



# *Ashland Public Schools*

## *Science*

### *Curriculum Review Plan*

#### **Introduction**

The Ashland Public Schools is committed to the pursuit of academic excellence for all students. Our Blueprint for Continuous Student Improvement drives the work that we do every day to ensure that we meet this goal. The development and implementation of a clearly articulated curriculum in all subject areas is essential for success. In order to make certain that the current curriculum meets the needs of our students, is taught to fidelity, and is aligned to the standards, the district has created and adopted a curriculum review process. During this comprehensive process teachers review essential questions, data, test results, staffing levels, and professional development and create a self study by grade level and building. The following self study was conducted for Science. It highlights strengths and areas of concern across all grade levels. his self study informs an action plan to address the needs in Science.

#### **Committee Organization**

The following are the members of the Science CRP Self-Study Team:

Paul Vieira	Assistant Superintendent	Central Office
Sali Diamond	Liaison	Warren
Leigh Tripp	Teacher	Warren
Rosemary Prater	Liaison	Mindess
Dessiree Tessicini	Teacher	Mindess
Kristen Mahony	Liaison	Middle School
Mike Morro	Assistant Principal	Middle School
Dave Prior	Teacher	Middle School
Adria Bodell	Teacher	High School
Erin Lachapelle	Dean	High School
Colleen Sherman	Liaison	High School

## Timeline

This committee first met in November to establish norms and create essential questions to be asked of all teachers in the department. These questions were sent to teachers in a survey form and as part of a round table discussion. Teachers had the month of January to answer each of the survey questions and attend the round table discussions at each grade level. Teachers met in schools and wrote the self study which was submitted in early March. Throughout the first three weeks of April, principals and teachers had the opportunity to look at the self study to validate the findings. This validation process is critical to make certain that the information accurately represents the work that is being done in each building and grade level. The final product was produced and presented to the School Committee in the late Spring of 2018.

## Summary

The following table summarizes the findings from the study at each school:

<u>School</u>	<u>Concerns/Recommendations from Self Study</u>	<u>Action Items/ Measurable Outcomes</u>	<u>Timeline</u>	<u>Person(s) Responsible</u>	<u>Resources Required</u>
Warren	Warren School recommends developing a scope and sequence for each grade including how each unit aligns to the NGSS during the Summer. In 2018-2019 each teacher will be fully implementing Mystery Science in their classrooms.	Establish a Curriculum Mapping Committee. A completed document will address this.	Fall 2018 to Spring 2020	Assistant Superintendent Building Admin Liaison Teachers	Time
Warren	Teachers are seeking PD in order to effectively implement the new curriculum and standards.	Create and implement a 2 year PD plan.	Fall 2018	Assistant Superintendent Building Admin Liaison Teachers	Time Financial
Mindess	The curriculum available to staff for science instruction is not sufficient for delivery of the science standards.	Establish a Curriculum Mapping Committee. A completed document will address this.	Fall 2018 to Spring 2020	Assistant Superintendent Building Admin Liaison Teachers	Time
Mindess	The materials available to staff for science instruction are not sufficient for delivery of the science standards.	Capital Plan	Spring 2019	Building Admin	Financial
Middle	The AMS Science Department would benefit from dedicated monthly meetings to review curriculum. As the new curriculum is far more spiraled, there is the potential for repetition of	Establish a Curriculum Mapping Committee. A completed document will address this.	Fall 2018 to Spring 2020	Assistant Superintendent Building Admin Liaison Teachers	Time

	<p>activities. Meeting to view the curriculum through a 6-8 lens rather than individual grade levels will help to further develop the courses and prevent repetition of lab activities. This will also provide time to determine if the UbDs are being taught as they are written, or if they have been modified over the course of implementation. This time would also allow us to develop pre- and post-assessments for each unit that are calibrated and consistent across teams and grades. Our current department time is fractured and often dictated by the administration.</p>				
Middle	<p>As teachers are asked to write ISSPs for Math and ELA, the science department would find a similar form helpful for Science. Students take the MCAS in 8th grade, but having a plan that has been updated from year to year will allow time for remediation in Discovery prior to the start of 8th grade. The ability to reinforce concepts with students in a more timely manner would lead to higher MCAS scores and easier transitions from year to year.</p>	<p>Meet with Building Administration to address this.</p>	Fall 2018	Admin Teachers	Time
Middle	<p>Students enter the Middle School with varying science skills based on the program they were in at the Mindess School.</p>	<p>Establish a Curriculum Mapping Committee. A completed document will address this.</p>	Fall 2018 to Spring 2020	Assistant Superintendent Building Admin Liaison Teachers	Time
Middle	<p>The Science Lab Rubric is not schoolwide. The sixth grade teachers each have their own rubric, whereas the seventh and eighth grade teachers use the same rubric. Consistency, starting in sixth grade, would create a more seamless transition.</p>	<p>Establish a Curriculum Mapping Committee. A completed document will address this.</p>	Fall 2018 to Spring 2020	Assistant Superintendent Building Admin Liaison Teachers	Time
High	<p>More students would benefit from access to the academic support center to strengthen study and organizational skills.</p>	<p>Meet with Building Administration to address this.</p>	Fall 2018	Admin Teachers	Time
High	<p>Update the college prep chemistry, honors chemistry, college prep physics, and honors anatomy &amp; physiology textbooks which have pre-2000 copyrights.</p>	<p>Meet with Building Administration to address this. See where Science falls in the book replacement cycle</p>	Fall 2018	Admin Teachers	Time Financial

