Eugene School District 4J

Supporting Equitable Opportunities & Outcomes in Math

Math Goal: Prepare every student for success in their chosen life path by providing rich, complex and multidimensional mathematics program

The image below shows the new secondary math course offerings, aligned to the Oregon Department of Education's math pathways requirement (p. 13-16 of the K-12 Standards Document), which will be fully implemented before the 2025–26 school year. In addition to two new high school math pathways (Data Science and CTE), our modernized Calculus pathway recognizes the overlap of traditional "Algebra 2" and "Pre-Calculus" courses and compacts them into a single course. Therefore, Calculus is accessible to all students who choose to take it, without the need to accelerate or "skip" during middle school.

Eugene 4J will implement grade-level math sequencing at all middle schools by fall 2023 by removing Math 7a from our course offerings. Several schools already implemented this change early in fall 2022: Arts & Technology Academy, Kelly, Kennedy, Madison, Monroe and Roosevelt. Single-subject acceleration or "skipping" will still be supported for students using our established district placement testing process. In order to skip an entire math course, students must demonstrate mastery of the math standards taught in the class they intend to skip.

Eugene 4J Grade-Level Sequencing* & 11th/12th Pathways			
Grade 6	Math 6		*Math placement testing process available during spring of 5th, 6th, and 7th grade. *Students in grades 8 - 11 can continue to take accredited courses outside of 4J at their own expense.
Grade 7	Math 7		
Grade 8	Math 8		
Grade 9	Algebra 1 (1.0 credit)		
Grade 10	Geometry Statistics (1.0 credit)		
	Data Science Path	Calculus (IB) Path	CTE-Aligned Path
Grade 11	Data Science	MTH 95/111 + MTH 112	Construction Geo, Health Occupations Math, Financial Alg, etc.
Grade 12	AP Statistics	Calculus	

Frequently Asked Questions

****ALL UNDERLINED TEXT LINKS TO OTHER SITES****

1) *Why do we have our current math course sequencing practices?*

Curricularly, our current high school sequence of courses (Algebra course followed by Geometry and then another course in Algebra) dates back to at least 1890 as evidenced in documents from the Committee of Ten who were charged with documenting current high school practices at the turn of the 20th century. *Structurally*, we can trace the roots of our math sequencing practices to the early 20th century. At this time the American school system underwent a substantial shift. The rise of manufacturing, immigration, and intelligence testing were among the leading causes of these shifts. "Tracking students to situate them for specific roles in the economic hierarchy helped to replicate existing social and racial hierarchy, and to provide "scientific" justification for doing so" (Grading for Equity, Feldman, pp. 21-22). These practices of sorting students based on perceived ability and potential are very much ingrained in our mathematics education system today.

Although most educators and school districts state their mission/purpose as helping all students to succeed, our math program continues to sort students by math "ability" which year after year mirror society's stratifications (or "castes") in race and economic status. A system that sorts and selects for some students is fundamentally at-odds with equitable and anti-racist principles for education (The Mo(ve)ment to Prioritize Antiracist Mathematics: Planning for This and Every School Year, TODOS).

Here is a sample of research/reviews of research that examines the history and myths about learning that underpin this practice:

- Keeping Track, Part 1: The Policy and Practice Of Curriculum Inequality, Jeannie Oakes
- The Truth about Tracking (sample here), Lauren Anderson and Jeannie Oakes
- "Opening Our Ideas": How a detracked mathematics approach promoted respect, responsibility, and high achievement, Jo Boaler
- Tracking and Detracking: Debates, Evidence, and Best Practices for a Heterogeneous World, Beth C. Rubin
- ODE Oregon Math Project Practice Brief: Tracking

2) *Why do these practices persist in math but not quite as systemic in other courses?*

The American populus largely holds unidimensional views of mathematics as a set of procedures that are mastered in a linear progression. The smarter you are in mathematics, the faster you are at mastering these procedures. This view of mathematics fits nicely with our current math course sequencing practices. A modern view of mathematics is multidimensional and recognizes the diversity of "smarts" needed in order to be successful in mathematics. Our modern world needs students who can visualize problem solving paths, connect and apply mathematics in contexts outside of the classroom, translate mathematics across representations, reflect and communicate diverse solution paths to diverse audiences, collaborate with colleagues with diverse strengths and many other "smarts." These aren't assessed through standardized means and do not align with a system that sorts students based on perceived ability. These are the kinds of "smarts" that are consistently elevated in surveys of industry leaders as well as post-secondary Science, Technology, Engineering, and Mathematics (STEM)

faculty when asked what they look for in potential employees/students. Teaching heterogeneous groups of students with multidimensional curriculum best prepares students for a world where diverse perspectives are needed to tackle complex mathematical problems. See Dr. Rebekah Elliot's presentation from December 9, 2021 for more information.

