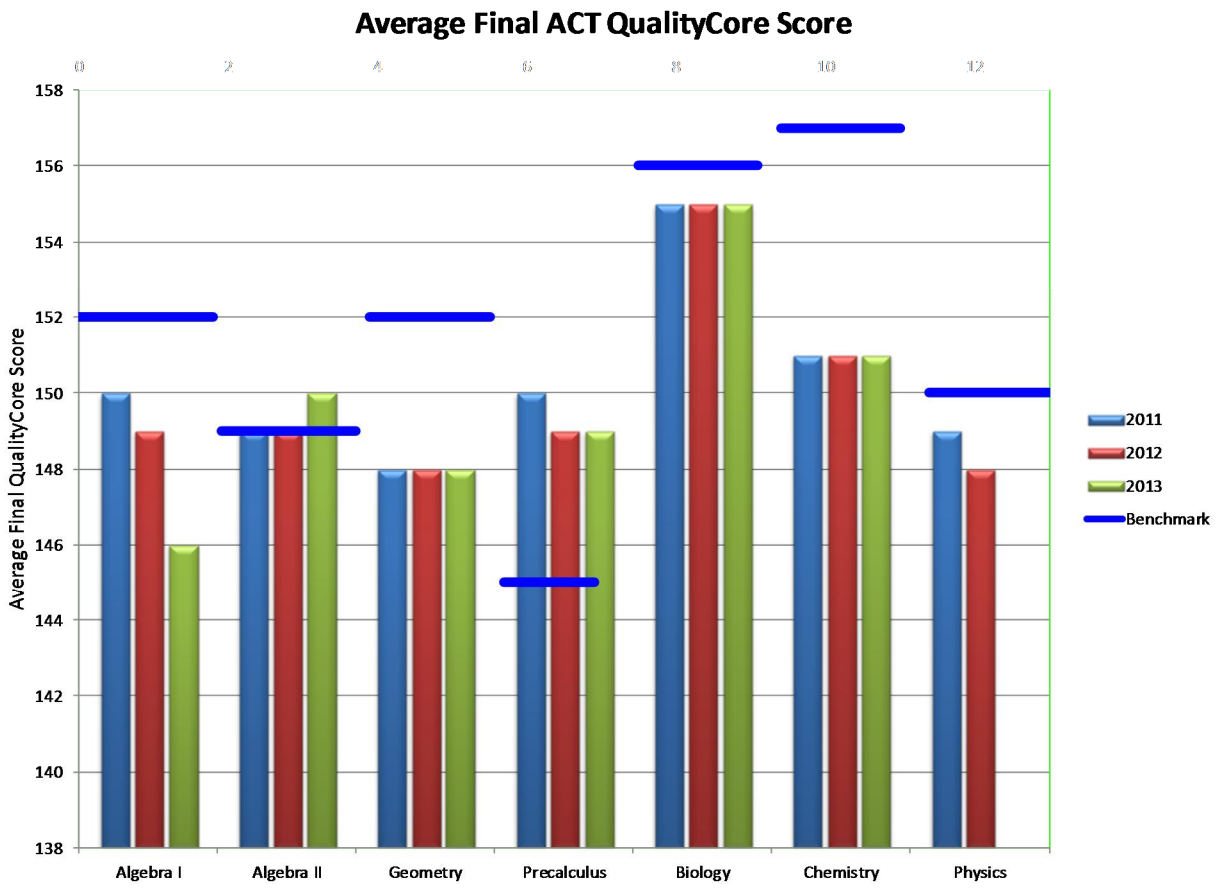
Fig.1 Potential Usage Schedule for Olentangy STEM Center

Year 1: 120 8th grade students (Olentangy Shanahan Middle School students)

