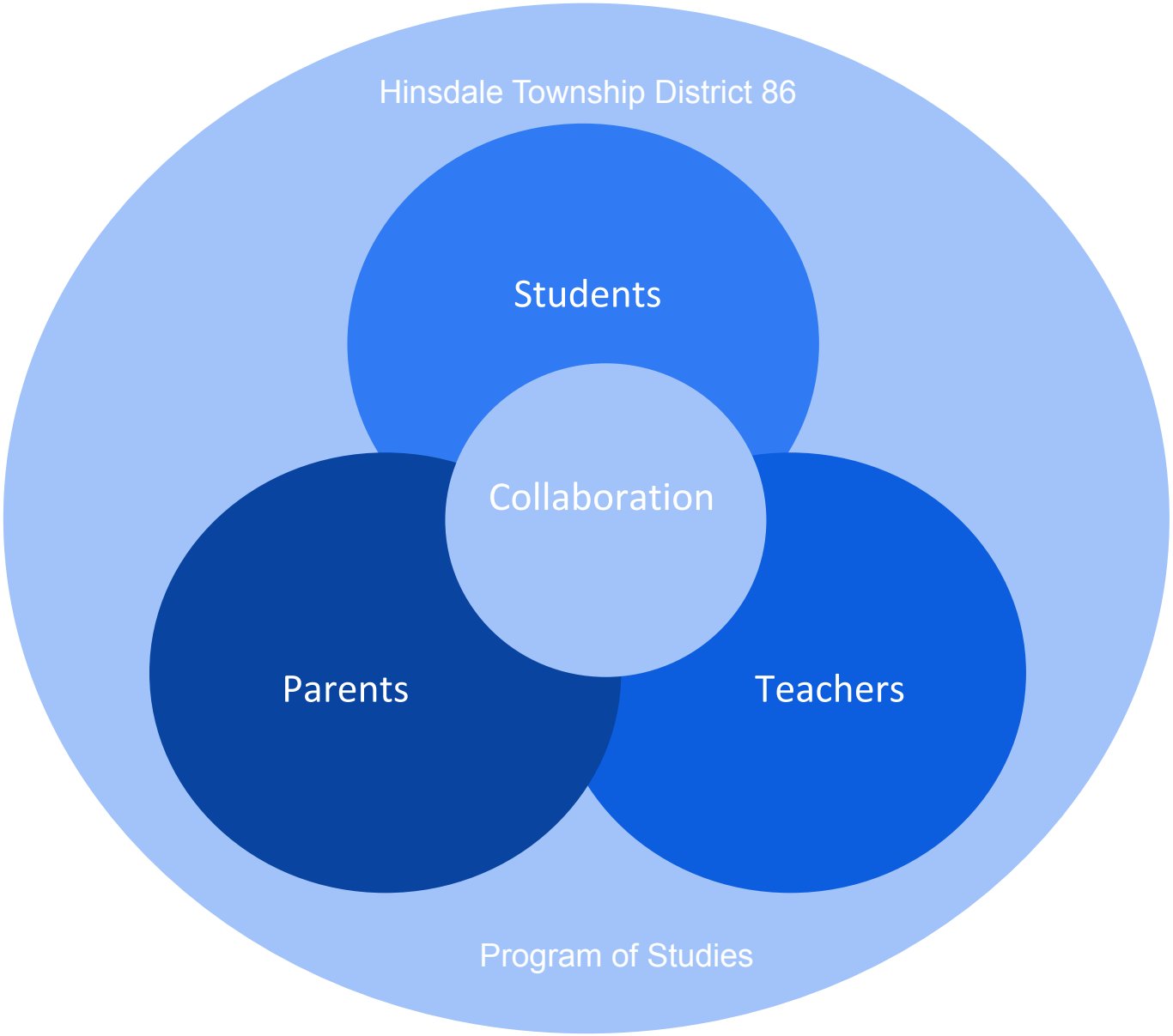
D86 Science Program

Physics: Physics in the Universe
Curriculum Development Update



Curriculum Alignment

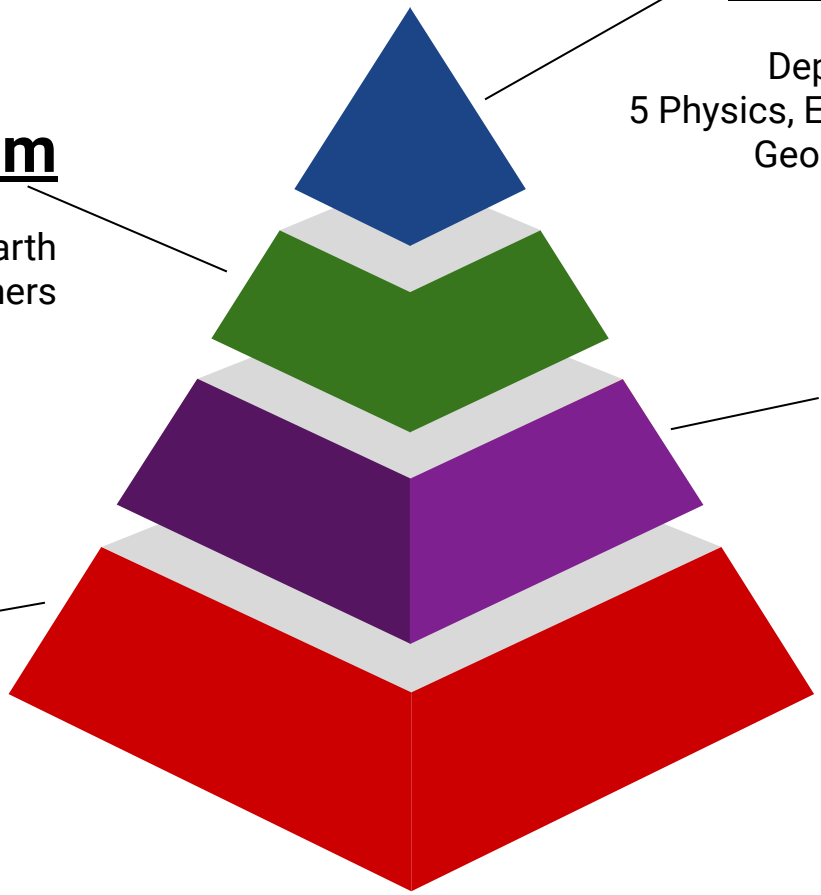
Structure of the Curriculum-Building Process

Writing Team

Department Chairs +
5 Physics, Earth Science, and GeoPhysics Teachers

Development Team

Department Chairs + 10 Physics, Earth Science, and GeoPhysics Teachers



D86 Science Program

Department Chairs, Teachers, Administrators

D86 Strategic Plan

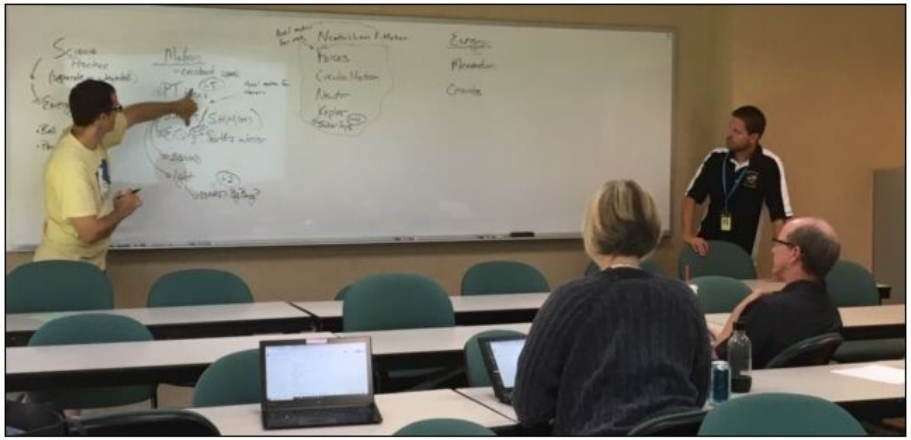
Community Members, Parents, Students, Board Members, Administrators, Department Chairs, Teachers, Consultants

D86 PITU Curriculum Development Team

This team focuses on the big picture and themes of the courses and serves as a sounding board to the writing team. This team met three times this fall semester to provide guidance and feedback to the writing team and will meet two times in the spring semester.	David Bonner	South	Physics H, AP Physics C
	Anna Breig	Central	AP Physics 1, Physics
	Randy Brogan	South	GeoPhysics, Interventionist
	Dylan Canavan	Central	Earth Sci G, Chem/Phys
	Tom Jacobson	South	Physics H, GeoPhys, Physics
	Kristin Kaduk	South	GeoPhys, AP Env Sci
	Joe Liaw	Central	Physics Themed, Physics
	Chris McClain	Central	AP Physics 1, Physics
	Alan McCloud	Central	Earth Science H, MAGO
	Cory Sargent	Central	Earth Science, AP Env Sci

