Ridgewood Public Schools

SCIENCE CURRICULUM PROGRAM REVIEW

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Ridgewood Public Schools
Science Mission Statement

- The Science program at the Ridgewood Public Schools will provide authentic science experiences that prepare and empower students to develop an appreciation and understanding of the world around them.
- Through meaningful guided inquiry, scientific investigation and engineering design, students will acquire the skills and concepts necessary to become scientifically literate, make informed decisions, and solve real world problems.

Science Curriculum & Program Review Plan

- **Year One, 2015-2016:**
  - Program Review, Research, and Recommendation; Curriculum Writing and/or Reaffirmation (6-12)
    - Administrators researched best practices in the content area, and reviewed current program, student achievement results, and input from staff, parents, and students. A recommendation is made to reaffirm or revise curricula and/or program. The curriculum was simultaneously being rewritten for grades 6-12 to address the implementation of the Next Generation Science Standards (NGSS) in September 2016.
- **Year Two, 2016-2017:**
  - Implementation of New, Revised, or Reaffirmed Curricula (6-12)
  - Program Review, Research, and Recommendation (K-5)
    - Professional development will be provided as needed for 6-12 teachers. A committee of K-5 teachers and administrators develops new or revised curricula, and recommends professional development and instructional materials to support implementation of the NGSS by September 2017.

The Ridgewood Public Schools Science Curriculum & Program Review Plan

- **Year Three, 2017-2018:**
  - Complete Curriculum Writing in summer 2017 (K-5)
  - Implementation of New, Revised, or Reaffirmed Curricula in September 2017 (K-5)
    - Employ professional development as needed.
- **Years Four and Five, 2018-2020:**
  - Monitoring
    - Implementation continues.
    - Achievement and feedback are monitored.
    - Modifications are made if needed.

Year One Study - Presentation Outline

- Research on best practices in science education
  - Review of current Ridgewood District science education practices in Grades 6-12 highlighting gaps with best practices
- Review of student achievement data
- Perceptional data from teachers, students, and parents
- Recommendations and work in progress

What does the research say about K-12 science education?

BEST PRACTICES AND RPS GAP ANALYSIS

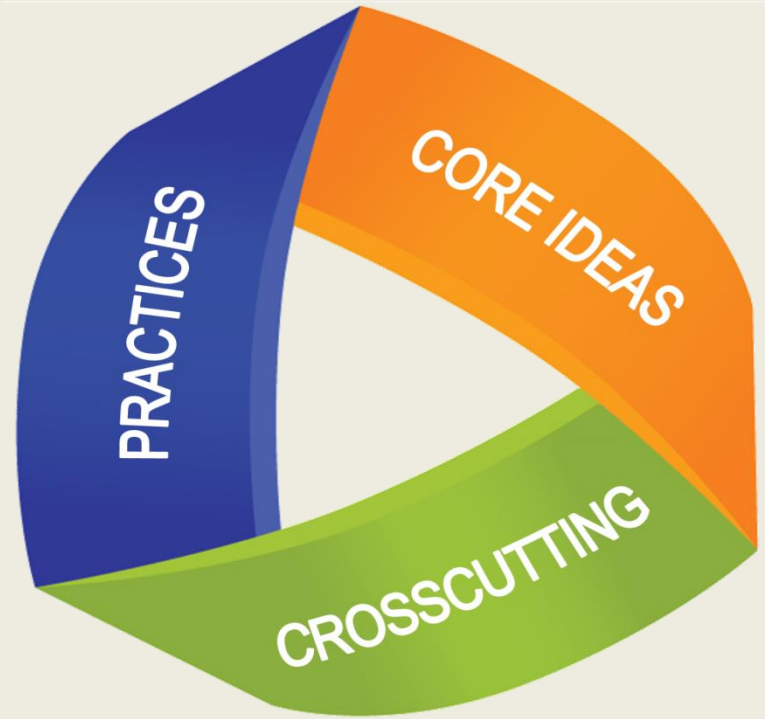
National Research on Science Education

- National research beginning in 2009 indicated a requirement to improve US standards for science education
  - **The need for new standards based on four major indicators**
    - **Reduction of US competitive economic edge**
      - Reduced share of patents and high-tech exports
    - **Lagging achievement of US students**
      - Program of International Student Assessment (PISA) ranked the US 23rd in science out of 65
    - **Essential preparation for all careers**
      - Many of the fastest growing careers require science and math
    - **Scientific & Technological literacy for an educated society**
      - Ability to make informed decisions about societal concerns and important events