High	Students would benefit from direct modeling and visual identification of microscopic specimens. A teacher projection microscope for each classroom is needed to deliver this instruction.	Capital Plan	Spring 2019	Building Admin	Financial
High	Computers and probes are no longer functioning or are becoming outdated. A cyclic technology replacement plan should be implemented.	Capital Plan	Spring 2019	Building Admin	Financial
High	Equipment and supplies are aging and consumable inventory is low. A cyclic materials replacement plan should be implemented.	Capital Plan	Spring 2019	Building Admin	Financial
High	Computer spreadsheet knowledge would benefit students with data analysis. An introduction to spreadsheets in lower grades would be beneficial.	Monthly vertical meeting will address the best grade level for this to occur	Winter 2018	Teachers Admin	Time
High	The AHS Science Department has 9.4 FTE teachers supporting 42 courses. Additional staffing would be needed to increase elective opportunities.	Meet with Building Administration to address this.	Winter 2018	Admin Teachers	Time Financial

## **Warren School**

### **Introduction**

The Warren School is in its first year of implementing NGSS. The teachers were given access to the Mystery Science online program as well as an introduction to the program during their Common Planning Time (CPT). During this time teachers were given the NGSS standards, were shown a sample lesson, and had an opportunity to ask questions.

### **Philosophy**

To Provide students with hands on, engaging learning experiences while implementing the Next Generation Science Standards.

### **Curriculum Overview/Alignment**

#### **Essential Questions and Round Table Discussions**

**How are program decisions made? In isolation? Inclusively? Do all stakeholders have a voice?**

Over all, the Warren School has some confusion on how science decisions are made and who makes them. In the past, the teachers felt that it was an independent decision for classroom teachers to make or as a grade level team on what they taught and the scope and sequence in which they taught the materials. The teaching staff is excited about having a science program to guide instruction.

**Suggestions:**

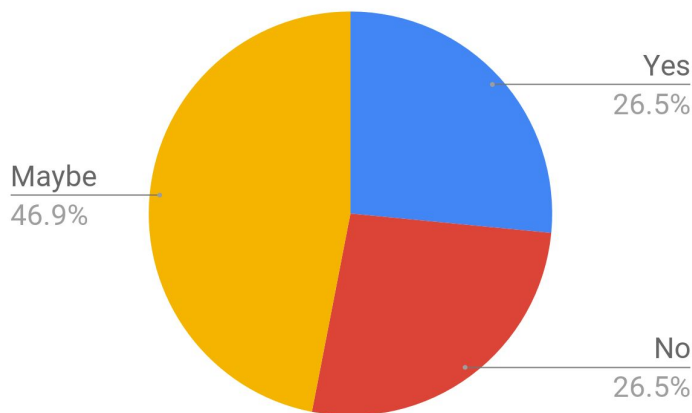
A second grade teacher was the science liaison for the 2017-2018 school year. It was suggested that a Kindergarten teacher take the role next year 2018-2019 school year and possibly a first grade teacher in the 2019-2020 school year to ensure that each grade level has a voice in the decision making for the science program. It was also suggested that curriculum work be done over the summer to supplement the Mystery Science program.

**In your opinion, what is the overall mission of the Science department?**

The Warren School overwhelming agreed that the science department mission is to enrich students exploration of physical, earth, and life science. The department also ensures that teachers are following the NGSS.

**Are your current instructional resources aligned to the NGSS(Next Generation Science Standards)?**

The Mystery Science program is aligned to the NGSS. Each teacher has tried Mystery Science but some have not fully implemented the program due to a variety of reasons including lack of comfort, training, and lack of materials needed in order to do so.



**Suggestions:** Warren School recommends developing a scope and sequence for each grade including how each unit aligns to the NGSS during the Summer. In 2018-2019 each teacher will be fully implementing Mystery Science in their classrooms.

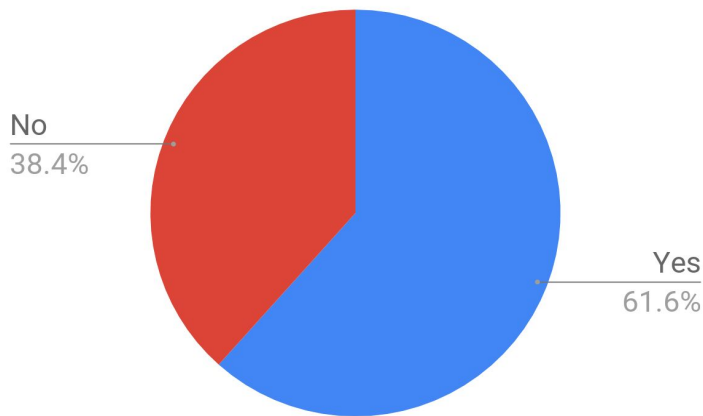
**Do your instructional resources meet the needs of our ELL and Special Education populations?**

Most teachers felt that Mystery Science was too new for them to make judgements on whether the resources meet the needs for our ELL and Special needs children. Some teachers felt that there were many ways in which to differentiate learning for this population of students, but since Mystery Science does not provide those options, teachers would need to provide differentiation on their own. Some other teachers felt as if Mystery Science was great for this population of students because it shows videos and provides hands on learning experiences for all students.

**Suggestions:**

There are many different extra activities including vocabulary cards for each lesson or Mystery. It is suggested that either during summer curriculum or during common planning time that some training is given to show how to use these extra activities to differentiate teaching in order for every student to be successful.

