Appendix E

Participation Data

Arlington Public Schools
Focus Group Research with Middle School Students on
Science Education

May 29, 2013

Background

The mission of the Arlington Public Schools (APS) Science program is to inspire an enthusiasm for scientific literacy, foster an inquisitive spirit in learners through inquiry-based experiences in real-life contexts, and create a community of scientifically literate individuals who are able to make informed decisions.

A multi-faceted evaluation of the APS Science program is underway. The evaluation includes explorations of the science program ranging from classroom observations and teacher surveys to reports on APS participation in statewide science competitions to focus groups with APS students. This report summarizes the qualitative research findings from a set of two focus groups conducted with middle school students in April and May 2013. These findings will be most meaningful when considered together with findings from other facets of the overall Science program evaluation.

Research Purpose

The overarching goals of the focus groups were to:

- Learn about students' decision-making process when choosing courses, particularly science courses.
- Understand students' thoughts regarding science fair and its role in their course selections.
- Explore students' levels of enthusiasm for science and participation beyond the classroom.

Research Method

Two 60-minute focus groups were conducted by an independent researcher, not employed by APS. The discussions were held at two APS middle schools. Eighth-grade students were selected randomly to be invited to participate. In all 15, students participated. Nine were girls and 6 were boys.

The discussion guide is attached as Appendix B. The questions were developed in collaboration with the Office of Planning and Evaluation and the Science Office. In brief, the discussion guide explored:

- **General decision-making about courses** (e.g., priorities in making choices, who students talk to for advice).
- **Decision-making about science courses in particular** (e.g., how students find out what courses are offered, factors they consider in opting for more or less challenging coursework).

- **Experiences and opinions related to science fair**, including the degree to which it is a factor in choosing science classes.
- **Enthusiasm for science and science beyond the classroom** (e.g., scientific hobbies, careers)**.**

In interpreting the findings presented in this report, it is important to note that focus group discussions are a qualitative research method. While the discussions produce rich, detailed information about the perspectives of those interviewed and opportunities to further explore relevant new perspectives, focus group findings are descriptive in nature and cannot be generalized due to sampling approaches and small sample sizes.

Findings

General Decision-Making about Courses

Priorities

The eighth-graders emphasize that they have had little opportunity to choose classes thus far in their academic careers. They acknowledged that teachers have much say in the classes they take in 9th grade, although all of the students were very aware that they could request a different class than what was recommended for them.

> *The teachers recommend you for classes, so they just put you in those. But, you can change it if you want, so you can request a more advanced or less advanced class. And, then, you can pick your electives.*
>
> *You have a take a specific class—like Biology for science or World History for social studies. But, what they do is they recommend you for the level, intensified or whatever.*
>
> *A lot of the classes, you have to take. Or, your teachers recommend them for you. So, next year, we have really only one class we can choose. Everyone's like, "You have to do a language," even though you don't really **have** to. So then you really only get to choose one class.*
>
> *Even if they don't recommend you, you can still do what you want [either regular or intensified] biology.*

Tips and suggestions students had heard about selecting classes included:

- Taking PE in 9th and 10th grade to get it over with.
- Taking college-level courses "so that you can show colleges that you can do the work, but pick them only if you're ready."
- Taking intensified biology because of the perception that students in regular biology do not do as much hands-on activity.
- Avoiding intensified classes freshman year while getting used to high school.

Consulting Others

These students said that they consult counselors, teachers, parents, and students older than they are. In related focus groups, high school students emphasized counselors' importance. But, eighth-graders emphasized parents and teachers to a greater degree than counselors. For example, several said they talked to their teachers because the teachers are well-positioned to evaluate them and recommend what classes to take.

> *In science class, our teacher gave us index cards and said, "Write what science class you think you should take next year. If I think that is right for you, I will recommend you. And, if I don't agree with you, then I will talk to you later about it."*

Decision-Making about Science Courses

Many students saw 10th grade as the first year they "get to choose" their science class. Indeed, most of the focus group participants were well-aware of their 9th grade choices, having recently made next year's schedule, but were less conversant about choices beyond that. Although their knowledge of upcoming science options was not deeply explored, they most clearly anticipated having more choices as they advanced through 10th, 11th, and 12th grades. A few with older siblings or who had read the course catalogue closely, however, talked at length about the pros and cons of taking Earth and Space (e.g., "The catalogue says unverified credit.") and the common progression from biology to chemistry to physics.

When asked the differences among "regular," "intensified," and "AP," about half said they did not know. In fact, a couple students said that if they understood intensified better, they might be more open to it. Interestingly, both "intensified" and "regular" classes had negatives associated with them. Intensified classes were perceived as "harder" and regular classes were seen by a few students as a cop-out or as the path that unmotivated students take.

> *I don't know the difference between intensified and AP. But, between regular and intensified, I'm guessing intensified is more advanced, maybe more knowledge.*
>
> *[My understanding is] in intensified, you move quicker.*
>
> *Intensified you still get the same credit. But, then for AP sometimes you get extra recognition from colleges.*
>
> *In AP you do more written work, more essays. Intensified is more hands-on than regular. My sister is taking AP of one subject…she says it's too much writing, essays for homework. And, the intensified class she's taking it's more hands-on and fun. They still cover the same content but AP covers it faster.*
>
> ***Participant 1:*** *My brother said that a lot of the really, really bad students wind up taking regular classes so the classes are so slow-paced and you're getting dragged down by all the bad students. But, if you're taking only intensified classes, you're only going to be with all the good students.*
> ***Participant 2:*** *[Agreeing] Intensified is the new regular. It's not like you're doing anything extra special. It's kind of like you're taking regular. It's like math now. I think there are only like 3 or 4 classes of Math 8 [at the middle school].*

Participant 3: *Like the regular norm is to be put in algebra. I was in [unintelligible], but I failed out so now I'm in Math 8. But, it's weird, you feel bad, when in fact it's normal. It's regular math for your grade. Math 8. You're in 8th grade, take 8th grade math.*

The questions students had about high school science included the following:

- What are colleges looking for—both for admission and for particular majors?
- What is the most hands-on class?
- In what class do I not have to sit at a desk?
- What does each class cover (e.g., "Environmental science, what does that cover?")
- Should science be one of our main priorities in school?
- Is the class more math-based?
- Who are the best teachers?
- What is the easiest? What is the most challenging?

The question "should science be a priority" was explored further. Students with scientific interests—those who said they liked the subject or wanted scientific careers—seemed to think it should be a priority. However, just as many prioritized other academic areas such as writing or mathematics. When students were pressed about whether all subjects are important, most agreed that most subjects are important although a couple singled out social studies as something that science could be prioritized over.

For me, I like science. And, a lot of careers are in science. There are a lot of careers you can do by getting a basic science major.

Participant 1: It is like the "main" subject.

Participant 2: I agree. I specifically want to be a marine biologist or a vet. So, definitely. And, I also enjoy it.

[Science is important] but other things, like writing, you have to be really good at that in almost every job you come across. I think English would be a priority.

…maybe social studies [is not as important as science], unless you want to be like a curator or something.

Science Fair

Science Fair and Choosing Courses

Nearly all of the students in these focus groups said that they would not reject a class because it requires science fair. Most regard science fair as somewhat unpleasant—the paperwork and writing parts, specifically. Yet, it is perceived by them as manageable enough that they would not make a major decision like changing their course schedule to avoid it.