3) *Why are we talking about this now?*

In October 2021, the Oregon State School Board committed to the goals of the Oregon Math Project. This triggered a conversation about course placement practices for three reasons:

1) The Oregon Math Project echoes national calls from mathematics education experts to support grade-level math experiences for students (Association of State Supervisors of Mathematics, National Council for Supervisors of Mathematics, NCTM's Catalyzing Change).
2) The Oregon Math Project contains the new 2+1 model for high school mathematics which enables all students to reach high levels of math courses without the need to skip or accelerate in middle school.
3) The Oregon Math Project contains new state math standards that demand increased access to Data Science and Mathematical Modeling. Students on accelerated math pathways receive an algebra intensive curriculum for the sake of time - this is often at the expensive of data, geometry and modeling opportunities which are critical for a modern mathematics preparation.

4) *How do heterogenous, multidimensional mathematics classrooms work?*

Mathematics education researchers have thoroughly investigated the practice of teaching mathematics to heterogeneous classes and have a wealth of curricular and pedagogical resources for teachers to put into practice. With support from administrators, trainers and families, teachers can and have supported students to make the normative and conceptual shifts to come to see mathematics as more than a set of procedures to memorize. Rich and applicable mathematics instruction will allow students to make connections and build a much stronger understanding that will allow for greater retention and transfer across subjects.

- Complex Instruction, Stanford Graduate School of Education, Rachel Lotan & Elizabeth Cohen
- Ambitious Teaching, University of Michigan, Magdalene Lampert
- Deeper Learning, Learning Policy Institute, Linda Darling-Hammond & Jeannie Oakes

5) *How do we make sure students with strong math skills are still being appropriately challenged in grade-level math?*

Academically, students with strong math skills were told to skip math courses or were placed into accelerated math courses as a means of meeting their needs. This is not the answer to appropriately challenging students by-in-large. In a longitudinal study of Eugene schools, students who skipped or were accelerated were found to:

- not perform as well in courses beyond Algebra 2 as those who had not skipped or accelerated;
- be more likely to not take math their junior and senior year (including enrollment at UO/LCC) than those who had not skipped or accelerated.

These data correlate with research findings that students who accelerate or skip have holes in their mathematical understanding and increased anxiety and fear about getting work wrong (see Boaler, 2016). The research has also shown that, particularly pronounced for girls, it is a lack of confidence that causes them to leave STEM pathways not ability. In short, some students with strong math skills are **not set up for long term success by skipping or accelerating in middle school.**

Socially, accelerating/skipping may feel right for some students/families and research finds this stems from a desire to remain with social peers (Wells & Serna, 1996). Given Oregon's history of racial oppression and lack of affordable housing, social peers are largely homogenous by race and class. The resultant is de-facto segregation through math course placement and this is **fundamentally at-odds with democratic, equitable and anti-racist principles for education**.

Ultimately, **all** students, including those with/without dispositions towards mathematics, need appropriate challenge; non-segregated systems can be designed to achieve this goal. This system functions in three ways: pedagogically, curricularly and normatively.

Instructional Time	Normative	Pedagogically	Curricularly
60-70%	*We need each other to be successful at math because we have diverse ways of knowing and that diversity is our strength.*	Teacher uses complex instruction including status interventions, group roles and norms and other pedagogical moves to increase student participation and learning.	High cognitive demand, group worthy tasks with a low floor and a high ceiling (for example).
15-20%	*I have unique needs that need to be developed.*	Students have "permission to have prerogative" (Allen, 2021) and teacher supports small flexible group instruction.	Differentiated learning experiences by depth-of-knowledge (for example) on grade-level content.
15-20%	*I have unique interests where I can apply my math understanding.*	Students have choice in project context/product or both and teacher engages as coach.	Mathematical modeling tasks/projects (see below)

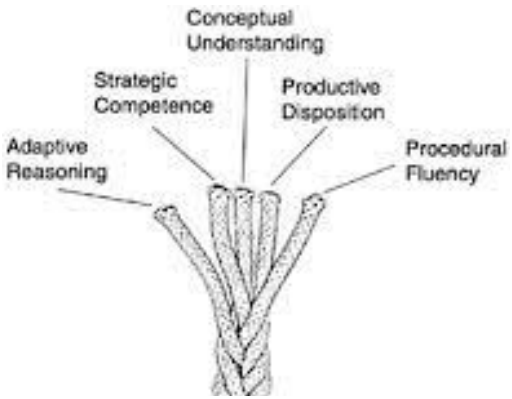
6) *How does the "focus on math modeling" work in practical terms?*

In a nutshell, a focus on mathematical modeling works by allowing students to access meaningful applications of grade level appropriate content with added interpretation and analysis. This diagram illustrates this shift (source: GAIMME report).