Time blocks	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A.M. (90 min.)	25 students 3 day block session (MTW)			75 students 2 day block session (ThF)		9:00-12:00 (3 hours)
A.M.- P.M. (90 min.)	25 students 3 day block session (MTW)			75 students 2 day block session (ThF)		Only 2 sessions offered on Saturdays
P.M. (90 min.)	25 students 3 day block session (MTW)			75 students 2 day block session (ThF)		1:00-4:00 (3 hours)
Afterschool	4:00-7:00 Rental	4:00-7:00 Rental	4:00-7:00 Rental	4:00-7:00 Rental	4:00-7:00 Rental	
Weekly Totals	>75 students 3 day block session			>75 students 2 day block session		<50 students/1 day block session
Year 1 Totals	2,600 students 3 day block session			2,600 students 2 day block session		1,800 students/ 1 day block session

Fig. 2 Average Final *ACT QualityCore* Scores of Olentangy students, 3 year comparison



- The above chart details the average ACT *QualityCore* score of all students in the Olentangy School District taking the specified test. There is no disaggregation of data to represent the different grade level each student was when they took the exam. The blue line above each bar chart indicates the score that is considered "college ready".
- The typical progression of classes is Algebra I, Geometry, and then Algebra II. Students have an option for their fourth required math class – Algebra III or Precalculus. The elective nature of the Precalculus course may be a factor in the high success rate of students on that particular exam.

Fig. 3 Estimated Cost of Installation and Operation of Olentangy STEM Center, 2014-2015

Item	2014-2015
1. *Fab Lab* equipment, shipping, program, installation and training on machinery; *Fab Academy* training for two gurus and three core STEM teachers (a five-month, part-time course)	158,901
2. *Teaching Institute for Excellence in STEM* (TIES) to include program support; curriculum development; customized assessment and sustainability tools; and other wrap-around services.	100,000
3. Infrastructure and construction costs for **Olentangy STEM Center** and *Fab Lab*	399,700
4. Furnishings for **Olentangy STEM Center** and *Fab Lab**	*Prices shown are 50% off list prices
60 Nodes seating	9,000
4 Verb teacher stations; white	1,800
12 conference tables for flexible learning spaces	2,640
6 Lab tables	2,250
32 stools	1,800
60 Whiteboards	3,270
4 Verb wall tracks	350
4 teacher desks/chair combinations	2,352
1 Bookcase	350
5. Custodial staff (@ $40 per hour) and operational costs on weekends (electricity, water, heating, cooling)	2,560 5,000
6. Two CHROME laptop carts (each with 30 laptops); and charging stations for iPads, Smart phones, notebook computers).	21,000 300
4 teacher laptops for use with projectors	3076
7. ThreeMimeo/projectors combinations	3,900
2 ceiling mount brackets	398
Total cost Year 1 2014-2015	**$718,647**