NGSS Integrated Structure

Three-Dimensional Learning

- **Engineering Practices:**
  - Scientific inquiry and engineering design
- **Disciplinary Core Ideas:**
  - key concepts to a specific discipline that are essential to understanding complex ideas
- **Crosscutting Concepts:**
  - Apply to all scientific domains (Ex: Cause & Effect, Patterns, Proportion & Quantity, etc)



Research Lead to Best Practice Standards

Instructional Shifts in the NGSS Standards:

- Addition of Kindergarten science standards
- Integration of content (ELA and Math) into science
- Deeper reliance on the use of empirical evidence to support findings and scientific argumentation by students
- Engineering practices (Design thinking and real world problem solving)
- Ubiquitous inquiry (experiential, student-driven learning rather than traditional lecture and lab format)

Ridgewood
Current Science Program

WHERE THE GAPS EXIST

Current 6-8 Program Findings

- We currently use inquiry-based, Carolina STC program in grades 6-8
- Curriculum spirals with Life Science, Physical Science, & Earth Science taught each year.
- Three to four units of study are covered each year in each grade with one hour classes
- No dedicated double period for lab exists in the schedule, which is common in MS
- Environmental Science is offered as an elective at all grade levels
- *Findings being addressed:*
  - *A lack of consistency in some grades regarding curriculum delivery and assessment, both across buildings and sometimes across classrooms*
  - *A lack of adequate teacher guidance in curriculum documents is currently being addressed*

Current High School Science Courses

Core Program

- Biophysical Science
- Biology
- Chemistry
- Physics

- Biophysical Science & Biology are taught at the CP level
- Chemistry & Physics are offered at the general, CP, & Honors level

Enriched Program

- RAHP Program with Valley Hospital
  - Capstone Research projects expanded
- AP Courses and other electives offered in 12th grade
  - AP Physics 1 offered in 11th grade
- STEM- RELATED
  - Physics, Engineering, & Art Honors; Genetics Honors
  - Forensic Science

Peer District Course Offerings

18 Schools Reviewed

Emerson, Fair Lawn, Glen Ridge, Glen Rock, Hillsborough, Hunterdon Central, Livingston, Mahwah, Millburn, New Providence, Northern Highlands, Paramus, Park Ridge, Pascack Valley, Piscataway, Ramsey, Tenafly, Westwood

Common Course Offerings

Courses delivered in block schedule with about 900 min/4-wk rotation

- Biology Honors offered to freshman in most districts
- Higher level math prerequisites for Honors and AP levels
- Honors courses aligned to the SAT II subject tests' rigor
- Most districts have some articulated STEM Programs:
  - Engineering & Technology programs and/or CAD/Engineering courses
  - Science Research programs
  - Project Lead the Way

Findings based on Review of Peer District Curriculum Guides and Interviews

RPS High School Findings

- NGSS alignment required in September 2016
- Courses delivered in block schedule with about 1200 min/4-wk rotation
- District graduation requirement - 3 years of science (common practice)
- Common benchmark assessments exist in all science courses.
- *Findings being addressed:*
  - *Labs are not consistently stocked with equipment*
  - *Lack of consistency in curriculum delivery in some science courses*
  - *Class size is on the high side (often above state recommendation of 24)*
  - *Honors courses are not yet completely aligned to the SAT II*
  - *Lack of adequate teacher guidance in curriculum documents*