[On the topic of possibly rejecting a class solely because of science fair] It depends on the class. If the one without the science fair, you like it, but you like the one with the science fair ***more****, you're going to take the one with the science fair. It's like, "If I think I'll enjoy that class more, I'll just put up with the science fair."*

Participant 1: *That already happened. Our teacher told us Biology doesn't have to do the science fair but Biology Intensified does.*
Participant 2: *Science fair is kind of like a big pain in the butt, but you get it over with and you just do it.*
Participant 3: *Doing the actual experiment is fun.*

I feel like it's a long line of things [that factor into class choices], like what colleges look for, not just science fair.

A couple of my friends in 6th grade were like, "Really, I hate it. Oh why do we have this science project for the class grade? It's kind of dumb." But, for me, I don't really care.

I didn't take Biology Intensified because I'm not really good at science and I have no idea what it's going to be like. Maybe it won't be too bad. But, I don't want to take a chance of being in a class where I have no idea what's going on. So, that's why I stuck with regular Biology and we'll see how that goes. It has nothing to do with science fair.

Some 8th graders did express general worry about high school course load, which may influence their decisions about taking intensified courses in general. They were keenly aware of the coming change and used words like "transitioning."

It's a jump from middle school to high school. You've got this idea that high school is like this really big thing and you're gonna be cramming and not getting any sleep. So, throwing intensified stuff in that just seems like it's going to be a lot more, when it reality when we get there we may see that it's not like that. Perhaps in high school people may realize, "Hey, not too bad. Let's go for intensified." But, making that jump from 8th to 9th grade, it's a little bit of nervousness about what to expect. So, that's probably a big part of it. Plus the fact that science has a lot of stuff you need to learn and a lot of terms and a lot molecular stuff that I don't understand it. So, to think of intensified stuff when I'm like, "I don't understand regular stuff."

Calling it intensified makes it seem harder. Everybody already realizes that science is pretty hard in 8th grade. So, it's like, "Regular science next year is going to be harder. And, intensified science is gonna be even harder than that." And, it just seems like taking five steps [in difficulty level], when in reality it might not be that hard.

Participant: *It seems like a lot, throwing it all at us.*
Moderator: *In the context of all the classes you mean?*
Participant: *Yes.*

<u>The "Word" on Science Fair</u>

The general theme throughout the groups was that science fair is a hassle, but can be rendered manageable. Still, most students avoid it if they can reasonably do so. For example, several said that in 7th and 8th grade when science fair was not required, they would either not do it or do it solely to get extra credit. Even several of those who began science fair for extra credit lost motivation after the first step or two and never completed the project. Also, a few students said that the additional work impinges on other activities and social life.

You just have to do what you have to do.

I just want to get extra credit and stuff.

Middle school students tend to be extremely lazy, so the thought of having to do extra work that will eat into their social life is kind of a negative.

Students said that they found science fair stressful. But, several of them became very animated when they talked about their experiments. For example, one had a project involving oil and water, another boiled water using a solar oven. Generally speaking, these middle schoolers said that when it comes to science fair, a small percentage of students are extremely interested, motivated, and complete impressive projects. They said the majority of kids range, instead, from being mildly interested to mildly disinterested.

Science fair is a big deal. It's stressful. You have to work like three months.

It's a lot of extra homework.—8th grade

[To overcome the downsides of science fair] choose something you're interested in…like I'm interested in biology. Choose something like that and it will be easier.

A lot of people care about the science fair and they try really, really hard and stuff like that. But, I mean you can do a really, really simple science fair project that won't take that long and still get an A on it. Like the paper towel test or whatever and you can do fine on the science fair.—8th grade

My partner and I built this catapult thing and we launched wooden balls. It was really fun.

[Laughing] you could build a potato clock.

Like 20 to 30 percent of 7th and 8th graders participate. [6th graders are required to.] In 8th grade a lot of the really smart kids are the ones who do it. And also the worst students do it just so they can get extra credit.

<u>Improving Science Fair</u>

Students said that teachers help make science fair much more pleasant when they provide guidance. Among the negatives for science fair were the length of time it takes to complete and the fact that it requires much writing. Some participants said that a presentation by a Virginia Junior Academy of Science (VJAS) winner and a video on the topic was slightly demotivating because the projects were so far beyond the scope of what the students could see themselves doing for science fair.

Getting a format for it [science fair writing] helps because I don't know how to write that. But, since I had a rubric and a sample one and [their teacher's] help, it was easier.

The teachers stayed on the weekends to help us if we needed to do an experiment.

They let you use their materials if you don't have any, like I needed a graduated cylinder to measure water [and did not have to buy one].

Sometimes Ms. [Name], she lets you borrow some of her equipment and stuff and lets you do it after school.

The kids who started it, she [teacher] would push them a lot more, like give them little reminders and encouragement.

*Ms. [Name] gave you like a **hundred** points of extra credit if you do the science fair, which is a pretty good motivation.*

They help you choose a topic that you're interested in.

There is a lot of writing. I'm just like "Ugh."

Enthusiasm for Science

As students introduced themselves, they were asked to mention something that was especially memorable to them about any science class they had taken thus far. They mentioned:

- Helpful teachers
- Bringing in a pet lizard for science fair project
- Science fair projects because you spend so much time on them
- MOUSE projects
- Helium balloon experiments
- In-class demonstrations
- Outdoor activities
- Going to a creek, outdoor labs
- Dissecting a mushroom
- Making goo
- Making plastic water bottle rockets
- Extracting DNA from strawberries
- A genetics exercise in which students identified the traits prospective children would have
- Growing "quick plants"
- The "water cycle boogie" song
- The "rock" song
- Making rain forest animals (many still have the animal they made)

<u>Getting Excited about Science</u>

Students clearly valued hands-on learning such as labs and outdoor activities.

I feel like kids learn better if they're enjoying it.

I agree, the labs are the most important part.

I bet in 9th grade it will be really interesting because we're still transitioning and we'll be like, "Oh my gosh, we're doing so many more labs and this is so fun" and then at the end of the year we'll be like, "[Sigh] this is sooo much work."

That's part of why I'll take Chemistry instead of Earth and Space. With chemistry it just seems like I'll be doing a lot of experiments and oooh that's fun instead of just sitting and learning lots of facts.

Students' Descriptions Comparing Science Throughout School

Elementary	Middle
• Basic • Did not go into detail (e.g., "one day we made ice cream and I still don't know why we did that") • Demonstrations (teacher does everything) • Graham crackers and Nutella (tectonic plate exercise) • An experiment with mice • Lifecycle (e.g., tadpoles→frogs) • Making a roller coaster out of paper • Singing	• Students get to do experiments after teacher demonstrates • Cooler (in elementary school, teacher demonstrates and tells answer; in middle school, teacher makes you think and find answer) • Labs • More experiments • More detailed • More complicated • More chemistry • More math • Bill Nye the Science Guy

Roughly equal proportions of these students felt their interest in science has grown and felt it has waned. Those who were more interested felt that they were getting exposure to more detail and additional information as middle schoolers than they had in elementary school. Those for whom interest waned found the added expectations burdensome.