Fig. 4 ***Teaching Institute for Excellence in STEM*** **Design Model**

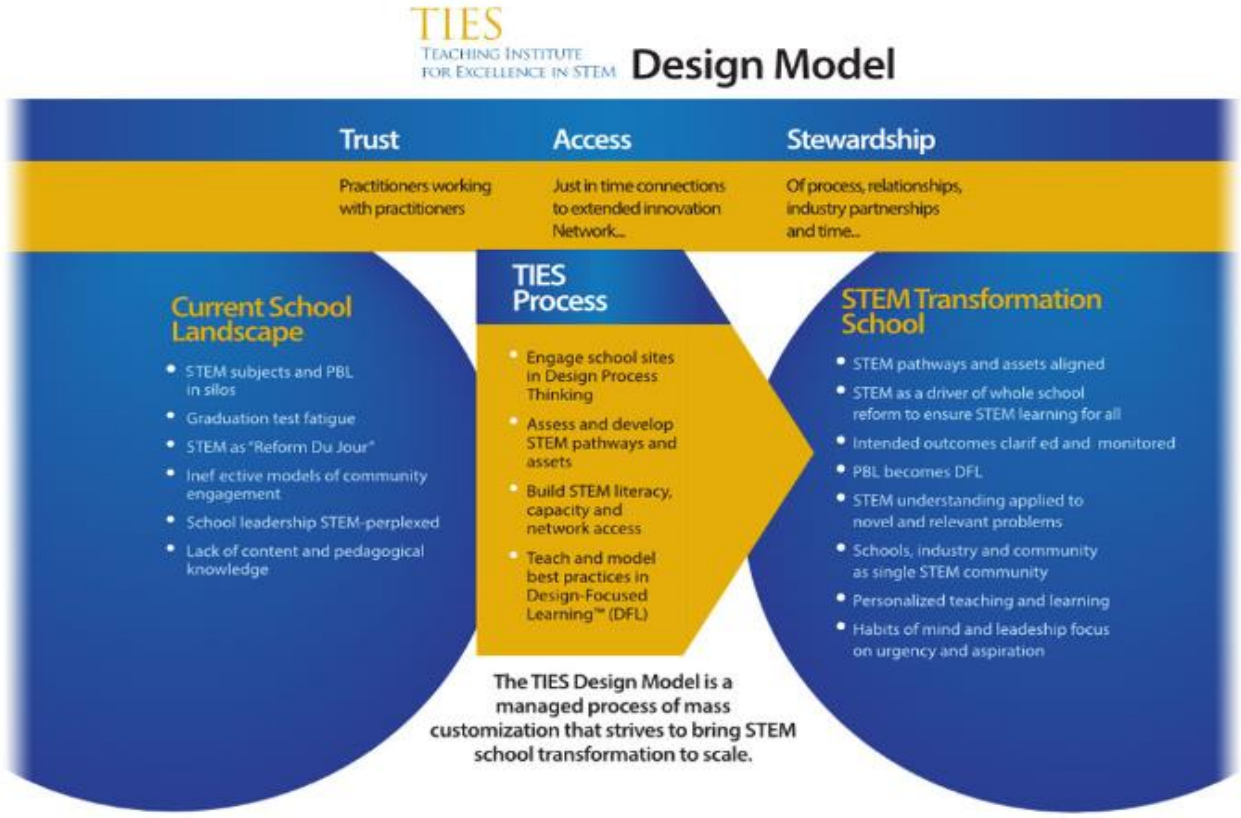


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Fig 5. Detailed Floor Plan of Olentangy STEM Center and *Fab Lab*