How Are We Doing?
Student Achievement Data

NJASK

BCT

SAT II SUBJECT EXAMS

ADVANCED PLACEMENT EXAMS

NJASK 4 & 8

NJASK 4

- Above DFG and State in all categories

Content	District	DFG	State
Life Science	12.1	12.0	10.5
Physical Science	8	7.8	6.6
Earth Science	8.5	8.5	7.1
Knowledge	3.4	3.3	3.0
Application	25.3	25.1	21.3

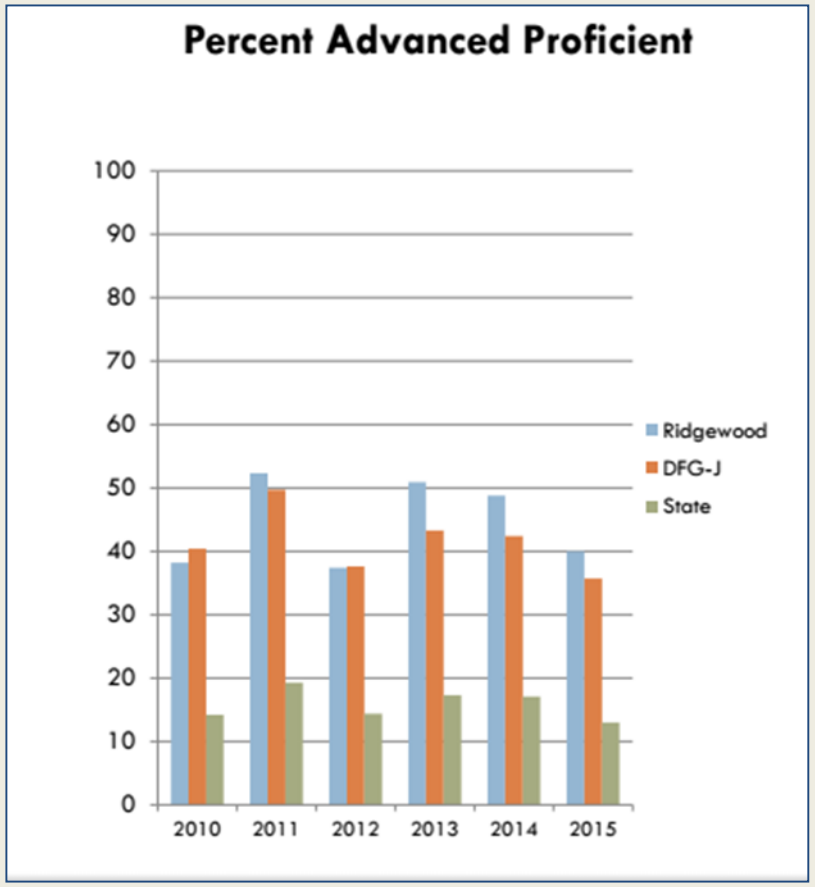
NJASK 8

- Above State in all categories
- Need to improve in the application of science concepts

Content	District	DFG	State
Life Science	14.3	14.8	12.6
Physical Science	11	11.7	9.5
Earth Science	11.1	11.2	9.2
Knowledge	4.6	4.6	3.8
Application	31.8	33.1	27.5