> *I think my interest has grown. I don't get bored in the class. I think it's neat most of the time.*
>
> *It's grown because I think about different careers.*
>
> *In elementary school you get baseline learning and in middle school it expands. And, then it expands more in high school. Like in elementary school and middle school you get a little bit of biology and then in 9th grade you get a whole class on biology.*
>
> *My interest in science depends entirely on the unit. [So, interest goes up and down within the year, but not across years.]*
>
> *My interest in science has decreased. It used to be really fun. I used to really, really like science. But, now we have to learn way more, like formulas.*
>
> ***Participant 1:*** *You just have to learn so much more stuff. You're like, "All the world and all this stuff" in middle school and all of a sudden the content gets a little more confusing and you're just like "I don't want to deal."*
>
> ***Participant 2:*** *[Agreeing] When you have like 5 other classes that are all putting a lot of stuff on you, then your interests drop a lot.*
>
> ***Participant 3:*** *[Agreeing] Yes, I used to* ***like*** *math.*

In addition, several students believed that people's interests would develop further at the high school level and people with a personal interest in science would take higher level classes while

other students would take higher level classes in other topics. A small number of students thought that enthusiasm for school is simply higher at the elementary school level generally.

> *The only reason I'm taking an intensified class in 9th grade is because I actually like [the subject], English. And, it just looks better on your diploma and everything.*
>
> *I guess [enthusiasm for learning in general] is the most in elementary school because whenever my little sister learns something new, she comes running up to me [to tell me]. And, I'm like, "I know that. And, that too]."*

Science Beyond the Classroom

Students in these two focus groups were hard-pressed to think of activities they do beyond the classroom that involve science. One thought of his sister who "goes around the neighborhood collecting rocks and breaking them open," another said she goes scuba diving, another thought of cooking which is a hobby she enjoys (saying she wants to be a "molecular gastronomist").

Many saw appeal in scientific careers—seeing the job opportunities and money available in such careers as a major benefit of them. For example, one student wanted to follow in his uncles' footsteps as an anesthesiologist. However, they recognized that it would "take a lot of education" to achieve in a scientific career.

> *I want to do anything but work behind a desk.*
>
> *I want to work outside. Work out in the world.*
>
> *I want to be a Mythbuster.*

Conclusions

- **A strong theme within these two groups was that students are preparing mentally for the switch to high school and are making course choices, in part, based on the coming transition.** In other words, they recognize that intensified and AP courses are important for college applications and many want challenging classes, but they are also worried about overloading themselves as they get used to high school.

- **These students mentioned teachers and parents as resources in choosing classes to a greater degree than they mentioned counselors.**

- **Many students saw 10th grade as the first year they "get to choose" their science class.** They had a strong, general sense that they would get more choice as they advanced through high school. Yet, their knowledge of what those choices would be was not detailed.

- **When they were asked the differences among "regular," "intensified," and "AP," about half said they did not know.** In fact, a couple students said that if they understood intensified better, they might be more open to it. Interestingly, both "intensified" and "regular" classes had negatives associated with them. Intensified classes were perceived as

"harder" and regular classes were seen by a few students as the path that unmotivated students take.

- **Students were asked what questions they would pose to a hypothetical expert on APS high school science. One question they posed, "should science be a priority?," was explored further.** Students with scientific interests—those who said they liked the subject or wanted scientific careers—seemed to think it should be a priority. However, just as many prioritized other academic areas such as writing or mathematics.

- **Nearly all of the students in these focus groups said that they would not reject a class because it requires science fair.** For certain, most regard science fair as generally unpleasant—particularly, the paperwork and writing required. Yet, it is perceived by them as manageable enough that they would not make a major decision like changing their course schedule to avoid it.

- **There were two nuances to their views. First, although they said science fair is unpleasant, many became animated when talking about past projects. Second, although they said science fair can be rendered manageable, many admitted to taking the initial steps for science fair (e.g., to gain extra credit), but then dropping the project because as the work increased their motivation to get the extra credit decreased.** Among the negatives for science fair were the length of time it takes to complete and the fact that it requires much writing.

- **Students said that teachers help make science fair much more pleasant when they provide guidance.** When students were asked what would make science fair better, this answer was the only strong theme. They liked having models, step-by-step instruction, after-class and in-class time, access to advice, and access to supplies and workspace.

- **There was no pattern among these students as to whether their interest in science has grown or waned since elementary school.** Roughly equal proportions felt their interest in science grew and felt it decreased. Those who were more interested credited increased exposure to more detail and additional information as middle schoolers than they had in elementary school. Those for whom interest waned found the added exposure and associated work and expectations to be burdensome.

- **Students in these two focus groups were hard-pressed to think of activities they do beyond the classroom that involve science. However, they expressed enthusiasm around some of the benefits of potential scientific careers**—such as working away from a desk and having good job opportunities and earning potential.

APPENDIX A – DISCUSSION GUIDE ARLINGTON PUBLIC SCHOOLS (APS)
Focus Group Research with Middle School Students
Regarding Science Education

April-May 2013

Discussion time: 1 hour

1. WELCOME, INTRODUCTIONS, PROCEDURES (10 minutes)

- First, **thank you** so much for your time and help.
- **Introduce** self (name, independent researcher not employed by APS).
- **Purpose** today is to talk about your experiences and thoughts related to science courses. Each year, APS evaluates different aspects of education to see how to serve students best. This year, one focus is science education.
- **Open, honest opinions**—both positive and negative—are most important of all. [Moderator will work through this a bit, and involve the group in: 1) agreeing everyone has different experiences/opinions and 2) buying into shared goal of being comfortable with their own view and everyone else's.]
- Our hour together may even surprise you—it will be enjoyable. I have some questions you might not have ever thought about.
- I would like to **audiotape**, to help with my report. But, all answers are **confidential**. I will keep the tape. My report will not use any names, rather it will describe what "participants" said, and talk about the group as a whole. Is taping ok with you?
- **Some basics** to help make sure that I still learn all I need to from you.
  - You are here because you have experience deciding which classes to take. My job is to ask questions, and your job is to make yourself heard (no silent participants).
  - Talk one at a time, loudly enough for tape to pick up.
  - No side conversations, put opinions on the table for all of us to hear.
  - Many questions to get through. So, I apologize in advance if I give you that feeling like I'm "moving us along."
- **Participant introductions**
  - In a moment we'll do introductions, starting with [NAME] and going around the table. Tell us your **first name**, what **grade** you're in, and something memorable about **science classes you've taken** so far in middle school.

2. DECISIONMAKING ABOUT COURSES IN GENERAL (5 minutes)

Let's think big picture first. I'm wondering how you choose your classes in general—walk me though what you think about.

a. What are your priorities?
b. Who, if anyone, do you talk to about which classes to take?
    - Are there any really good pieces of advice or tips you've gotten? Share.
    - Looking ahead to high school, any tips you've gotten so far?

3. DECISIONMAKING ABOUT SCIENCE COURSES (20 minutes)

Still looking ahead to high school, what, if anything do you know about what science classes you can take in high school?

a. If we had an expert here who could tell you all about high school science what questions should we ask? [Easel list.]
b. When you think about what high school science classes might be like, is there anything you're hoping for?
    - [If needed] hoping against?
c. Who, if anyone, do you see yourself talking to about which science classes to take in high school?
    - What input have others given so far?
    - Has anyone given you advice *not* to take a particular science class? If so, tell me about that.
d. Think back on science in elementary school and middle school. Let's make a few notes on each so you're really remembering. [Easel list, what comes to mind for each—topics studied, events, tests, etc.].
    - Looking at our list, is there anything that you recall especially enjoying? And, the flip side—not enjoying? And why?
    - Think about yourself. Would you say your interest in learning scientific topics has gotten greater, less, or stayed the same? [Discuss changes or status quo and why.]
    - Do you remember any particular year when science class was especially great? What made it so? Any points you were less interested? What made it so?
    - Looking ahead, any prediction about how your interest level will be in high school?