D86 PITU Curriculum Writing Team

This team focuses on the details of the courses. They meet every 3-4 weeks, and their work includes refining objectives, fleshing out pacing, and refining the differences between honors and regular sections of the course.	David Bonner Randy Brogan Dylan Canavan Chris McClain Alan McCloud	South South Central Central Central	Physics H, AP Physics C GeoPhysics, Interventionist Earth Science G, Chem/Phys Physics, AP Physics 1 Earth Science H, MAGO



Physics Curriculum Meetings

Fall Semester 2019		Spring Semester 2020	
Sept 24	Development Team	Jan 14	Writing Team and Physics Teachers
Sept 25	Writing Team	Jan 15	Math DCs and Writing Team
Oct 8	Writing Team	Feb 4	Development Team
Oct 9	Writing Team	Feb 5	Writing Team
Oct 29	Development Team	Feb 25	Writing Team
Oct 30	Writing Team	Feb 26	Writing Team
Nov 12	Writing Team	Mar 10	Development Team
Nov 13	Writing Team	Mar 11	Writing Team
Dec 3	Development Team	Mar 24	Teaching Team
Dec 4	Writing Team	Mar 25	Teaching Team
		April 14	Teaching Team
		April 15	Teaching Team and Math Teachers
		May 12	Teaching Team
		May 13	Teaching Team
		May 19	Teaching Team
		May 20	Teaching Team

Program of Studies Course Descriptions

PHYSICS: **PHYSICS IN THE UNIVERSE** *For students recommended for Algebra 1*	This course covers the skills and content of a first year physics course within the context of the Earth and its place in the Universe. Topics include experimental design, waves, earthquakes, motion, plate tectonics, forces, energy, climate, momentum, gravity, planetary motion, projectiles, and the solar system.
PHYSICS HONORS: **PHYSICS IN THE UNIVERSE** *For students recommended for Integrated Algebra and Geometry* or *higher*	This course covers similar topics as Physics: Physics in the Universe, but at a deeper level and an accelerated pace. This course requires mastery of Algebra I and strong math critical thinking skills.

Physics Linkages to NGSS & The College Board

Next Generation Science Standards (IL State Standards)	**DRAFT Physics with ESS** (1st yr physics course; algebra-based)	**College Board AP Physics 1** (1st yr physics course; algebra-based)	**College Board AP Physics C** (2nd yr physics course; calculus-based)
Science Practices	Science Practices	Science Practices	Science Practices
	Kinematics + projectiles	Kinematics + projectiles	Kinematics + projectiles
Forces & Newton's Laws	Forces & Newton's Laws	Forces & Newton's Laws	Forces & Newton's Laws
Energy	Energy	Energy	Energy
Momentum	Momentum	Momentum	Momentum
	Circular Motion	Circular Motion	Circular Motion
		Rotation	Rotation
	Oscillation (Honors)	Oscillation	Oscillation
Waves	Waves	Waves	
		Sound	
	Gravitation		Gravitation
Electric Charge/Force	Electric Charge/Force	Electric Charge/Force	Electrostatics
	Circuits (Honors)	Circuits	Circuits
Electromagnetism	Electromagnetism		Electromagnetism

Unit Template Example

Unit Title	**1. SCIENTIFIC PRACTICES**	
Unit Summary	Students will learn investigatory and communication skills that will be used throughout this course and will be built upon in future science courses. Topics include: Graphing, collaboration, communication, confidence in data (repeated measures, range…), data presentation, and questioning. Honors will additionally apply linear modeling with regression and quadratic mathematical modeling.	
Time Frame	9 days	
NGSS SEPs	✓ Asking Questions and Defining Problems ❑ Developing and Using Models ✓ Planning and Carrying Out Investigations ✓ Analyzing and Interpreting Data	❑ Using Mathematics and Computational Thinking ❑ Constructing Explanations and Designing Solutions ❑ Engaging in Arguments from Evidence ✓ Obtaining, Evaluating, and Communicating Information
NGSS CCCs	❑ Patterns ✓ Cause and Effect ❑ Scale, Proportion, and Quantity ❑ System and System Models	❑ Energy and Matter ❑ Structure and Function ❑ Stability and Change