* Cluster means obtained from 2015 NJASK scores

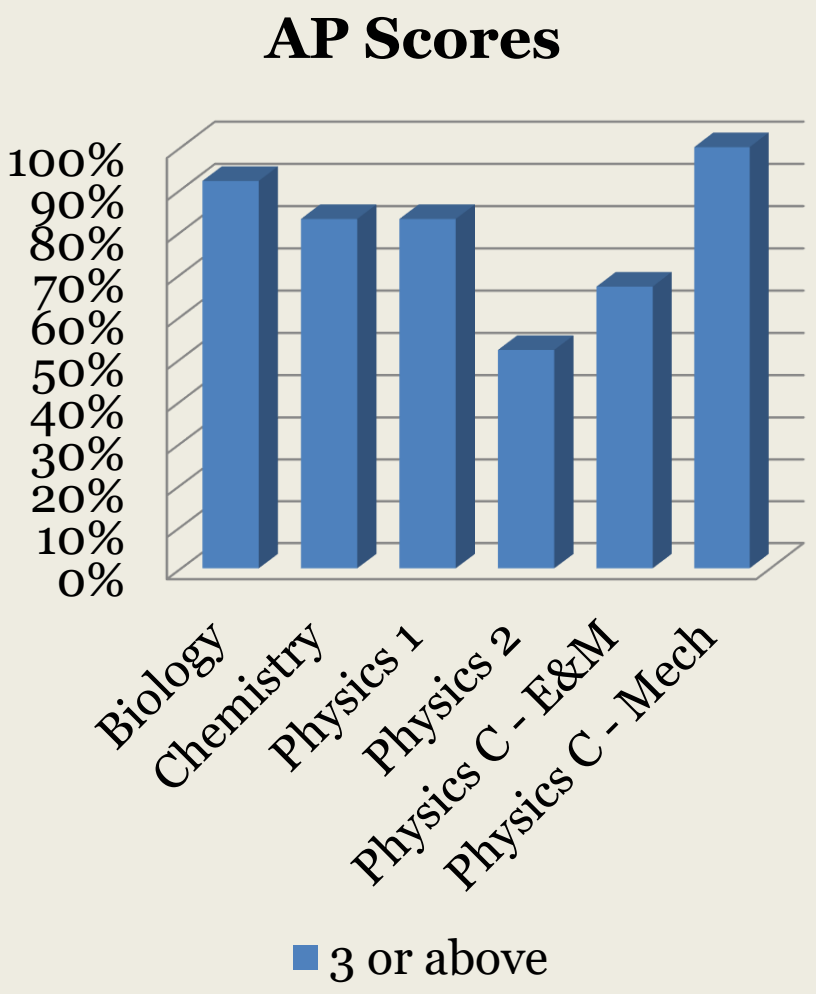
Biology Competency Test (BCT)



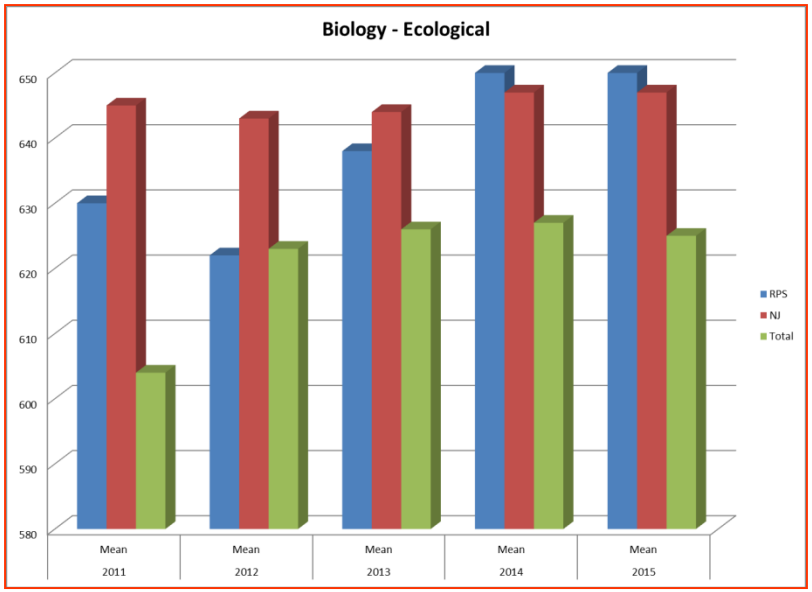
- We consistently score better than the State
- Above DFG in advanced proficiency for the past 3 years