4. SCIENCE FAIR (15 minutes)

I'd like to hear a little more on science fair, which was/was not mentioned.

a. When you start choosing more of your classes, do you think science fair will factor into your decision? If so, how so?
    - I'm going to ask you to look at two sides—first, if you were to encourage a friend that science fair should *not* be a factor in choosing science classes what would you say? And, the reverse, that it *should* be a factor?
b. How would you describe what "the word on science fair" is at your school?
    - How much participation is there?
    - And, in your view, why so much/so little?
c. And, what is doing a science fair project like for you?
    - How do teachers make it easier or get you "into it" more?
    - Anything you've seen teachers do that is a turn *off* in terms of science fair for you?

5. SCIENCE BEYOND THE CLASSROOM (5 minutes)

a. Do any of your activities outside school involve science? [Why/why not.]
b. Do you see yourself in a scientific career? [Why/why not.]

6. CLOSING (5 minutes)

Our time is nearly up. Are there any final thoughts you would like to share?

Thank you so much for your time and all your help.

Arlington Public Schools
Focus Group Research with High School Students on
Science Education

May 29, 2013

Background

The mission of the Arlington Public Schools (APS) Science program is to inspire an enthusiasm for scientific literacy, foster an inquisitive spirit in learners through inquiry-based experiences in real-life contexts, and create a community of scientifically literate individuals who are able to make informed decisions.

A multi-faceted evaluation of the APS Science program is underway. The evaluation includes explorations of the science program ranging from classroom observations and teacher surveys to reports on APS participation in statewide science competitions to focus groups with APS students. This report summarizes the qualitative research findings from a set of four focus groups conducted with high school students in April 2013. These findings will be most meaningful when considered together with findings from other facets of the overall Science program evaluation.

Research Purpose

The overarching goals of the focus groups were to:

- Learn about students' decision-making process when choosing courses, particularly science courses.
- Understand students' thoughts regarding science fair and its role in their course selections.
- Explore students' levels of enthusiasm for science and participation beyond the classroom.

Research Method

Four 60-minute focus group discussions were conducted by an independent researcher, not employed by APS. The discussions were held at two APS high schools. Students were selected randomly to be invited to participate—although the selection process was designed to ensure that students taking various different levels of science courses (i.e., "regular," "intensified," and Advanced Placement (AP) courses) were included in the research.

In all, 13 students participated. Groups were stratified so that 9th and 10th graders met together, and 11th and 12th graders met together. Among the participants were 3 freshmen, 3 sophomores, 5 juniors, and 2 seniors. Six were girls and 7 were boys. A summary of students' grade-level and the high school science courses they have taken thus far is shown in Appendix A.

The discussion guide is attached as Appendix B. The questions were developed in collaboration with the Office of Planning and Evaluation and the Science Office. In brief, the discussion guide explored:

- **General decision-making about courses** (e.g., priorities in making choices, who students talk to for advice).
- **Decision-making about science courses in particular** (e.g., how students find out what courses are offered, factors they consider in opting for more or less challenging coursework).
- **Experiences and opinions related to science fair**, including the degree to which it is a factor in choosing science classes.
- **Enthusiasm for science and science beyond the classroom** (e.g., scientific careers)**.**

In interpreting the findings presented in this report, it is important to note that focus group discussions are a qualitative research method. While the discussions produce rich, detailed information about the perspectives of those interviewed and opportunities to further explore relevant new perspectives, focus group findings are descriptive in nature and cannot be generalized due to sampling approaches and small sample sizes.

Findings

General Decision-Making about Courses

Priorities

Students said their first step in choosing courses is to look at the school system's overall requirements. As one senior put it, "I went through all the stuff" to see what the course choices were and how they could fit together for that year and in the four-year picture. Their choices also factor in the logistics of arranging a workable schedule as well as advice from counselors, teachers, parents, and friends about which classes to take. Most said they consider how their transcripts will look to colleges as well.

> *Basically, you talk to a counselor and make a plan for you.*—Senior
>
> *I just take the most challenging class that's offered. I didn't take the most challenging classes freshman and sophomore years and so junior year, I decided to step it up.*—Senior
>
> *I think about what the appeal to colleges will be.*—Senior

Most students perceived greater value in intensified and AP classes in general, even those not taking higher-level classes. Many described AP courses as being "college-level" courses and intensified courses as being "harder high school level." Most believe that colleges and universities "like to see" higher-level courses such as AP and intensified courses on applicants' transcripts and are motivated, in part, by the goal of being accepted by the schools of their choosing. A few said that they opted for higher level classes because "regular classes" were too

easy or they had other slightly negative perceptions of regular classes. The motivating factors for taking courses such as Earth and Space and Astronomy focused on personal interest and "fun." A couple students were dissuaded from taking a class like Earth and Space or Astronomy because they felt "you don't *need* that class" in order to take future classes or perceived the class to be "going nowhere" because it is not a stepping stone to a future AP option.

> *I was taking AP Spanish, AP English, AP calculus and basically I saw it as…if I wouldn't take AP science my transcript wouldn't look as good [to colleges], it would look funny.*—Senior
>
> *I always just go for the most intensified, hardest courses.*—Junior
>
> *I go for intensified if regular seems too easy. An "A" in a regular class is not the same as an "A" in intensified.*—Freshman
>
> *I was pretty much used to it [challenging classes] so I thought, "Why should I go for regular?"*—Freshman
>
> *When I'm picking classes, if I'm in a regular class and I think it's too easy, then I go for the intensified class [the next year].*—Sophomore
>
> *Regular classes are for people who really don't care that much. I've heard they're almost too easy.*—Junior
>
> *I base it off of my friends who are older than me. That's why I took Earth and Space this year. I heard it was a good class…[My friends said] Chemistry is boring. The teachers are not that good. Earth and Space is a fun class.*—Sophomore

Most of the students—in both lower and upper grades—were also generally aware of the topical progression from biology to chemistry to physics. Several said that they simply followed the prescribed map in choosing first biology, then chemistry, then physics courses.

> *For me, it was just following the progression. Everybody takes bio, then chemistry, then physics. It's the general course that most people follow.*—Junior
>
> *A lot of choosing the [science] topic is just prescribed.*—Junior
>
> *You have to take some of them. For example, as a freshman, I think you have to take biology.*—Junior

It was less common for students to talk about choosing subjects they thought they would enjoy. Yet, a few mentioned this factor. For example, one senior who took all very high-level courses said to "choose what you like" and one junior chose regular physics over "Earth and Space, or something like that, or astronomy" because she thought physics would be more "useful in life because everything is physics."

Consulting Others

Counselors play a critical role. Students talk to their parents about their decisions, but counselors were always mentioned before parents and more often than parents. Teachers were also mentioned, but to a lesser degree than counselors and parents.