Modern mathematics curricula integrate these kinds of authentic tasks directly into the grade-level mathematics curriculum (see Illustrative Mathematics) but even without access to these tasks, other resources are available for teachers to ensure these experiences can be integrated on a regular basis (see Routines for Reasoning). Organizations like the Society of Industrial and Applied Mathematicians offer exceptional support for integrating mathematical modeling as well.

7) How do we know it's okay to deemphasize computational skills?

It's all about balance. Past president of the National Council of Teachers of Mathematics, Matt Larson, offers a great synthesis of the history of mathematics educators searching for this balance. Ultimately, true mathematical proficiency requires a balanced multidimensional approach. The National Research Council (2001) defined multidimensionality with 5 strands of proficiency (see image). The strands of *conceptual understanding and procedural fluency are* essential for students in all grade levels in order to comprehend the mathematical concepts, perform operations, and identify appropriate relationships. They are the WHAT and HOW of mathematics. Equally as important is the WHEN. Strategic competence and adaptive reasoning allow students to make sense of WHEN mathematical ideas can be appropriately applied as they problem solve, problem pose, and justify one's reasoning. One of the last but most essential strands of mathematical proficiency is having a productive disposition toward mathematics. This is the agency, the confidence that "I am a math person" sense that we want **ALL** our students to believe.



If what is happening in our modernized mathematics program *feels* like a deemphasis on computational skills - it is likely because procedural fluency was being OVER emphasized at the deficit of one of these other proficiencies.

8) *What are the modernized math course offerings recommended by the Oregon Department of Education?*

Modernized Math Course Offerings

Grade 6: Algebraic reasoning in real world contexts with ratios & rates, algebraic expressions, single variable equations & inequalities and the concept of independent and dependent variables. Geometric reasoning in real world concepts with area/surface area, and volume and an introduction to coordinate geometry include early reasoning about length. Data reasoning in real world contexts including formulating statistical questions, using technology to collect, organize and analyze data and interpreting measures of center and variability.

21-22	22-23	23-24	24-25	25-26	26-27	27-28
Grade 6						
	Grade 7					
		Grade 8				
			Grade 9			
				Grade 10		
					"+1"	
						"+1"

Grade 7: Algebraic reasoning in real world contexts with proportional reasoning, equivalent expressions, equation solving, integer operations. Geometric reasoning in real world concepts with scaling, angle measure, area/surface area, and volume. Data reasoning in real world contexts of sample selection and measures of center and variability.

Grade 8: Algebraic reasoning in real world contexts with exponents, radicals, irrationals, linear equations, systems of equations and an introduction to functions. Geometric reasoning in real world contexts with congruence, similarity and the Pythagorean Theorem. Data reasoning in real world contexts of bivariate data associations.

Grade 9*: Algebraic reasoning through more formal mathematical modeling of real world contexts with linear/exponential equations/inequalities as well as systems thereof. Functional reasoning also applied to modeling situations including formal notation with an emphasis on multiple representations.

Grade 10*: Geometric reasoning with real world contexts involving transformation, proofs, and geometric modeling situations applying concepts of congruence, similarity, area and volume. Data reasoning applied to multivariable statistical investigations including a study of causality/correlation.

*Note some districts may choose to integrate these courses across the domains of Algebra, Functions, Geometry and Data

Sample Choices of Math Course for Grade 11 & 12

"+1" Advanced Algebra: School sites can choose to map this course to IB Math and/or College Now math. In either case, this course builds on prior algebra and function work to study rational, polynomial, logarithmic and trigonometric functions. (Note: this has historically been a 2-credit sequence called Algebra 2 and PreCalculus. The redundancy of these courses is now being recognized and removed. Also, through the integration of technology, the traditional computational components have reduced substantially).

"+1" Data Science: Data reasoning in preparation for STEM majors including natural sciences, engineering and the major of

"data science" itself. This "+1" level builds on past work in data reasoning to use computational tools to make sense of "big" data through programming (R and python), simulation, regression, vectors, algorithms, and functions.
"+1" Math for CTE: Career-technical education courses (CTE) articulate with career and postsecondary expectations to provide juniors and seniors with meaningful career-oriented experiences. These Math for CTE courses will vary by schools' CTE programs of studies but blend relevant college preparatory mathematics concepts into the CTE program's context. For example: Health Occupations Mathematics, Financial Algebra for Business, Computational Thinking for Computer Science, etc.
"+1" Advanced Placement (AP) Courses: School sites with qualified teachers will continue to offer AP Calculus and AP Statistics.