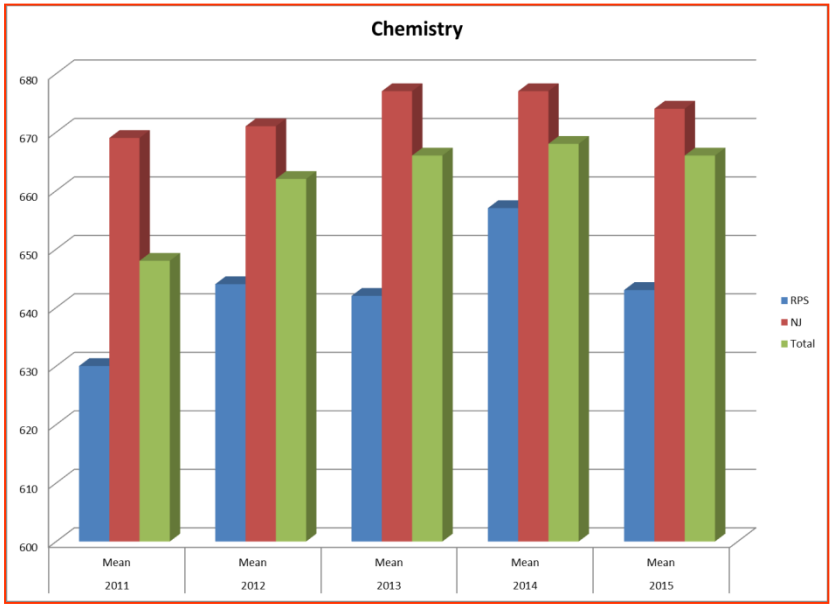
AP Exams

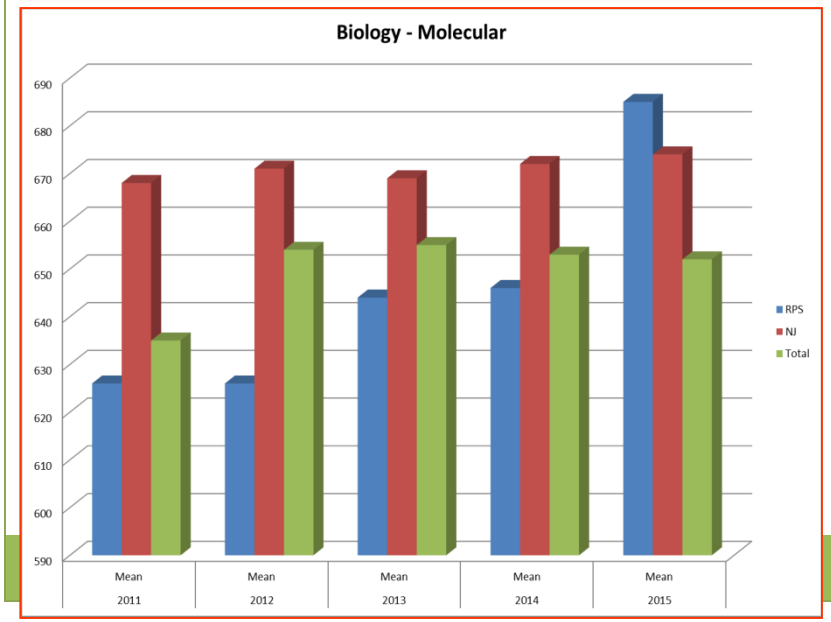
- Biology
  - Average: 3.54
  - 3 or above: 92%
  - 4 or above: 46%
- Chemistry
  - Average: 3.06
  - 3 or above: 82%
  - 4 or above: 26%
- Physics 1
  - Average: 3.31
  - 3 or above: 83%
  - 4 or above: 34%
- Physics 2
  - Average: 2.6
  - 3 or above: 50%
  - 4 or above: 11%