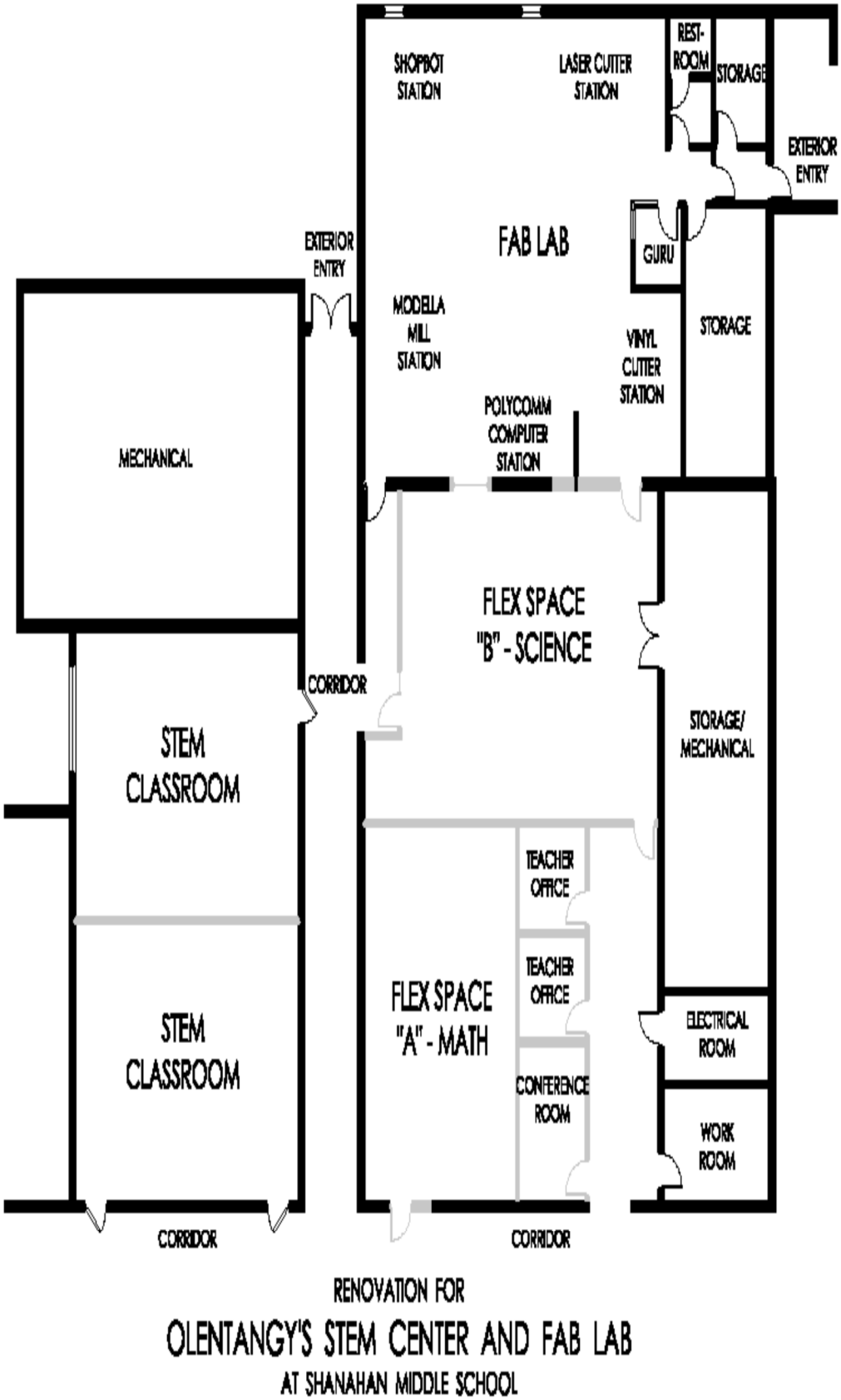


Fig. 6 Timeline for Olentangy STEM Center

Olentangy STEM Center and *Fab Lab* timeline	Action items
Spring 2013 **PLAN**	Core STEM teachers form Personal Learning Network for research into STEM-focused curricula and potential impact; Shanahan administrators evaluate current facilities and resources for STEM school. Teachers attend first of 6 conferences and workshops re: PBL and STEM (through winter of 2013). Core teachers and administrators visit 3 innovative middle school programs: Phoenix School (Worthington City – inquiry and project-based learning); Metro High School (STEM); and Baldwin Jr. High (Reynoldsburg City-STEM). Establish contact with Ohio STEM Link network and OSU.
Summer 2013 **PLAN**	Teachers compile curriculum crosswalk; begin bi-monthly meetings to shape O-STEM program.
Fall 2013 **PLAN**	Teachers commit to participate in open courseware classes on STEM topics as a cohort (HP Catalyst Academy); hold 3 info meetings for OLSD staff; initiate dialogue with leaders in neighboring districts, local post-secondary institutions, and alternative/vocational high school and community college. Establish list of potential mentors who work or teach in STEM areas; 3 *First Lego League* robotics teams formed; communication to parents about STEM school through conferences; complete *Straight A Fund* app. (Oct.).
Winter 2013-2014 **PLAN**	*Straight A Fund* grant award (Dec.); 2 stakeholder focus groups to discuss plans; late Jan.-first written communication to parents of current 7th graders about STEM option in 8th; Science teachers (grades 6-8) collaborate to plan Spring *Science Day* to feature inquiry-based projects such as Lego Robotics demonstrations; an integrated 8th grade project on global industrialization; *Invention Convention* projects; and *Christopher Columbus Awards* teams. Early March-7th grade parent info meetings; curriculum mapping continues; begin formal dialogue with *Teaching Institute for Excellence in STEM* (TIES).
Spring 2014 **PLAN/IMPLEMENT**	Finalize construction plans; continue to build bank of STEM mentor contacts; explore industry partnerships and with other educational institutions; 7th grade student applications for O-STEM Center distributed and reviewed, selection letters sent; and lottery process developed and communicated to parents. If there are too few applications, additional recruitment meetings.
Summer 2014 **IMPLEMENT**	Re-train teachers to be *Fab Lab* gurus; July-order *Fab Lab* materials, equipment and furnishings;renovation and outfitting of O-STEM space; gurus trained by *Fab Ed*. STEM teachers link into TIES support and resources; interested teachers and admin participate in *Fab Lab* orientations and training. Procurement and construction delays are possible and would delay the *Fab Lab* opening.
2014 – 2015 School year **IMPLEMENT**	Mid-August-installation of *Fab Lab*; opening of O-STEM Center; stakeholders are invited to open house; Sept.- gurus begin teacher trainings and establish contact with other *Fab Labs* in international network; finalize plan for progress monitoring measures used to determine student engagement, mastery of skills and content in *CCSS* and academic goals in pre- and post-program assessments of year 1. Specific instructional supports will be used to individualize instruction.
Late Spring – Summer 2014 **SUMMATIVE**	Use state and national standardized tests to build a profile of students enrolled in year 1 to track achievement against past student years. Growth measures for individualized instruction programs will be included. Teacher satisfaction surveys and OTES data voluntarily collected, if possible. Areas of strength and deficit in the program will be identified and addressed.
2015 – 2016 school year **SUMMATIVE**	Second year of program implementation; possible extension of STEM into 7th grade and/or district-wide population; collection of testing data continues as students in year 1 cohort remain a test group through 12th grade. OAA and ACT *Quality Core* subjects will be tracked and analyzed along with STEM course selection in high school.