9) What is the benefit of splitting calculus and data science tracks vs. offering a higher-level familiarity with both?

To be honest, we are WELL overdue offering students ANY experience with data science in K12 education. To "make-up" for this - Data Science is now a requirement for all high school students via the new 2021 Grade 9/10 standards (equivalent to at least 0.5 credits). The pathways that follow do offer students a choice between a deeper dive into data science, quantitative reasoning or a pathway to Calculus. These ideas are grounded in research out of the Charles Dana Center and their experience working in other states to create meaningful career & college aligned pathways.

It is hard for the math teachers that are writing this to answer the "benefits" part of your question because we love all these options and think students should take math all day!! In short, the benefit is there are no bad options; just modern mathematics relevant for a career pathway that will help them develop an identity as a mathematician that sticks with them when they inevitably change their minds about that pathway.

10) How will "responsible," as opposed to "reckless" (Allen, 2022) acceleration occur in mathematics?

The standards and content taught in middle schools provide core knowledge and experience for all students, regardless of their postsecondary plans. Middle school mathematics builds the foundation for future success in high school. Eugene 4J currently has two methods for accelerating students in mathematics:

- Building-based acceleration, arbitrarily placed at 7th grade, in the form of a compaction course called Math 7a
- District wide single-subject acceleration, where students can skip a course after demonstrating mastery of standards

The intent of our building-based acceleration course, Math 7a, was to teach all 7th and 8th grade standards to students in one year. The reality of the course is that teachers only have time to teach the priority standards from 7th and 8th grade, *leaving one third of those grade level standards untaught*. This trimmed curricular experience creates mathematical gaps for these students in the areas of applied geometry, data reasoning, and probability. Our building-based acceleration course is an example of reckless acceleration that creates mathematical gaps for students and perpetuates inequitable representation of students on the basis of race and socioeconomic status.

Responsible acceleration looks like our single-subject acceleration process, where students **demonstrate comprehensive mastery of the grade-level standards they intend to skip.** We will continue to offer this single-subject acceleration process, recognizing that there will always be a few exceptional students who have mastered above grade-level standards. Students have the opportunity to participate in placement testing each spring, from 5th grade through 7th grade. (Note: Students may test to skip any middle school math course up to, ***but not including***, Algebra1.) Students who attempt to skip, but don't have mastery of all of the grade-level standards for that course, will still have access to engaging and differentiated mathematics instruction through group worthy tasks, differentiated learning experiences, and mathematical modeling projects/tasks (described in greater detail in question 5). Our changes to pathways at the high school level no longer require a student to accelerate or "skip" in middle school to reach college-level courses such as AP Statistics, College Algebra (Pre-Calculus), or Calculus.

Additional Resources

Curriculum:
Modern & Multidimensional Math

Modernizing Mathematics
- Mathematical Modeling
- Podcast on Data Science
- STEM integration at Elementary
- Progression in Reasoning (Dev Sinha)

Sample Modernized Math Lessons
- Math Modeling Task
- Data Science Task
- Data Visualization Platforms
- Number Talk
- Using a Worked Example
- Multiple Ways to Solve a Problem
- Rich Tasks: Square Counting video

Changes at High School
- Detracking impacts on IB
- Mathematics Association of America says stop the rush to Calculus
- Multiple Pathways in High School
- Interviews about College Readiness

Culture:
We are all Math People

Support for Heterogeneous Classes
- Dr. Thanheiser on Think Out Loud
- TODOS: Math Success for All
- National Council of Supervisors of Mathematics
- National Council of Teachers of Mathematics
- Association of State Math Supervisors

Oregon Department of Education Information
- Presentation to Lane County Math Teachers about Statewide Changes
- ODE Mathematics Website

Case Studies
- San Francisco USD Overview
  - Quick Facts about Math and Tracking
- Video Overview of North Clackamas
  - Q&A from North Clackamas

Videos
- Five Principles of Extraordinary Math Teaching
- Rethinking Giftedness
- Dr. Jo Boaler on Ability Grouping

Instruction:
Complex Instruction for Diverse Learners

Teacher Moves
- 8 Equitable Teaching Practices
- Complex Instructions
- Video on Complex Instruction
- Overview of 5 Practices for Orchestrating Math Discussions
- Video on 5 practices for Orchestrating Math Discussions

Student Voice
- Student Experience Network Study

In the News
- Forbes, Dec. 2020
- USA Today, Feb. 2020
- Edutopia, Aug. 2019
- NCTM, March 2018