**Are the science courses/lessons/texts used at your grade level current and relevant and do they reflect the growing diversity of our student population?**



**Is the current format/ timing for science working for your class?**

Most teachers felt that, in spite of the allotted science time, other priorities, including core subjects, pull out services, and special activities, are taking precedence and science is not being taught daily.

**Suggestions:** When a scope and sequence is determined for each grade level it will help teachers plan ahead and give some flexibility on when the unit needs to be completed. This should help keep teachers accountable for completing units in order to ensure each student has the same experiences.

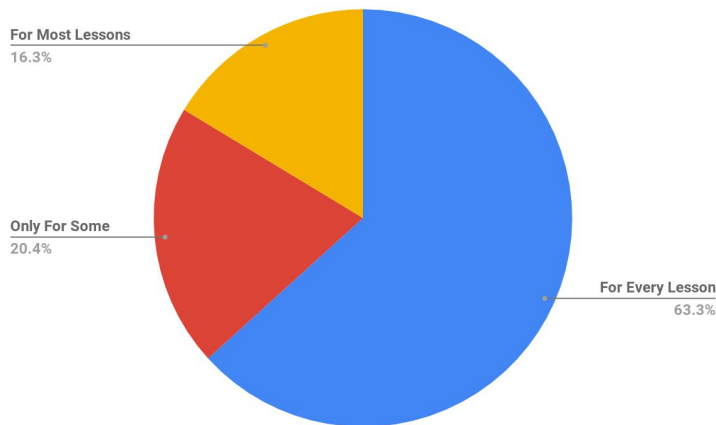
**Are the materials (programs, text and UBDs) sufficient for delivery of the curriculum?**

Although some materials were distributed to teachers, there was not a great system in place to have all materials for teachers. This was due to the fact that this year teachers were experimenting with Mystery Science and a clear scope and sequence was not yet established.

**What is your comfort with the new Next Generation Science Standards(NGSS)?**

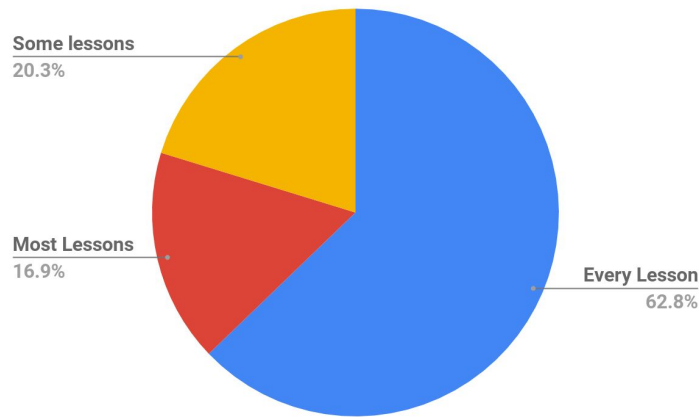
8 Teacher expressed a comfort level with the standards, 10 teachers expressed that they were not comfortable, and 7 teacher expressed they were still learning.

**How often do you need to look for more information to supplement the science you teach?**



**Suggestions:** Summer curriculum development is requested for additional work to help organize supplemental activities through Mystery Science and or create activities to supplement where needed.

**How often do you need to search for (beyond what the school has supplied) materials to teach science?**



**Suggestions:** Each grade level has determined that they would like to have all materials at the beginning of the school year. It was also suggested that the materials be stored out of their classrooms because of space constraints.

### **Assessment of Student Learning and Data Analysis**

This will be analyzed further as more time is needed to fully align the science instruction to the NGSS.(2018-2019)

### **Technology**

The teachers need technology in order to access the curriculum on Mystery Science, including access to a projector with which to project the interactive videos for the students to view.

### **Staffing Levels and Needs**

Classroom teachers will implement the program in their individual classrooms. There are no staffing needs or concerns.

### **Professional Development**

Teacher led professional development

- Distribute binders and *I can* statements (NGSS standards) for each teacher
- Demonstrate how to best utilize the program at each grade level

### **Strengths**

- 30 minutes into our daily schedule for science.
- Science Liaison position
- Common Planning time

### **Areas of Opportunity**



Our staff has begun to embrace the Mystery Science program and is becoming more familiar with the NGSS. We will continue next year (2018-2019) with a scope and sequence, materials needed, and teacher led professional development to ensure each teacher is comfortable with the program and with the NGSS.

### **Recommendations based on the Self-Study**

- **Each grade level determined a simple scope and sequence for the 2018-2019 school year**
  - Kindergarten:
    - Fall-Earth and Space Sciences(ESS) Weather Watching
    - Winter- Physical Science (PS) Force Olympics
    - Spring- Life Science (LS) Plant & Animal Secrets
  - 1st grade:
    - Fall- Physical Science (PS) Lights and Sounds
    - Winter- Life Science (LS) Plant and Animal Superpowers
    - Spring- Earth and Space Sciences(ESS) Spinning Sky
  - 2nd grade:
    - Fall- Earth and Space Sciences(ESS) Works of Water
    - Winter- Physical Science(PS) Material Magic
    - Spring- Life Science(LS) Animal Adventures and Plant Adventures
- Summer work has been requested for summer 2018
  - Develop a more in depth scope and sequence
  - Create and provide additional lessons per each unit of study
  - Print supplemental materials and masters provided from Mystery Science and create a binder for each teacher
  - Generate a list of materials by grade level that would be needed every year to implement Mystery Science
- Teacher led professional development
  - Distribute binders and I can statements (NGSS) for each teacher
  - Demonstrate how to best utilize the program at each grade level

### **Conclusion**

The Mystery Science program is aligned with the Next Generation Science Standards. However, a scope and sequence, supplemental activities, professional development, and materials are needed in order for the program to be done with fidelity throughout Warren School.