> *The counselor gives you a schedule for like two to three years…then, you can take one home with your parents and check on what you like.* –Freshman

Students also get advice from one another, and older siblings—most of which focuses on particular teachers to seek or avoid. There is some talk among students about whether one's overall course load is too great or about trying to be in classes together. Similarly, a couple students said their parents monitored class choices and dissuaded them from taking too great a course load.

> *I base [class choices] off of my sister because she is a junior here.*—Freshman

> *Most of it [advice from peers] is like "the class work is hard," or about this teacher that teacher. But, there is very little said to deter you if it's what you want.*—Junior

> *My parents set an "AP limit." I am taking three AP courses next year and they said that was enough.*—Junior

> *My parents are very into my academics. [Student is taking AP Biology and regular physics. The purpose of the physics course is to develop basic knowledge for future college physics.] For physics, I wanted to take intensified but they convinced me it was a bad idea…I want to get the good grade, and the class is just for an introductory purpose.*—Senior

Decision-Making about Science Courses

As with general course mapping, counselors and the course catalogue are clearly students' key resources for knowing what science classes are available. Grappling with the questions of regular versus intensified versus AP seemed not to begin in earnest until students choose courses in 10th grade. Generally speaking, more students felt "pushed" or encouraged by counselors and teachers to take higher level classes than felt held back from taking higher level classes. Ninth grade choices were strongly related to teachers' recommendation, although it was widely known among students that one *could* take a class other than what their 8th grade science teacher recommended.

> *When I first moved here, they sent us a catalogue—like [name] mentioned.*—Senior

> *Our counselors kind of made us map out what we would do, even if it was going to change.*—Junior

> *In 8th grade you get a sheet and your counselor comes in and you pick the classes that will most likely fit you. It's mostly the teacher's decision. They recommend you [for Biology Intensified] or not.*—Sophomore

> *I just go with what the teacher says [in deciding whether to take 9th grade Biology Intensified].*—Freshman

Especially sophomore year, you kind of start to look into colleges and think about what they want. I feel like that's the main influence that me and most students have, everywhere. So, in my junior year, I stepped it up. I thought I wouldn't take any AP science and I wound up taking two.—Senior

Students were asked to sum up the factors that go into each choice—that is, topic choices (e.g., whether to take chemistry or physics) and course-level choices (i.e., regular, intensified, or AP). The answers they supplied in a group exercise are shown below. Topic choices were said to be guided mostly by the normal progression from biology to chemistry to physics and/or by one's interest level in a topic (e.g., choosing AP Biology in 12th grade over AP Chemistry because you prefer biology as a subject). Decisions about class intensity levels were guided mostly by making transcripts look good for college applications, logistical scheduling matters, personal drive for challenging work, and one's interest level in a topic. The factors described in the summary exercise were repeated in other ways throughout the discussion as important.

Factors in Decision-Making about Class Topics

- Linear progression (biology →chemistry→physics).
- Passion for the topic, your preferences (e.g., "In 8th grade, you cover it all and that helps you to know what you like").
- Your interests, plans for your college major, plans for a future career.

Factors in Decision-Making about Class Levels

- Colleges' view of your transcript, college applications.
- Time/space issues in one's schedule. For AP classes, in particular—finding time among many priority classes for two-period AP classes (e.g., one student had to choose between orchestra and AP Chemistry. He felt he was not as talented as others in orchestra, which made his choice a bit easier.).
- Personal drive.
- Your own passion for the topic (whether you are interested enough to warrant taking a higher level course), "boring factor"/interests (whether or not the class interests you).
- Teachers' recommendation (specifically, Biology versus Biology Intensified).
- Opting out of classes that are not stepping stones to other classes in order to avoid limiting your options later.
- Doing (or not) what the majority does.
- Making sure course load is manageable enough to perform well.
- Rejecting a class as possibly too easy.

What it'll look like on your college application is definitely one of the biggest things for me.—Junior

One of the biggest limiting factors for me is just how much time I have. The AP sciences are two periods long and I just don't have room for one of them. I've got a language and an art and another elective so there just really isn't room…[in addition] some of the electives are sequential [so, if one is skipped to allow space for science] it is a missed opportunity as well.—Junior

I know in my senior year, I'll take an AP science class and I really like biology so hopefully next year I'll take AP Bio. But, I just didn't think I would have that much time this year—two periods—so, I just took intensified physics.—Junior

I've always been oriented toward math and science. I know I'll be going into that in college. I know that's where my skills are.—Senior

Because I took so many AP classes junior year, I had to step it up this year [for college applications]. I basically had no choice. So, I took everything AP.—Senior

Everyone wants to take really intense classes so they'll look good for college applications. But, if you do badly on all of them, it can end up looking worse for you.—Junior

I'm not that good at science. I took regular. I knew it if I took AP or whatever, I'd just be all confused.—Junior

Very few students had been specifically dissuaded by another person from taking a specific class. In the instances in which that had occurred, most dissuaders were other students with issues centered around dislike of a particular teacher or how "hard" the class was.

Science Fair

Science Fair and Choosing Courses

For most of the students in this very small sample, science fair does not factor into their course decision-making. Students said that the workload of the intensified and AP classes is the greatest factor for students who opt to avoid those classes. They also said they did not think others were basing their class decisions on avoiding science fair.

[Avoiding science fair] did not push me to AP. It's just an added bonus [not to have to do it].—Senior

Science fair is not keeping people out of intensified courses. Again, it's a teacher-by-teacher basis on whether they make you do it or not. So, it's not really a factor.—Senior

At the upper levels, science fair is required. I don't really consider science fair a deal-breaker or anything. It's just sort of "there."—Junior

Personally, I don't think it's a factor. [Although I see] there's more people complaining about science fair than getting excited about it.—Senior

*You don't **have** to go to the science fair. Like me, I've always done a science project, but I haven't gone to the science fair. It doesn't really bother me.* –Junior

I would do my best to avoid science fair if I had another option. But, I would not pick an entire year's class based on avoiding it.—Junior

I have never heard anyone use science fair as a factor. [The choice] more depends on the teacher.
–Junior

To me it doesn't really matter if the class says I have to do science fair. I've done it before in middle school. As long as I try….I mean, I know I won't get first place or second place or third place. But, just trying and doing what I could and learning something in the process is fine.—Junior

Why avoid it? Just go do it. And, plus, intensified class gives you more credit than just regular. That's the thing about it. [Several answer] It just looks better, you don't get more credit. You get more credit for AP.—Freshmen, sophomores

There were several reasons for the view that science fair is not an important factor in choosing classes:

- Teachers replace science fair with another similar project, thus one has a similar project anyway.
- Science fair can be rendered manageable by choosing a simple project or an interesting one.
- Students perceive conducting the experiment itself as easy and the paperwork associated with science fair as the difficulty.
- Students like being able to work with a partner.

Of course, given a hypothetical choice between two classes—one with science fair and one without—a few students said that they would allow science fair to factor into their decision. And, one student did specify that he chose regular physics rather than intensified in part to avoid science fair, which he did not think he would have time for given his extracurricular activities. However, this student was taking AP Chemistry and had chosen regular Physics to help lay the groundwork for future physics classes.

If I could pick between a class with science fair and one without, I would pick one without.—Freshman

Yeah, [avoiding] science fair was a factor for me. It was a big factor. –Senior

The drawbacks to science fair were "annoying" paperwork that is required and must be done in a very specific way and the time required outside of school.