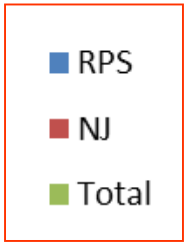


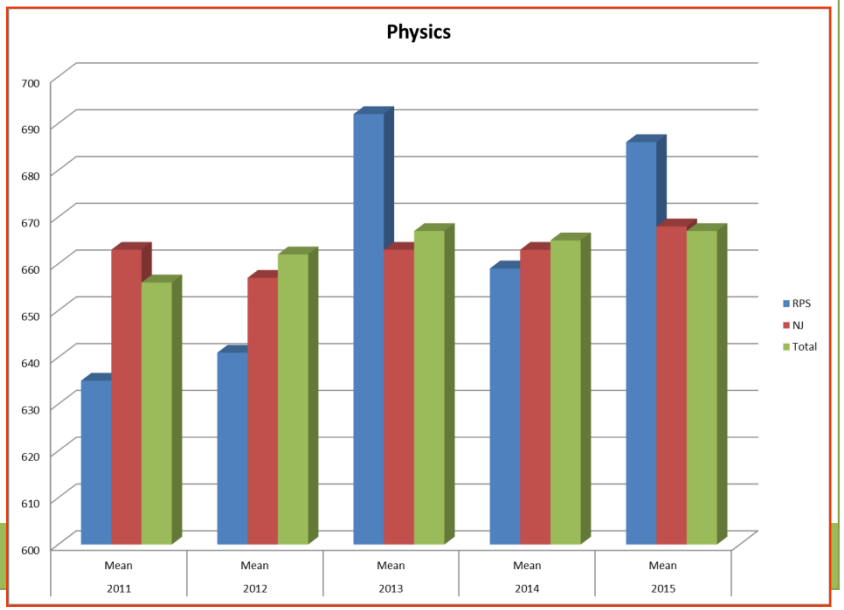
SAT II Subject Tests









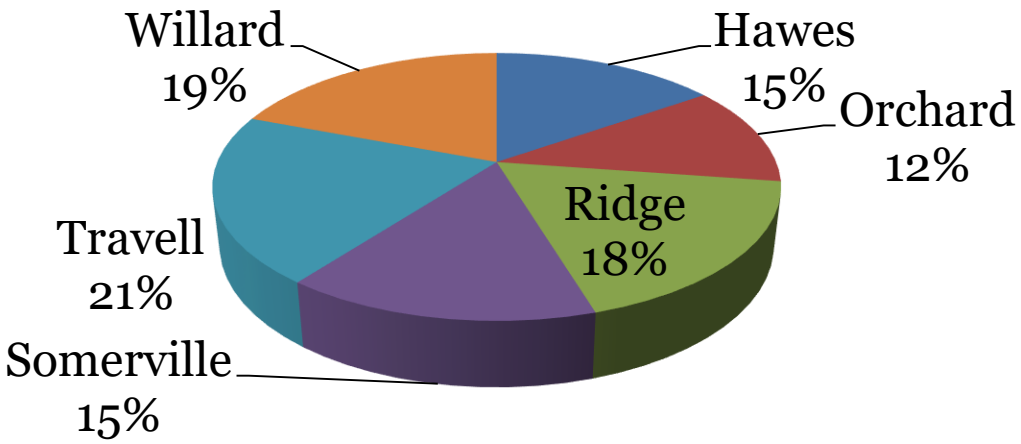


Community Perceptions

SURVEY RESULTS

- Parent Survey
- Student Survey
- Staff Survey

K-5 Parent Survey



Total of 417 responses

Question	Strongly Agree	Agree	Total
Student is interested in science	48.4%	48.4%	96.8%
Student enjoys science program	22.8%	64.7%	87.5%
Student is successful in science	26.6%	66.9%	93.5%
Student is appropriately challenged	8.4%	61.2%	69.6%
Science is essential to educational experience	72.2%	24%	96.2%
Overall satisfaction with science program	9%	58.8%	67.8%

K-5 Parent Survey
(*Common Comments*)

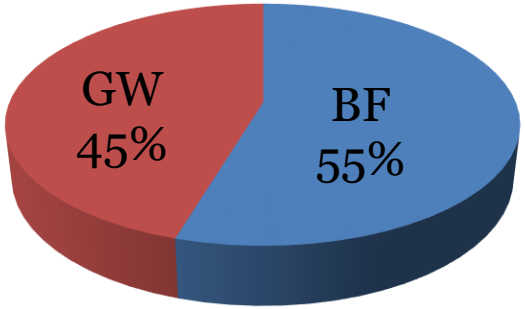
Positive Responses

- "My son is so excited when he has science!"
- "…science activities are the first thing my kids talk about when I pick them up after school."