### **Mindess**

## **Introduction**

The David Mindess School is an Elementary school that houses grades Three through Five. There are multiple classroom models being used in the building. The school is separated into 21 Traditional classrooms containing a single grade and 8 Neighborhood multi age homebases. The delivery of content in the Neighborhood is based on ability groupings. The Special Education population is addressed by a special needs teacher and an assistant who push into classrooms during the required academic periods. Within the traditional classrooms there are two models being used for delivery of special education services. One model is the Dual Certified classrooms that typically contain a teacher and a certified paraprofessional. The other delivery model is push in. There are also dedicated classrooms for ELL students who are integrated with regular education students. The survey was sent to all academic teachers and 23 teachers responded: 6 Fifth grade teachers, 7 Fourth grade teachers, 5 Third grade teachers and 5 Neighborhood teachers.

## **Essential questions**

1. How are program decisions made? In isolation? Inclusively? Do all stakeholders have a voice?
2. In your opinion, what is the overall mission of the Science department?
3. Are the current instructional resources aligned to the MA Frameworks?
4. Do your instructional resources meet the needs of our ELL and Special education populations?
5. Are the science courses/lessons/texts used at your grade level current and relevant and do they reflect the growing diversity of our student population?
6. Does your grade level have a common lab form and rubric that you use to score labs?
7. To what extent is MCAS data shaping the way we deliver content?
8. What tier one and tier two interventions and supports are available at your grade level for students who struggle?
9. Have you received professional development in your current science program? Is the text that goes with the series appropriate?
10. Is the current format/timing for science working for you class?
11. Are the materials (programs, text, and UBDs) sufficient for delivery of the curriculum?
12. What science writing methods are being used?
13. What is your comfort with the new Massachusetts standards?
14. How often do you need to look for more information to supplement the science you teach?
15. How often do you need to search for (beyond what the school has supplied) materials to teach science?
16. Which units of study, if any, do you feel you need more information, supplies or guidance with?  
Grade 3, Grade 4, Grade 5

## **Round Table Discussion**

1. How do we know that the curriculum is being taught to fidelity?
2. How do teachers and buildings communicate vertically to ensure continuity?

3. What is in place to support horizontal cooperation and coordination?
4. Which Science skills are emphasized, reinforced, and practiced in other disciplines and/or subject areas at your grade level?
5. How is formative assessment being used to improve instruction?
6. How clear are the Science UBD curriculum targets for each unit, and to what extent do those targets involve the collection of data through pre-assessments and summative assessments?
7. How can we evolve our Science curriculum and instruction to meet the needs of growing ELL population?
8. How do Science classes take advantage of library resources, and how might those resources be enhanced or altered to better serve district needs?
9. How is technology currently being used to accomplish Science goals?

### **Curriculum Overview/ Alignment**

43% of the Mindess teachers feel that program decisions are made in isolation. 26% feel that a small group of people including the Administration and science teams determine programs. 17% feel that program decisions are made inclusively and another 13% are unsure.

It is perceived that the mission of the Science department for the Mindess School is focused on re-aligning the curriculum to match the Massachusetts Frameworks. They should offer curriculum, lessons, materials and guidance to the staff so that the children learn what is expected and be able to pass the MCAS. There is a small number of teachers that do not recognize that there is a science department for the Mindess School.

The instructional resources that the teachers at the Mindess currently use are a combination of teacher created lessons and STEMScopes which is an online science program that is aligned with the current Massachusetts Frameworks. Each lesson in STEMScopes has a reading attached to the lesson that can be printed off or assigned electronically. It also has teacher background information, but there is no text book per se that has colored pictures, a scope and sequence or reference section.

52% of the teachers in Mindess feel that our instructional resources are aligned with the Massachusetts Frameworks, 43% are unsure and 5% believe that the resources are not aligned.

52% of the teachers feel that our instructional materials do not meet the needs of our growing diverse population, 35% feel that some of the materials meet their needs and 13 % feel that the materials are appropriate for their classroom needs.

How do we communicate vertically? The Neighborhood program allows for vertical continuity as they have third through fifth grade for three years. The third grade teachers would like more opportunities to discuss topics vertically and to create a scope and sequence. The fourth and fifth grade teachers meet to

talk amongst their grade level but not vertically. Two years ago we had a vertical science team, but it has not met since. Last year the fifth grade teachers met with two sixth grade teachers to discuss what they would expect their students to know when they reach sixth grade.

All grade levels and Neighborhood have a common planning time (CPT). Each level has the ability to discuss science needs at this time. All levels also have CPT with Mr. Caira which would be a good time to discuss science as well. The fifth grade also mentioned the UBD that allow each teacher access to horizontal cooperation and coordination. The fifth grade also mentioned the ability to switch amongst teachers to have some teachers teach science and others to teach social studies.

Most of the teachers feel that the lessons are current to today's understandings, but 60% of the teachers say that the materials are not sufficient to service our ELL and Special Education populations. 20% feel the materials meet the classroom needs and another 20% feel that the materials sometimes meet their needs.