I don't like doing science fair because it's so much paperwork.—Freshman

The "Word" on Science Fair

Science fair is not especially popular. It is generally disliked—but, disliked in the sense that it is regarded as a hassle or a "box you have to check off" rather than a major issue. In each group, students acknowledge that some students are "really into it." Many said that those who are less enthusiastic can do enough to get by relatively easily.

> *I don't take it as a joke, but it's not as serious. Most people are not as pressed about it as they are about the rest of their science work.*—Junior
>
> *Only one person in my class chose to do the science fair.*—Freshman
>
> *It's not a requirement. You don't have to do it. So, there is nothing pushing you towards it.*—Sophomore
>
> *A fair number of people take advantage of the fact that you don't have to* ***go*** *to the fair. Some teachers offer extra credit. So, some go to get the free points [for the science project they had to do anyway]*.—Junior
>
> *Nobody particularly likes science fair. Not many people are gunning for VJAS (Virginia Junior Academy of Science).*—Junior
>
> *I did have one friend who was really into it. [Laughing] I think she spent like eight weeks in a lab…. There are people who really enjoy it, I think.*—Junior

Improving Science Fair

What students said they appreciate most—or, would appreciate—is a more directive approach from teachers regarding science fair. They would like more in-class time, for example. And, many said they appreciated teachers' step-by-step instructions in the past. Students said they do not like it when teachers are "hands off" about science fair.

> *There is all this paperwork for science fair. Sometimes I think there should be just a whole unit dedicated to science fair….that would be so much better. But, since there is testing and SOLs, classes have to be prepared for that.*—Senior
>
> *In 7th grade, my teacher gave me more support. They helped us in class. [As a result] We had more time out of school to do other things, not just the science fair.* –Freshman
>
> *In 3rd grade, I remember it because that was the only year I actually liked doing [science fair]. My teacher gave every student in our class a big packet of different topics. And then I found one that I liked and that's how I did it. I was actually interested in it.*—Sophomore
>
> *In 9th grade, we actually devoted class time to it…I preferred the teacher who actually talked about it.*—Junior
>
> *I liked this one teacher. She gave us ideas. She told us where to start and once we got into it, where to go from there.*—Senior
>
> *My one physics teacher said so little about it that I had to use another teacher's rubrics…had no idea what to do, unfortunately.*—Junior

Enthusiasm for Science

Getting Excited about Science

The students' enthusiasm for science was fostered in large measure by teachers they described as "good." They specified that qualities of good teachers included having good organization, being clear about the assignments and expectations, holding extra hours when the students could go in for help, supplying aid and guidance for science fair.

When students introduced themselves at the start of each discussion group, they were asked to describe something memorable about science classes they had taken in the past. Most students recalled something hands-on (e.g., a week-long copper lab in which the copper changed), outdoors, or something involving fire (e.g., balloons and hexane gas). A couple mentioned their past science fair projects as memorable—more specifically, projects they had enjoyed. For example one student who was not taking intensified courses remembered his project on the topic of energy using basketballs. A senior with a history of intensified and AP courses, remembered his project on garlic and E. coli bacteria.

> *[I remember] last year's science fair. I did a basketball project on kinetic energy. I got second place.*—Freshman

> *I remember in middle school, we dissected an owl pellet. And, we had to make the model with the stuff we found, the bones.*—Sophomore

When students reflected on their enthusiasm for science, there was almost no pattern to how they said their enthusiasm changed over time. In other words, there was wide variation as to whether students' enthusiasm increased, decreased or stayed the same. However, two patterns did emerge. Some students pointed out that students may not sustain interest in science as classes get more challenging in middle- and high school. Also, many students who said their enthusiasm decreased, pointed to where else their interests lie or specified that having more class choices means people will gravitate to what they like and it may not be science.

> *I think the classes have something to do with [diminished interest in science]. In elementary and middle school, it's easy and fairly standard for everyone to get an A or B in science class. And, so at that point, everyone is really enjoying it because it's fairly easy to do whereas in high school, if you want to go into the science classes, all the other science classes get a lot harder. So, that's probably why.*—Senior

> *In elementary and middle school, a lot of things were more hands-on and were more easier. In high school, people are getting closer to college so they have to make choices [between science and other topics they like].*—Junior

> *I took an AP history course I liked and I think that pushed me a little bit to the humanities.*—Senior

> *My interest got greater. I like science.*—Freshman

> *You don't really have much choice in elementary and middle school. We couldn't choose our courses, it was up to "whatever is next." I think when people get the opportunity to*

*choose whether or not to do it, they start to take advantage of it… "I might still like science, but I like **this** more."*—Junior

I don't think my interest has gone down because my family is very "sciency." But, I do have friends whose interest has, I think, gone down because they get into other subjects that they find they're challenged by and they enjoy more than science….like I have a friend who likes business a lot.—Senior

Students were asked to reflect on and describe science in elementary, middle, and high school. Generally speaking, elementary school science was seen as more fun and hands-on. Yet, students recognized that they had greater freedom and more choice in what they studied as they got older. Memorable topics over the years included the water cycle, cell parts (drawing, labeling), genetics (traits, DNA), caterpillars, and moon and ocean interaction.

Students' Descriptions Comparing Science Throughout School

Elementary	Middle	High
• Easy • Fun • Hands-on • Interactive • Interesting • Simple machines • How things work (e.g., environmental change), but not why • Demonstrations (*that* things work, but not as much detail on how or why)	• More work • More writing (formulas, elements) • More thinking • Fun (especially experiments, although paperwork after is not fun) • Increased focus on how and why (e.g., do experiments and talk about them) • More in-depth than elementary school	• A lot more work • Less hands-on, more paper • No fun • More math • More figuring out answers yourself (e.g., do a lab on your own and go over it later) • Apply learning

Science Beyond the Classroom

About a third of the students said that their future careers would likely involve science. And, when they talked about their anticipated majors, many highlighted scientific pursuits such as medicine, astronomy, and marine biology. However, very few said that their current activities outside school involved science.

This one girl, she did an internship at NASA. So, if you really care about it and you really want to do it, there are opportunities for you out there. Not the case for me, however [not interested].—Senior

I did an internship at Bethesda Medical last year. I used a lot of biology.—Senior

Conclusions

- **Intensified- and AP-level courses were seen as more valuable than regular courses.** They were valued especially because having such classes on a transcript is appealing to colleges and universities. There were slight negative perceptions about "regular" classes, that perhaps they are too easy and that some (e.g., Earth and Space) may limit future options because there is no path from them to higher level or AP courses.
- **Counselors and the course catalogue were these students' top resources in course decision-making.** Parents and friends were mentioned as well, but to a lesser degree.
- **Choices of which course topics to take were said to be guided mostly by the normal progression from biology to chemistry to physics and/or by one's interest level in a topic (e.g., choosing AP Biology in 12th grade because you prefer biology to chemistry).**
- **Decisions about class intensity levels were guided mostly by making transcripts look good for college applications, logistical scheduling matters, personal drive for challenging work, and one's interest level in a topic.**
- **Planning for sophomore year was the starting point for long-term planning among these students.** Ninth-grade choices were said to be limited. And, in 10th grade, college planning was said by some to be just beginning. Thus, the matter of choosing more intense courses was under greater consideration starting with 10th grade planning. In fact, among the 8th graders (reported upon separately), there was great concern about the transition to high school in planning for 9th grade. In other words, in planning for 9th grade the focus was on high school. In planning for 10th grade, it begins to be on college for some.
- **For most of the students in this very small sample, science fair does not factor into their course decision-making.** Science fair was regarded as a hassle by most. They perceived a very small number of students as being "really into it." Yet, science fair is a manageable hassle in that one can choose a simple or interesting project. Students said that the workload of the intensified and AP classes is the greatest factor for students who opt to avoid those classes. They also said they did not think others were basing their class decisions on avoiding science fair.
- **Students said that a directive approach from teachers regarding science fair makes science fair more pleasant for them as students.** They appreciate in-class time and step-by-step instruction, for example.
- **There was almost no pattern to whether these students' enthusiasm for science grew or waned since elementary school. They were quite varied on that topic. However, two patterns did emerge.** Some students believed those whose interest waned were put off as science classes grew more challenging in middle and high school. Also, many students who said their enthusiasm decreased, pointed to other interests or specified that having more class choices means people will gravitate to what they like, which may be something other than science.