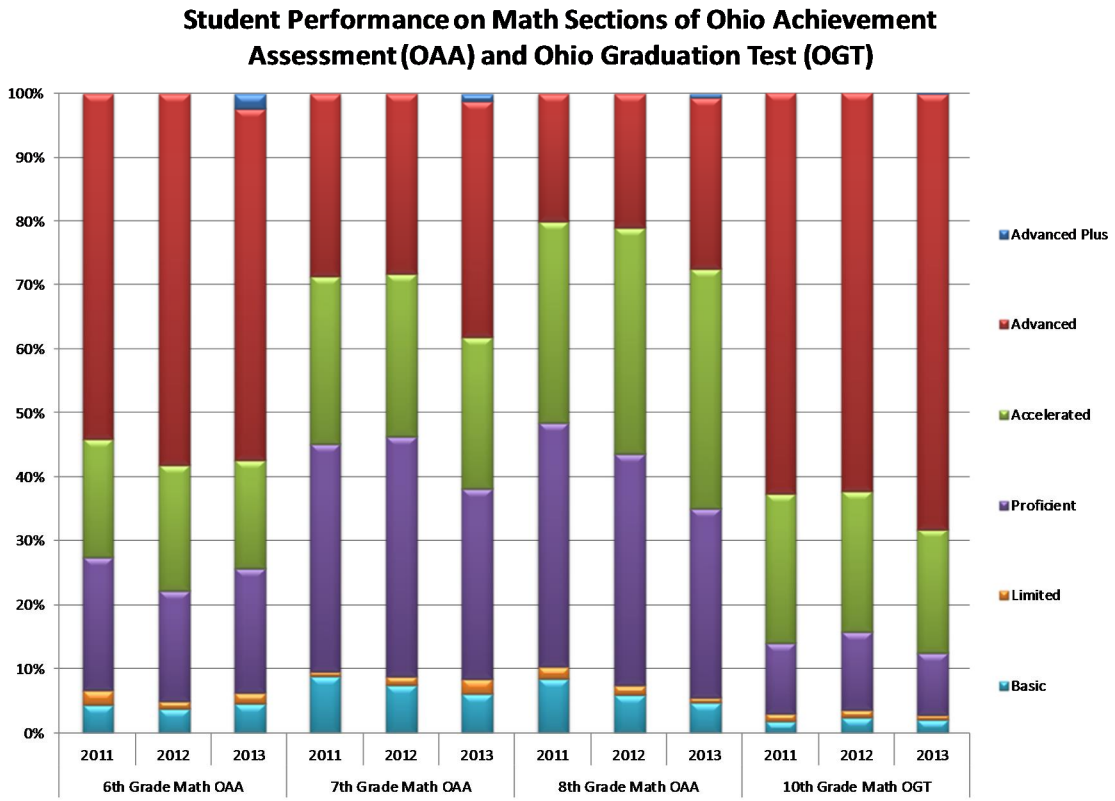
Fig. 7 Skills Associated with STEM Occupations