How can we evolve our science instruction to better meet the needs of ELL and Special Education Students? The Neighborhood feels that vocabulary should be previewed and reviewed throughout the unit and would like more visual and hands-on learning opportunities provided. The third grade needs a curriculum with tiered vocabulary. There also needs to be more in class support, especially for the non-English speaking children. The fourth grade would like to get instructional materials in Portuguese. STEMScopes has a lot of materials for ELL, but only in Spanish. They like the picture vocabulary, if there could be picture vocabulary for all languages. Additionally, the fourth and fifth grade teachers observe that, even in their native language, ELL Students may not have academic vocabulary present. The fifth grade teachers feel having the ELL teachers push in during science content would help. A color printer for vocab cards from STEMScopes would bring the vocabulary better to life. We use the materials from STEMScopes for ELL and Sped but some of the ELL material does not go low enough.

### **Assessment of Student Learning**

82% of the teachers use our current Guided Science Lab form. 18% of the teachers were not aware that there was a common lab. Currently none of the labs have a common grading rubric that is being used throughout their level.

MCAS testing in science starts in the fifth grade. 65% of the teachers do not use MCAS data to determine delivery of content. 35% use some form of the MCAS data to drive instruction whether it is to look at an area that the children may have not done well in or to address their answering of Open Response questions.

Science writing is being taught in multiple ways through guided lab reports, CER, note taking and Open Response prompts from previously released MCAS.

Teachers within the building use many different things for tiered support in science such as BCAP/DCAP, differentiated readings, STEMScopes tiered support materials, and teacher modified instructional materials. The fifth grade uses some of it's tiered support block to review curriculum from third and fourth grades. The teachers group their students based on data gathered from previously released MCAS questions. The students go through six to ten lessons on an area and then are retested.

How do we know that the curriculum is being taught to fidelity? One of the findings from this question is that the teachers are confused by what our school considers science curriculum. Is it referring to the Ma/NGSS standards, UBD units or STEMScopes? Many of the grade levels feel that currently we don't know if the curriculum is being taught to fidelity. We could insure this through the completion of the common labs.

How is formative assessment being used to improve instruction? The Neighborhood uses teacher created pre- and post-assessments to inform instruction. Projects, exit slips, check-ins, and interactive notebooks are also tools being used. The third grade use plickers, but assessments are varied and mostly teacher created. The fourth grade stated they are not there yet; they do test at the end of the unit. They do use KWL for lessons. The fifth grade uses tiered support, quiz and tests that are teacher created. They also use quick writes and KWL.

### **Data Analysis**

This year the teachers were given a scheduled time to teach each academic subject. Science and Social Studies should have 30 minutes a day, every day set aside for each subject. Some teachers have opted to teach an hour of science each day for a week and then switch to social studies the following week. Half of the teachers state that this schedule works for them. The half that says it does not work state that they do not have enough time to teach due to their tiered support block, or 30 minute split does not allow for enough time.

In the past, many of the grades worked with science that was delivered in a unit format, usually in a kit that contained all materials necessary to address the standards being taught. Our current format consists of the UBDs and STEMScopes, which are both online formats. Teachers are required to gather materials needed for experiments and to print off any reading material needed. Some teachers have purchased reading material on their own. Some teachers have expressed a wish for the kits with all supplies, others prefer a textbook that would guide them through a scope and sequence, and still others feel that what we are doing is working well.

There is a mixture of comfort levels among the teachers for teaching the new standards. Half of the teachers are comfortable with what they are teaching. The comfort level of the other half range from somewhat, low and beginning to be comfortable.

How clear are the Science UBD curriculum targets for each unit, and to what extent do those targets involve the collection of data through pre-assessments and summative assessments?

The Neighborhood continues to work on re-organizing the single-graded UBD's to match our three-year curriculum map. The teacher created pre/post assessments assess end of unit goals. Some assessments used in the third grade are from STEMscopes and some teachers use teacher created assessments for the units. Some teachers were unsure how "deep" to go with each topic. The fourth grade has looked at them, but not much. They may preview the UBD's before the unit, but they don't necessarily use them. Some teachers have printed them out and looked at them. They do use the quizzes from STEMScopes. Most of the fifth grade teachers are not using the UBD's. Three of our new teachers were not even aware that they were there to use.

Which science skills are emphasized, reinforced, and practiced in other disciplines and or subject areas at your grade level? Using informational text, data collection, graphing, observations, writing to explain, drawing conclusions, informational research, CER in math and writing, problem solving, math conversions of measurements and using algebraic expressions are all ways we incorporate science throughout our reading, language and math.

### **Technology**

How do Science classes take advantage of library resources, and how might those resources be enhanced or altered to better serve district needs? The Neighborhood feels that our school librarian is very supportive and has offered to pull texts that align with our curriculum topics. She also frequently reviews research strategies with the students. The third grade said the Ashland Public Library has great science kits you can sign out. The librarian there is great about getting materials together when requested. The fourth grade uses the library for animals and energy. They would love some read out louds to be added to our library. It would also be nice if all of the books on a subject could be put together in bins for teachers to pull. The fifth grade currently does not use materials from the library.

How is technology currently being used to accomplish Science goals? The Neighborhood uses Chromebooks for students to use for research purposes, watching informational videos, and completing online activities and STEMscopes. The third grade uses STEMscopes and many videos on BrainPop and Youtube, but feel it would be easier once we have a 1:1 device ratio. The fourth grade uses STEMScopes, BrainPop, Bill Nye, and Youtube videos. Some teachers use Kahoot as a review; they may try it as a preview as well. The fifth grade use Stemsscopes and Google Classroom, Brainpop, kahoot and UBDlinks.