Appendix A
Profile of Students Who Participated in High School Focus Groups

Freshman	• 9th – Biology
Freshman	• 9th – Biology
Freshman	• 9th – Biology intensified
Sophomore	• 9^{th} – Biology intensified • 10^{th}- Chemistry intensified
Sophomore	• 9^{th} – Biology • 10^{th} – Chemistry intensified
Sophomore	• 9^{th} – Biology • 10^{th} – Earth and space
Junior	• 9^{th} – Biology intensified • 10^{th} – AP chemistry • 11^{th} – AP biology
Junior	• 9^{th} – Biology • 10^{th} – Chemistry • 11^{th} – Physics
Junior	• 9^{th} – Biology intensified • 10^{th} – Chemistry intensified • 11^{th} – Physics intensified
Junior	• 9^{th} – Biology intensified • 10^{th} – Chemistry intensified • 11^{th} – Physics intensified
Junior	• 9^{th} – Biology intensified • 10^{th} – Chemistry intensified
Senior	• 9^{th} – Biology intensified • 10^{th} - Chemistry intensified • 11^{th} - AP chemistry • 12^{th} - Physics B
Senior	• 9^{th} – Biology (in another state's school system) • 10^{th} – Astronomy, environmental sciences, psychology (semester-length classes in another state's school system) • 11^{th} – Chemistry • 12^{th} – AP biology • 12^{th} - Physics

APPENDIX B – DISCUSSION GUIDE ARLINGTON PUBLIC SCHOOLS (APS)
Focus Group Research with High School Students
Regarding Science Education

April-May 2013

Discussion time: 1 hour

5. WELCOME, INTRODUCTIONS, PROCEDURES (10 minutes)

- First, **thank you** so much for your time and help.
- **Introduce** self (name, independent researcher not employed by APS).
- **Purpose** today is to talk about your experiences and thoughts related to science courses. Each year, APS evaluates different aspects of education to see how to serve students best. This year, one focus is science education.
- **Open, honest opinions**—both positive and negative—are most important of all. [Moderator will work through this a bit, and involve the group in: 1) agreeing everyone has different experiences/opinions and 2) buying into shared goal of being comfortable with their own view and everyone else's.]
- Our hour together may even surprise you—it will be enjoyable. I have some questions you might not have ever thought about.
- I would like to **audiotape**, to help with my report. But, all answers are **confidential**. I will keep the tape. My report will not use any names, rather it will describe what "participants" said, and talk about the group as a whole. Is taping ok with you?
- **Some basics** to help make sure that I still learn all I need to from you.
  - You are here because you have experience deciding which classes to take. My job is to ask questions, and your job is to make yourself heard (no silent participants).
  - Talk one at a time, loudly enough for tape to pick up.
  - No side conversations, put opinions on the table for all of us to hear.
  - Many questions to get through. So, I apologize in advance if I give you that feeling like I'm "moving us along."
- **Participant introductions**
  - In a moment we'll do introductions, starting with [NAME] and going around the table. Tell us your **first name**, what **grade** you're in, what **science classes you've taken** so far in high school, and something memorable about a science class you've taken in middle or high school.

6. DECISIONMAKING ABOUT COURSES IN GENERAL (5 minutes)

Let's think big picture first. I'm wondering how you choose your classes in general—walk me though what you think about.

c. What are your priorities? [Make easel list.]
d. Who, if anyone, do you talk to about which classes to take?
    - Are there any really good pieces of advice or tips you've gotten? Share.

7. DECISIONMAKING ABOUT SCIENCE COURSES (20 minutes)

Think back to when you decided to put the science class you're in now on your schedule.

a. What factors that went into that choice?

Let's think more broadly, about your science classes over all 4 years of high school.

e. How do you find out what science classes are available to you?
f. Who, if anyone, did you talk to about signing up for the class you're in now?
    - What input have others given?
    - Has anyone given you advice *not* to take a particular science class? If so, tell me about that.
g. Some choices are about the course topic like deciding "Earth science or chemistry." Some are about deciding whether to take an intensified course—like "intensified biology or biology." [2 columns on easel. Start under topic decision, then move to intensity. For each ask:] Is this a choice you've had to make so far?
    - What factors go into making a decision like this for you?
    - Let's get even more specific…For those not in intensified classes now, tell me about your choice.
    - For those in intensified classes now, tell me about your choice.
h. So far, have there been any science classes you wanted to take but didn't? [Which ones? Why not?]
i. [Start w/ underclassmen] What science classes do you see yourself taking in the future, if you know? Why those?
    - How far ahead have you planned out your science classes [for seniors, how far ahead *did* you plan?].
    - [Planners] What are the reasons you're aiming for that particular set of classes?
    - [Nonplanners] Are there any particular reasons why you opted not to? Any barriers?

j. Think back on science in elementary school, middle school, and now. Let's make a few notes on each so you're really remembering. [Easel list, what comes to mind for each—topics studied, events, tests, etc.].
    - Looking at our list, is there anything that you recall especially enjoying? And, the flip side—not enjoying? And why?
    - Think about yourself. Would you say your interest in learning scientific topics has gotten greater, less, or stayed the same? [Discuss changes or status quo and why.]
    - Do you remember any particular year when science class was especially great? What made it so? Any points you were less interested? What made it so?

8. SCIENCE FAIR (15 minutes)

I'd like to hear a little more on science fair, which was/was not mentioned.

d. Does science fair factor into your decision about classes? If so, how so?
    - I'm going to ask you to look at two sides—first, if you were to encourage a friend that science fair should *not* be a factor in choosing science classes what would you say? And, the reverse, that it *should* be a factor?
e. How would you describe what "the word on science fair" is at your school?
    - How much participation is there?
    - And, in your view, why so much/so little?
f. And, what is doing a science fair project like for you?
    - How do teachers make it easier or get you "into it" more?
    - Anything you've seen teachers do that is a turn *off* in terms of science fair for you?

7. SCIENCE BEYOND THE CLASSROOM (5 minutes)

a. Do any of your activities outside school involve science? [Why/why not.]
b. Do you see yourself in a scientific career? [Why/why not.]

8. CLOSING (5 minutes)

Our time is nearly up. Are there any final thoughts you would like to share?

Thank you so much for your time and all your help.