Skills Associated with STEM Occupations	
Mathematics: Using mathematics to solve problems.	**Science:** Using scientific rules and methods to solve problems.
Critical Thinking: Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	**Active Learning:** Understanding the implications of new information for both current and future problem-solving and decision-making.
Complex Problem Solving: Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.	**Operations Analysis:** Analyzing needs and product requirements to create a design.
Technology Design: Generating or adapting equipment and technology to serve user needs.	**Equipment Selection:** Determining the kind of tools and equipment needed to do a job.
Programming: Writing computer programs for various purposes.	**Quality Control Analysis:** Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
Operations Monitoring: Watching gauges, dials, or other indicators to make sure a machine is working properly.	**Operation and Control:** Controlling operations of equipment or systems.
Equipment Maintenance: Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.	**Troubleshooting:** Determining causes of operating errors and deciding what to do about it.
Repairing: Repairing machines or systems using the needed tools.	**Systems Analysis:** Determining how a system should work and how changes in conditions, operations, and the environment will affect our outcomes.
Systems Evaluation: Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.	

Fig. 8 Abilities Associated with STEM Occupations

Abilities Associated with STEM Occupations	
Problem Sensitivity: The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.	**Deductive Reasoning:** The ability to apply general rules to specific problems.
Inductive Reasoning: The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).	**Mathematical Reasoning:** The ability to choose the right mathematical methods or formulas to solve a problem.
Number Facility: The ability to add, subtract, multiply, or divide quickly and correctly.	**Perceptual Speed:** The ability to quickly and accurately compare similarities and differences among sets of letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.
Control Precision: The ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions.	

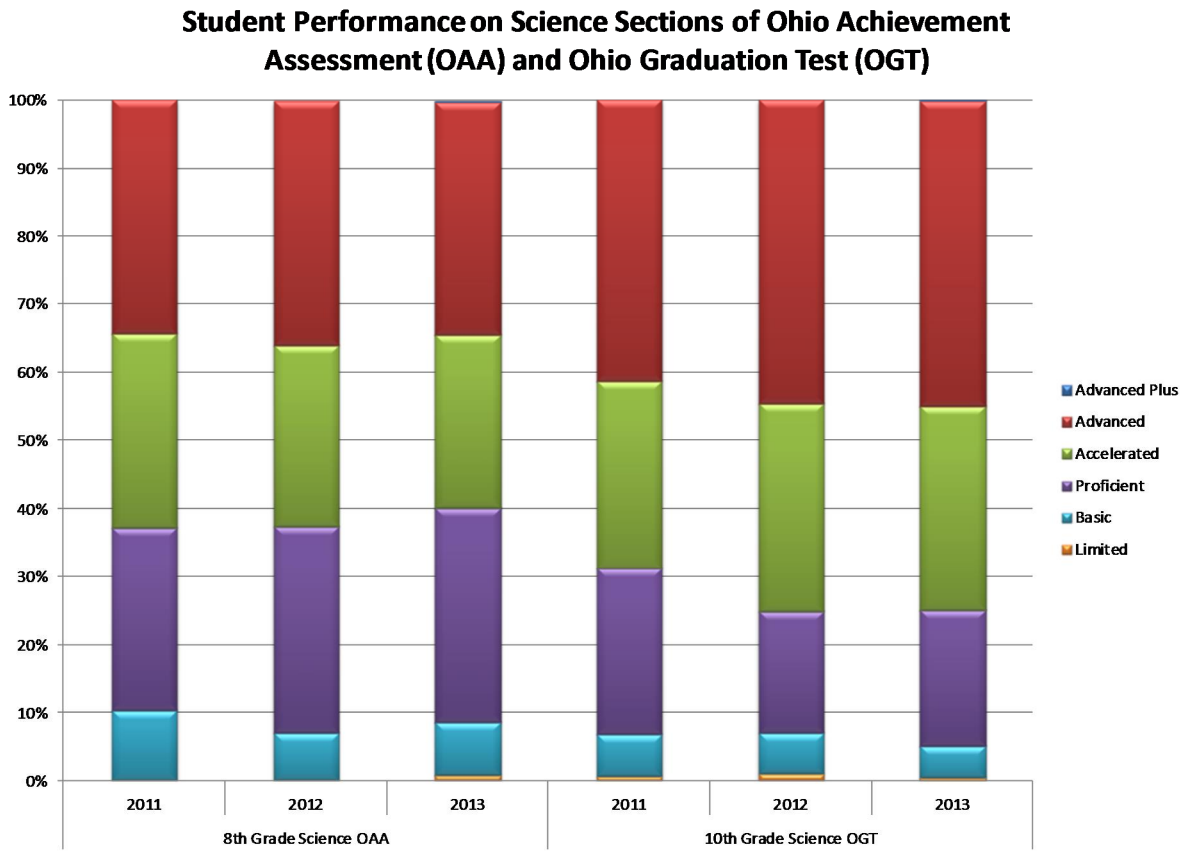
Fig. 9 Olentangy Student Performance – Math OAA and OGT, 2011-2013