### **Staffing Levels and Needs**

Currently each teacher in the David Mindess School is responsible for teaching science. Some teachers have teamed together and split the duty of teaching science and social studies. This teaming approach

allows for teachers to teach a subject they may feel more comfortable with and ease of planning. This team approach should be presented to all the teachers in the building as it seems not all teachers are aware of the possibility. Teaming also allows for an hour each day for a week, every other week, for teaching of science, which many of our experiments require, and might solve some of the time issues mentioned in the survey.

It is apparent that not many of the teachers are using the UBDs as intended, and there is confusion as to what is meant when we talk about curriculum. The school needs to determine what they will use to teach the Massachusetts Frameworks and if there can be multiple ways to address our curriculum needs. We have been using an online program for almost two years. The third grade struggles with using this as a basis for their instruction due to the age and ability of the third graders and constructive teaching without the one to one devices. Conversely when presented with a “Workbook/textbook” version of our frameworks there were many teachers of older students who were afraid that it is more of what they already have in ELA and Math and are afraid of the too structured, over simplified activities that seem contrived. The Neighborhood would also find a grade leveled workbook/textbook difficult to assimilate into their teaching. Another need to arise from this study is the materials needed for teaching. Many, if not most, of the teachers are buying the materials needed to teach this subject.

### **Professional Development**

Since the adoption of the new Massachusetts Frameworks much of the standards have changed and topics have moved grade levels. In 2016 the teachers had a brief overview of the new standards and work commenced in creating lessons that met those standards amongst the science team at the Mindess. Since that meeting there has been one professional development that happened earlier this year on how to use STEMScopes. It was a thirty to forty minute overview of what STEMScopes had to offer and how to access it. There has been no offerings of content based pd, unless a teacher specifically took a science class or went to a conference for science.

### **Strengths**

The Mindess School has 29 dedicated teachers who want to do the best they can for their students. We have much of the UBD information completed, only requiring rubrics for much of the work. We also have an online science program that addresses the current Massachusetts Frameworks that contains some tiered support. STEMScopes continues to update and add to their lessons in an effort to keep current and students engaged. We do have non-consumable science supplies such as microscopes, scales, magnets, sand tables, etc. The Mindess also has one of a kind programs such as the Science Symposium that introduces children to all the jobs that are science based, hoping to peak their interest, the Invention Convention in the third grade, and many PTO sponsored science programs.

### **Areas of Opportunity**

Most of the teachers feel the materials they are currently using for science instruction is not sufficient for delivery of the science standards. Twenty-six percent feel that our UBD's and STEMScopes are sufficient.

One third of the teachers say they search for information to teach a lesson everyday, another third state that they look for information for most of the lessons, while still another third state they only need to find supplemental information some of the time.

The majority of the teachers feel that our supplies are not sufficient for teaching the lessons. Many stated that they are purchasing the materials needed. A few expressed the wish for the kits that contain all supplies. It should be noted that of the few that stated they have the materials needed, some of these supplies came as parent donations from teacher requests.

Most of the teachers responding stated that they would like more information on all units being taught at their grade level.

We need an agreed upon and clearly stated science curriculum. That curriculum must come with the supplies needed to teach the standards. There needs to be professional development opportunities for both programming and content, as only half of the teachers feel comfortable teaching the standards they are teaching. Once curriculum has been chosen, there needs to be time given to the teachers to assimilate what is expected. We need agreed upon pre and post assessments and the ability to ensure fidelity to teaching the standards. Vertical teams need to be reinstated within the Mindess to ensure that we are moving ahead.

## **Middle School**

### **Introduction**

The AMS Science department includes grades 6-8 and STEM. There are two teams at each grade level with one Science Teacher per team. The STEM teacher is in the specials rotation and instructs all three grades. Grade Level Science teachers teach four forty-five minute classes per day along with a Discovery class. Class sizes vary from 20-30 students per class. Special Education, 504 and ELL students are heterogeneously mixed in each of the four classes. Primary support for these students is provided by the classroom teacher and an ESP in the classroom. ELL students receive additional support in the ELL classroom.

### **Perceived Mission**



To engage all learners in inquiry practices that help them to develop strong science practices, an awareness and curiosity of the world around them, and an understanding of their impact on the natural world.

### **Coordination**

The AMS Science Department meets five (5) times per year to discuss a variety of topics. All members of the department are represented in the large scale decision making process. The Curriculum Leader will at times make decisions regarding budget and ordering after consultation with the whole department. Curriculum Leaders meet K-12 once a month to discuss curriculum development. This work has primarily been focused on the elementary grades for the past few years. Transition meetings occur on average once per year with 5/6 teachers meeting in late spring and 8/9 teachers meeting in February.

The AMS Science Department benefits from dedicated monthly meetings to review curriculum. As the new curriculum is far more spiraled, there is the potential for repetition of activities. Meeting to view the curriculum through a 6-8 lens rather than individual grade levels will help to further develop the courses. This will also provide time to determine if the UbDs are being taught as they are written, or if they have been modified over the course of implementation. This time would also allow us to develop pre- and post-assessments for each unit that are calibrated and consistent across teams and grades.

### **Data Analysis and Implementation**

The department uses 8th grade MCAS to determine areas of success that we can replicate, as well as areas of concern where we can improve instruction either through different curriculum resources or pedagogy.