Would like to see…

- More time devoted to science
- Incorporate science into math & ELA instruction
- Specialized elementary science teachers
- STEM initiatives
- More hands-on experience

MS Parent Survey



Total of 196 responses

Statement	Strongly Agree	Agree	Total
Student is interested in science	40.3%	48.5%	88.8%
Student enjoys science program	28.6%	51%	79.6%
Student is successful in science	37.8%	54.6%	92.4%
Student is appropriately challenged	18.9%	60.2%	79.1%
Overall satisfaction with science program	19.4%	57.1%	76.5%

MS Parent Survey
(*Common Comments*)

Positive Responses

- "..hands-on learning is great!"
- "The science classes are awesome!"
- "...teachers go the extra mile to make science fun and relevant for kids."

Would like to see...

- STEM course offerings
- Additional group work to solve problems
- Cross-curricular connections
- Science Club/Participation in state science competitions

RHS Parent Survey

Topic	Strongly Agree	Agree	Total
Student is interested in science	35.2%	35.2%	70.4%
Student enjoys science program	55.2%	21.8%	77%
Student is successful in science	35.2%	53.3%	88.5%
Student is appropriately challenged in science	25.5%	53.9%	79.4%
Satisfaction with science course choices	22.4%	61.2%	83.6%

* Total of 165 responses

RHS Parent Survey
(*Common Comments*)

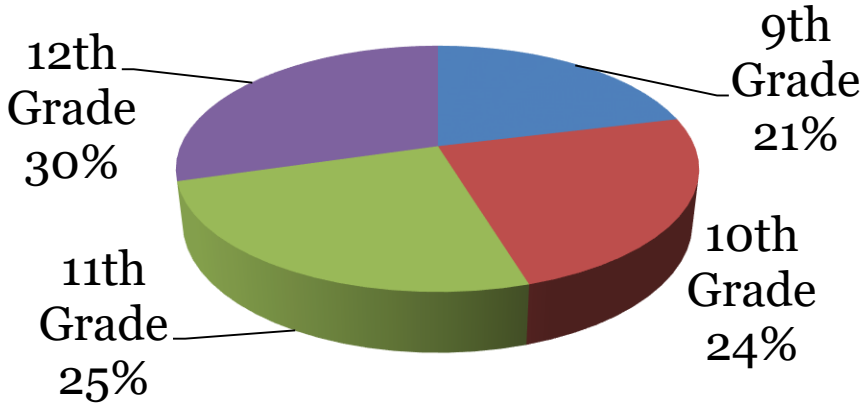
Positive Responses

- "The RAHP Program is excellent!!
- "…teachers are very supportive of students."

Would like to see…

- Preparation for the SAT II subject tests
- Honors science in 9th grade
- AP courses offered earlier than senior year
- Additional CP electives

HS Student Survey



Total of 353 responses

Statement	Strongly Agree	Agree	Total
I enjoy science program	13.9%	58.1%	72%
I am successful in science	35.7%	53.3%	89%
I am challenged appropriately in science	17.3%	60.1%	77.4%
I have had an overall positive experience in science	12.5%	62.3%	74.8%

RHS Student Survey

(*Common Comments*)

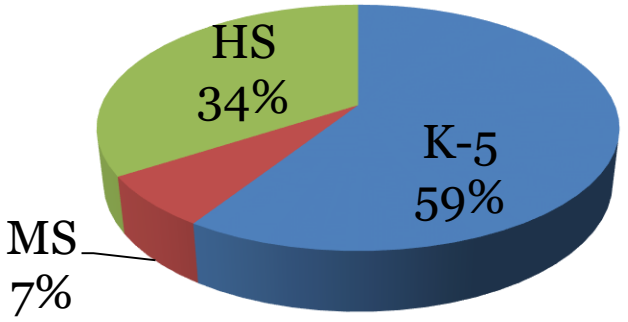
Positive Responses

- "…look forward to class every day!"
- "Excellent teachers!"
- "…teachers are encouraging, challenging, and passionate."