OBJ	PITU R: Students will be able to...	PITU H: Students will be able to...
1a	**I can plan and carry out scientific investigations.**	**I can plan and carry out scientific investigations.**
1a1	I can apply the following three key techniques for obtaining data that accurately depicts a relationship: maximize the domain of the	I can apply the following three key techniques for obtaining data that accurately depicts a relationship: maximize the domain of the

Earth & Space Science NGSS Example Linkages

Sample ESS NGSS Topics
Orbital Motions
Evidence of Plate Tectonics
Cycling of Matter in Earth's Interior
Nuclear Fusion and the Sun's Energy
Interactions of the Hydrologic and Rock Cycles
Stellar Nucleosynthesis
Feedback in Earth's Systems
Biodiversity, Natural Resources, Sustainability
Coevolution of Life and Earth's Systems
Creation of Landforms
Energy Variation and Climate Change

Physics:
Physics in the Universe

Chemistry:
Chemistry of Earth Systems

Biology:
Biology of the Living Earth

Multiple Courses

Example Objectives: **Physics in the Universe**	**Example Objectives:** **Honors Physics in the Universe**
(NGSS PS4-1). I can use *mathematical representations to support a claim* regarding relationships among the frequency, wavelength, and speed of waves traveling in various media, (i.e., I can demonstrate an understanding of how the frequency and period of a wave depends on the source's motion, and move at a particular speed dependent only on the medium, and whose wavelength must adjust such that $v = f\lambda$).	
I can *measure and calculate* the following wave characteristics: period, frequency, wavelength, amplitude, and propagational speed.	I can *measure and calculate* the following wave characteristics: period, frequency, angular frequency, wavelength, amplitude, and propagational speed.
I can *create a model* that shows the relationship between amplitude, period, wavelength, and speed.	I can *mathematically model* a wave source's back-&-forth motion using a cosine function (i.e., convert between radians and cycles; determine amplitude, period, frequency, and angular frequency; and write an expression for y as a function of t).

Example Objectives: **Physics in the Universe**	**Example Objectives:** **Honors Physics in the Universe**
(PS4-1). I can *use mathematical representations to support a claim* regarding relationships among the frequency, wavelength, and speed of waves traveling in various media, (i.e., I can demonstrate an understanding of how the frequency and period of a wave depends on the source's motion, and move at a particular speed dependent only on the medium, and whose wavelength must adjust such that $v = f\lambda$).	
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I can *create a model* that shows the relationship between amplitude, period, wavelength, and speed.	I can *mathematically model* a wave source's back-&-forth motion using a cosine function (i.e., convert between radians and cycles; determine amplitude, period, frequency, and angular frequency; and write an expression for y as a function of t).

Next Steps for D86 Science Curriculum

Physics: Physics in the Universe: The Development, Writing, and Teaching Teams will continue their work on this course during second semester. The Teaching Team will do additional work on the course over the summer.

Math Collaboration: The Teaching Team and the math department will be meeting to continue their discussion about aligning the regular-level freshman course with algebra.

Re-evaluation of Physics Elective Offerings: Discussions continue to determine which AP Physics option will best serve the needs of students who begin in Algebra I (AP Physics C-M, AP Physics 1, AP Physics 2)

Chemistry: Chemistry of Earth Systems: Development and Writing Team members will be determined this semester so that work on this course can begin this summer.

D86 Science Program Goals

GOAL 1 (ALIGNMENT)	GOAL 3 (COLLEGE/CAREER)	GOAL 5 (STUDENT CHOICE)
Align course fees, texts, objectives, and semester exams.	**Align courses with college and career opportunities.** - Increase AP enrollment - Increase # of students passing AP exams - Enrollment in capstone course(s) - Provide junior/senior courses matching high demand careers/student interests - Courses are acceptable to colleges	**Provide informed student choice in coursework junior and senior year.** - Provide options for 11-12 specialization - Support level changes
GOAL 2 (BIG IDEAS, INTEREST)	**GOAL 4 (STRUCTURE)**	**GOAL 6 (SEL)**
Increase student exposure to and interest in core sciences. - Student experience more core sciences - Students experience more NGSS - Students enroll in more than the required 2 yrs of science, or the 3 yrs suggested by colleges	**Create a strategic and coherent science program.** - One course leads to another in terms of knowledge, skills, and in building interest - Courses align intuitively - Courses reflect student developmental level - Maximize teacher expertise	**Increase SEL considerations for students and parents.** - Decrease confusion on course selection - Decrease perceived need for tutoring - Support student ability to change levels - Support academic risk-taking - Courses address academic needs