### **Technology**

Each team has a 30-count Chromebook cart that is generally used by the Science and Social Studies. Each of the three grades has a subscription to an online curriculum (STEMscopes for grades 6 and 7 and Mosa Mack for grade 8). Four out of six teachers use the online programs 1-2 times per week while the other two teachers use it 3-4 times per week. It should be noted that the online curriculum does allow for downloading and printing materials which teachers may not have included in their assessment.

### **Resources and Alignment to Common Core**

The curricula being used is generally strong, but each teacher/team has activities and resources from other sources that can enhance or be more successful in teaching some content. A combination of previous text activities and readings, videos (like NOVA and HHMI), worksheets and other online activities are used to supplement the online curricula. Teachers report that they are using these resources often. As the new online curriculum is rolled out, teachers are incorporating more of the units

into their day to day routine. This is the second year for 7th grade with STEMscopes and the first for 6th grade. 8th grade utilizes Mosa Mack for almost every unit.

As teachers are asked to write ISSPs for Math and ELA, the science department would find a similar form helpful for Science. Students take the MCAS in 8th grade, but having a plan that has been updated from year to year will allow time for remediation in Discovery prior to the start of 8th grade. The ability to reinforce concepts with students in a more timely manner would lead to higher MCAS scores and easier transitions from year to year.

As a department, a list of skills necessary for success in our courses was developed. Measurement (distance, mass, volume, density, SI measurements), accuracy vs. precision, observations (detailed and specific; quantify vs. qualify), using data, explaining data, graphing, general lab safety and awareness were those skill identified. Students enter the Middle School with varying science skills based on the program they were in at the Mindess School.

All science teachers in the Middle School are working with students to develop their analytical reasoning and writing skills. All grades are using the Claim, Evidence, Reasoning format with both lab analysis and on demand writing. Students will be expected to answer Open Response questions on the MCAS in this manner starting in 2018.

### **Rubrics**

There is a common Science Lab Rubric that is used among the Seventh and Eighth grade science teachers. In Eighth grade, this rubric is used each time a student writes an Analysis using CER. The Seventh and Eighth grade teachers have worked together over the past two years to evaluate, modify, and calibrate grading according to this rubric.

### **Strengths:**

- Each of the three grades has a subscription to an online curriculum (STEMscopes for grades 6 and 7 and Mosa Mack for grade 8). This allows for both fidelity to the standards and provides common learning experiences across teams.
- As a department, a list of skills necessary for success in our courses was developed. Measurement (distance, mass, volume, density, SI measurements), accuracy vs. precision, observations (detailed and specific; quantify vs. qualify), using data, explaining data, graphing, general lab safety and awareness were those skill identified. All teachers in each of the three grades will reinforce these skills.
- All science teachers in the Middle School are working with students to develop their analytical reasoning and writing skills. All grades are using the Claim, Evidence, Reasoning format with both lab analysis and on demand writing. Students will be expected to answer Open Response questions on the MCAS in this manner starting in 2018.

- There is a common Science Lab Rubric that is used among the Seventh and Eighth grade science teachers.

### **Areas of Concern:**

- The AMS Science Department would benefit from dedicated monthly meetings to review curriculum. As the new curriculum is far more spiraled, there is the potential for repetition of activities. Meeting to view the curriculum through a 6-8 lens rather than individual grade levels will help to further develop the courses and prevent repetition of lab activities. This will also provide time to determine if the UbDs are being taught as they are written, or if they have been modified over the course of implementation. This time would also allow us to develop pre- and post-assessments for each unit that are calibrated and consistent across teams and grades. Our current department time is fractured and often dictated by the administration.
- As the new online curriculum is rolled out, teachers are incorporating more of the units into their day to day routine. This is the second year for 7th grade with STEMscopes and the first for 6th grade. 8th grade utilizes Mosa Mack for almost every unit, though this is the first year. As time goes on, these programs will be more fully utilized.
- As teachers are asked to write ISSPs for Math and ELA, the science department would find a similar form helpful for Science. Students take the MCAS in 8th grade, but having a plan that has been updated from year to year will allow time for remediation in Discovery prior to the start of 8th grade. The ability to reinforce concepts with students in a more timely manner would lead to higher MCAS scores and easier transitions from year to year.
- Students enter the Middle School with varying science skills based on the program they were in at the Mindess School.
- The Science Lab Rubric not schoolwide. The sixth grade teachers each have their own rubric, whereas the seventh and eighth grade teachers use the same rubric. Consistency, starting in sixth grade, would create a more seamless transition.

## **High School**

### **Description**

The AHS Science Department includes grades 9-12. Teachers teach multiple grades and levels; the majority of the science classes contain mixed grade levels. Environmental Science, Biology, Chemistry, Physics, Anatomy and Physiology, and Engineering the Future courses are year-long and elective courses; Marine Biology and Robotics are semester based. Science lab courses meet five of the seven days of the rotation; one of the days in the cycle would be a double lab block. Class sizes are on average 20 students per class. Special education support professionals support Applications of Biology I and II and when warranted an Environmental Science and/or a Biology CPII section. Students with IEPs and

other ed plans are supported in a variety ways by the Special Education Department and the classroom teacher. All students are offered Tier 1 and Tier 2 support in Science by virtue of graphic organizers, study guides, class notes, exemplars, and out of class support. ELL interventions are provided by the SEI trained/endorsed teachers (8 of 9 department members) with support from the ELL teacher.

### **Perceived Mission**

The AHS Science Department prepares students for college and career and to understand the scientific process in the world around them. AHS uses the Massachusetts Science and Technology/Engineering Curriculum Frameworks to equip students with the ability to think critically and analyze data.