Note – The Advanced Plus designation was first introduced in 2013. To qualify for this level of achievement, a student needed to score "Advanced" while taking a grade accelerated assessment – for example, a 6th grader scoring "Advanced" on the 7th grade OAA.

- While the majority of students across all tests and all years scored better than "Proficient" (ranging from 51% to 88%), the percentage of students scoring "Advanced" dropped between 6th and 7th grade, as well as between 7th and 8th grade.
- Additionally, a slightly higher percentage of students scored below "Proficient" in 7th grade than in 6th grade. So, not only are fewer students achieving the highest designation, there are also a greater number of students who are considered as "not passing" the math OAA in 7th grade (as score of "Proficient" is often recognized as "passing" the assessment). This trend was consistent with 8th grade OAA scores in 2011, however the number of students not passing the math OAA has decreased over the past three years.
- Students taking the 10th grade Math OGT had the highest percentage of "Advanced" scores.

Fig. 10 Olentangy Student Performance – Science OAA and OGT, 2011-2013



Note – The Advanced Plus designation was first introduced in 2013. To qualify for this level of achievement, a student needed to score "Advanced" while taking a grade accelerated assessment – for example, a 6th grader scoring "Advanced" on the 7th grade OAA.

- While the majority of students across all tests and all years scored better than "Proficient" (ranging from 60% to 75%), the percentage of students scoring "Advanced" increased between 8th and 10th grade.
- Overall, the percentage of students scoring above proficient remained relatively stable on both tests across the three year period.

Fig. 11 Olentangy Students Meeting College Readiness Benchmark - *ACT QualityCore*

Students Meeting Benchmark ACT QualityCore Spring '13				
			Met Benchmark	
Subject	**Total Students Taking Test**	**Average Final Score**	**N**	**%**
Algebra I	120	146	7	5.8%
Geometry	1328	148	318	23.9%
Algebra II	1194	150	769	64.4%
Pre-Calc	992	149	848	85.5%
Biology	1049	155	548	52.2%
Chemistry	945	151	175	18.5%

- This table further illustrates students' success and achievement as measured by the ACT *QualityCore* exam.
- It should be noted that adoption and implementation of the Common Core Standards for the 2013 school year is the main influence in the small number of Algebra I students.
- Additionally, because of the change in curriculum, the students taking the Algebra I test are not necessarily representative of the typical population of students taking that class in past and future years.
- As demonstrated in the previous chart, there was a much higher rate of students meeting the benchmark for Precalculus as compared to other math classes.

Fig. 12 Distribution of Degrees Attained of Olentangy Students

	N	%
Total	330	100.0%
Total STEM	54	16.4%
Science	29	8.8%
Technology	3	0.9%
Engineering	13	3.9%
Math	9	2.7%
Non-STEM	276	83.6%

- Data collected from National Student Clearinghouse which records graduating students' college major, when/if the post-secondary institution reports it. This is Olentangy Local School District's most recent report on Olentangy graduates and the college degree reported upon graduation.