Would like to see…

- Preparation for the SAT II subject tests
- Honors science in 9th grade
- AP courses offered earlier than senior year
- Smaller Class Sizes
- Increased ability to take 2 sciences in the same year
- "…more hands-on and discovery-based learning."

Science Staff Survey



- **K-5**
  - 100% agree or strongly agree that students are interested in science
  - 46% disagree or strongly disagree that science is a priority in the District
  - 58% are engaged by the content and 70% pursue science knowledge on their own
- **MS**
  - 100% agree or strongly agree that students are interested in science
  - 100% agree that the curriculum needs to be updated
  - 100% are engaged in content and pursue science knowledge on their own
- **HS**
  - 74% agree or strongly agree that students are interested in science
  - 66% agree or strongly agree that science is a district priority
  - 67% agree or strongly agree that the curriculum needs to be updated
  - 53% disagree or strongly disagree that the department has the resources needed to be science leaders
  - 93% are engaged by the content and 100% pursue science knowledge on their own

Total of 44 responses

K-12 Staff Survey

(*Common Comments*)

K-5

- Concerns about set up time
- Need science professional development
- "Science is pushed aside for math and ELA"
- "Program is comprehensive and engaging!"

MS

- "…satisfied with movement to NGSS."
- Curriculum is about "doing, figuring out, investigating…and kids really like that."

HS

- Need updated equipment
- Need time for collaboration within and between disciplines

Science Program Recommendations

MIDDLE SCHOOL AND HIGH SCHOOL

K-5 RECOMMENDATIONS TO COME NEXT YEAR

Work In Process 2015-16

Middle School

- NGSS Curriculum alignment in process to be completed by Sept 2016
- NGSS engineering practices professional development took place in 2015-16
- Increased focus on using evidence to support scientific writing
- Increased focus on analysis incorporated in instruction
- Increased application of knowledge in instructional program

High School

- NGSS Curriculum alignment in process to be completed by Sept 2016
- Alignment of Math pre and co requisites to Science course
- Inventorying materials/equipment needs for increased innovation in program

K-8 Recommendations for 2016-2017

Elementary Schools

- Comprehensive study of K-5 science curriculum
- Professional development for K-5 teachers
- Alignment of curriculum to Next Generation Science Standards (NGSS)
- Investigate available resources

Middle Schools

- Addition of Waves, Electricity, & Information Transfer kit in 8th grade
- Continue with increased focus on using evidence to support scientific argumentation
- Continue an increased focus on data analysis

HS Recommendations for 2016-2017

- AP science courses available for juniors (Addition of Environmental Science AP)
- Environmental Science offered in place of Biophysical Science in 9th grade
- Creation of a Biology Advanced course in 9th grade
- Expansion of Genetics Honors to a full-year Genetics & Biotechnology Honors course to increase STEM opportunities
- Increase preparation for the SAT II subject tests by aligning courses to appropriate rigor
- Transitional increase of rigor in Physics Honors
- Explore addition of engineering courses through Project Lead The Way and other programs

Recommendations for 2017-2018

Elementary Schools

- Complete new NGSS-aligned curriculum in summer 2017
- Purchase new program resources to support curriculum
- Increase instructional time dedicated to science to meet state regulations
- Sustained, comprehensive professional development for K-5 teachers
- Explore departmentalization concept for elementary science

Middle Schools

- Continue an increased focus on using evidence to support scientific writing
- Continue an increased focus on data analysis
- Explore additional STEM opportunities

High School

- Recommendation of a medical technology program for the CP level
- Increase Engineering opportunities in follow-up to exploration in prior year
- Explore options to reduce class size

Special Thanks

THANK YOU TO:

- **6-12 science teachers for their input and curriculum work throughout the year**
- **Cheryl Best for her guidance and support throughout the study**

Works Cited

- http://nextgenscience.org/need-standards
- http://nextgenscience.org/sites/default/files/news/files/op-ed%20-%20delaware%20-%20new%20science%20standards%20turn%20students%20into%20thinkers.pdf