### **Coordination**

The AHS Science Department has department meetings once per month as well as monthly curriculum meetings. At these meetings the Department discusses plans, needs, and curriculum questions.

### **Data Analysis and Implementation**

AHS Science teachers use MCAS scores, Advanced Placement scores, results on common Midterms, Finals, lab assessments, and shared tests to assess student proficiency and to revise instruction and curriculum. Results from the 2017 10<sup>th</sup> grade Biology MCAS Exam report AHS Biology students scored 91% in the Advanced / Proficient category vs. 74% state average and 100% of the 2017 Advanced Placement Biology, Environmental Science and Chemistry students scored a passing grade vs. approximately 50% nationally.

### **Technology**

The AHS Science Department has four science labs that contain desktop computers at the lab stations, a shared iPad cart ( 24), an iPad cart shared with the English department (20), shared Vernier portable interface (28), shared probes and sensors that service all Science courses. Biology classes have 10 compound light microscopes per classroom. Students would benefit from direct modeling and visual identification of microscopic specimens. A teacher projection microscope for each classroom is needed to deliver this instruction.

### **Staffing Levels and Needs**

The AHS Science Department has 9.4 FTE teachers supporting 42 courses. Additional staffing would be needed to increase elective opportunities.

### **Resources and Alignment to Massachusetts Curriculum Frameworks**

Textbooks are selected to meet the demands of the Massachusetts Science and Technology/Engineering Curriculum Frameworks. All levels of biology, AP and honors physics and AP chemistry textbooks

have been recently updated. Currently, the college prep chemistry, honors chemistry, and college prep physics have pre-2000 copyrights. The honors anatomy & physiology textbook was published in 2004, but has considerable incorrect information and is too advanced for a high school course. The AHS Science Department would like to continue to expose students to current hands-on lab investigations but this is limited by budgetary constraints.

### **Curriculum and Instruction**

Each AHS Science Department course ties its curriculum to the Massachusetts Science and Technology/Engineering Curriculum Frameworks. Each science discipline is taught through investigative, inquiry-based lessons which incorporate differentiated classroom instruction, lab investigations, and research projects. Students will build upon their analysis and critical thinking skills as they progress through their science sequence and will make connections to key concepts taught throughout the science curriculum.

Environmental Science – Provides an introduction to how science is linked to students' everyday lives and their relationship with the world around them through instruction of ecology (biomagnification, transfer of energy, symbiosis), energy (fossil fuels, alternative sources, conservation), and human impact on the environment.

Biology – Addresses the study of living things on both the molecular and the organismal level. Employs the scientific method in discussion of photosynthesis, cellular respiration, cells and cell structure, genetics, and evolution.

Chemistry- Teaches critical thinking and problem solving within the following domains: atomic theory, reactivity, thermodynamics, equilibrium, kinetics, and electrochemistry.

Physics – Presents kinematics, force, energy, momentum, gravitation, electricity, magnetism, waves, and electromagnetic radiation through data analysis and problem solving.

Elective courses - Allow the students to apply the fundamental knowledge attained through the core science courses to more specific applications through electives such as Marine Biology, Anatomy and Physiology, Robotics, and Engineering the Future.

### **Strengths**

- All students are offered Tier 1 and Tier 2 support in Science by virtue of graphic organizers, study guides, class notes, exemplars, and out of class support.
- ELL interventions are provided by the SEI trained/endorsed teachers (8 of 9 department members) with support from the ELL teacher.

- The AHS Science Department prepares students for college and career and to understand the scientific process in the world around them.
- AHS uses the Massachusetts Science and Technology/Engineering Curriculum Frameworks to equip students with the ability to think critically and analyze data.
- AHS Science teachers use MCAS scores, Advanced Placement scores, results on common Midterms, Finals, lab assessments and shared tests to assess student proficiency and to revise instruction and curriculum.
- Results from the 2017 10<sup>th</sup> grade Biology MCAS Exam report AHS Biology students scored 91% in the Advanced / Proficient category vs. 74% state average and 100% of the 2017 Advanced Placement Biology, Environmental Science and Chemistry students scored a passing grade vs. approximately 50% nationally 99% of AHS students scored either Advanced (67%) or Proficient (32%) on MCAS.
- Student scores on standardized tests are a testament to a competent and motivated department that offers instruction with high fidelity to the curriculum and standards. Anecdotal feedback from graduates and parents serve to reiterate this.
- Texts and curricula taught reflect the demands of the Massachusetts Science and Technology/Engineering Curriculum Frameworks and standardized tests.
- All courses focus on critical thinking and data analysis.
- Lab investigations provide hands-on application of science concepts.
- Writing lab reports teaches comprehensive data analysis and ability to articulate findings.

### **Areas of Improvement**

- More students would benefit from access to the academic support center to strengthen study and organizational skills.
- Update the college prep chemistry, honors chemistry, college prep physics, and honors anatomy & physiology courses which have pre-2000 copyrights.
- Students would benefit from direct modeling and visual identification of microscopic specimens. A teacher projection microscope for each classroom is needed to deliver this instruction.
- Computers and probes are no longer functioning or are becoming outdated. A cyclic technology replacement plan should be implemented.
- Equipment and supplies are aging and consumable inventory is low. A cyclic materials replacement plan should be implemented.
- Computer spreadsheet knowledge would benefit students with data analysis. An introduction to spreadsheets in lower grades would be beneficial.
- The AHS Science Department has 9.4 FTE teachers supporting 42 courses. Additional staffing would be needed to increase elective opportunities.