Science Fair and Science Project Participation

Each year, a science fair is held in APS middle and high schools. Three middle schools require their students to create a science project and participate in the science fair. Participation is optional for the remaining middle schools and all high schools. Participating students may go on to the regional science fair, which leads into the I Intel International Science and Engineering Fair (NTEL ISEF) and/or the state science fair. Participation data for the school-based fairs, INTEL ISEF, and the state science fair are not available. **Table 1** shows the science project and science fair requirements for secondary students by school.

Table 1: APS Science Project and Science Fair Requirements by School

School	Science Project Requirement	Science Fair Participation Requirement	When Science Fair Is Held
Gunston	Required participation for 7th and 8th grade students	7th grade participation decided by individual teachers; 8th grade participation required	Wednesday, after school
Jefferson	Required participation for 6th, 7th and 8th grade students	Required participation for 6th, 7th and 8th grade students	Wednesday, during the day
Kenmore	Required participation for 7th and 8th grade students	Required participation for 7th and 8th grade students	Wednesday, during the day
Swanson	Optional participation for 7th and 8th grade students	Optional participation for 7th and 8th grade students	Thursday, evening
Williamsburg	Optional participation for most 7th and 8th grade students (participation is required by one 7th grade teacher)	Optional participation for most 7th and 8th grade students (participation is required by one 7th grade teacher)	Wednesday, evening
H-B Woodlawn	Required participation for 7th and 8th grade students	Optional for 7th grade and Intensified Biology; required for 8th grade	Thursday, evening
Wakefield	Required participation for students in intensified Biology, Chemistry, and Physics	Participation is optional.	Saturday, morning
Washington-Lee	Required participation for students in all intensified Courses	Required participation for students in Intensified Biology and Chemistry; optional for students in Intensified Earth Science and Physics.	Saturday, morning
Yorktown	Required participation for students in all Intensified and AP Courses	Participation is optional.	Saturday, morning

Virginia Junior Academy of Science (VJAS) Participation

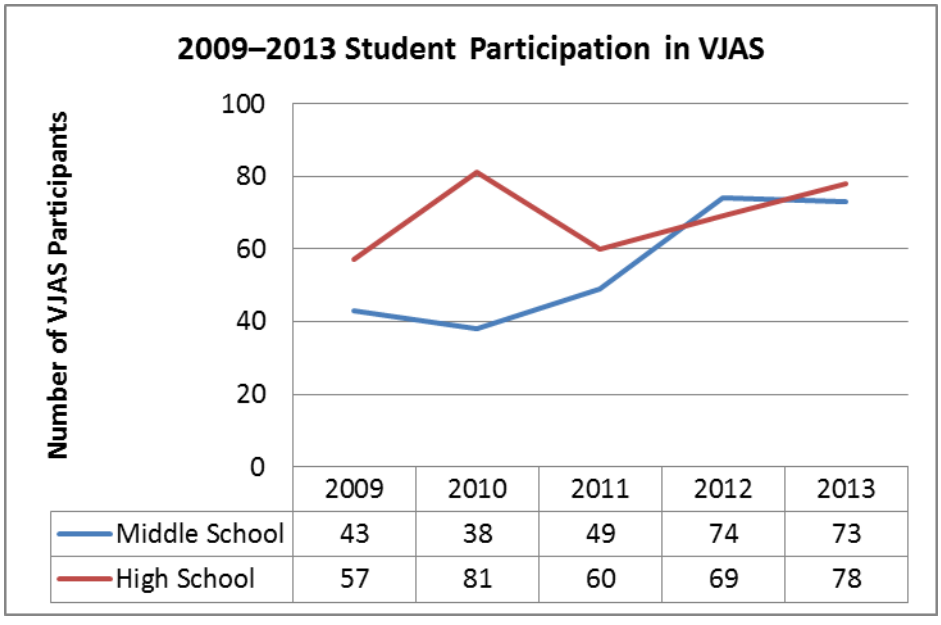
The Virginia Junior Academy of Science (VJAS), a state chapter of the American Academy of Science, is dedicated to the advancement of Science by discovering and encouraging scientific aptitude among Virginia's middle and high school students. Sponsored by the Virginia Academy of Science (VAS), the objectives of the VJAS are to

1) discover and encourage scientific aptitude among secondary school students in Virginia,
2) foster fellowship between its members and members of the VAS,
3) encourage students to continue their education in science, engineering, and related fields, and
4) develop a background among its members which will lead to membership in the Virginia Academy of Science and other professional science organizations.[1]

To participate in the VJAS, students submit their research papers for review by the Academy in early March. Papers that are selected for presentation are selected in April and their authors are invited to present the research at the annual VJAS symposium that is held each year in May at a Virginia university. All student projects receive feedback from experienced scientists and science educators. Students are given 10 minutes to present their research in front of a panel of judges and awards are presented to students whose research is recognized as top in their category. The VJAS symposium precedes the annual VAS meeting, and select students that receive top honors in their categories are invited to present their research to members of the senior academy. These students have an opportunity to publish, receive awards, and obtain scholarships.

Figure 1 shows the number of APS middle and high school students who have participated in VJAS over the last five years.

Figure 1: APS Student Participation in the VJAS, 2009–13



[1] Source: http://66.147.244.216/~vacadsci/vjas-1.htm

Outdoor Lab Visits

Each spring, the Outdoor Lab Director determines the number of days to be allocated to each school and grade based on projected enrollments for the following September. Bus limitations often determine if a school receives 1 or 2 days per grade. Until this year (2013-14), the number of days allocated for high schools was based upon the school's percentage of the total APS enrollment.

All students in grades 3 and 7 are offered an opportunity to visit the Outdoor Lab as a day trip, and all students in grade 5 are given the chance to attend the Lab on a two-day visit with an overnight stay. The majority of students stay the entire time, with a small subset opting to travel back and forth on the bus each day. Schools deciding not to use the overnight opportunity are still allocated two days at the Lab. Every year, 2 or 3 schools decide on this option.

Until the 2010-11 school year, grade 6 students also visited the Lab as a day trip. The primary reason for eliminating grade 6 visits was that student numbers routinely pushed or exceeded the capacity of the buses. This meant that some teachers and/or chaperones were required to provide their own transportation to the Lab or, in some cases, also had to transport students. Not all schools were able to find parent drivers or wanted to take on the responsibility of transporting students in private cars. Since students already visited the Lab in grades 5 and 7, the grade 6 trip was the most logical one to eliminate.

When the high schools had a larger selection of days, teachers at the school signed up for slots on a first-come, first-served basis. Most trips were taken by students enrolled in Biology, Chemistry, and Environmental Science classes, with one or two days taken by students in HILT or Special Education classes.

Table 1 shows the number of days allocated to high school students for Outdoor Lab visits per year.

Table 1: Total Number of Outdoor Lab Days Allocated to High Schools and Secondary Programs

School	2009-10	2010-11	2011-12	2012-13	2013-14
Wakefield	8	8	8	8	1
Washington-Lee	8	10	10	9	1
Yorktown	8	10	10	8	1
HB Woodlawn	2	2	1	2	1
Secondary Programs[2]	10	11	9	10	6

The decrease in days allocated to high schools was directly related to increased enrollments in the elementary grades which necessitated that they be allocated more days. In addition, the Lab staff said that it preferred having more trips with fewer students per trip than trying to accommodate the maximum on the bus (approximately 70 students). This was especially true for the overnights. The staff felt that groups between 40 and 50 were more manageable and provided the students a better educational experience. This change in schedule also allowed the Lab staff to build in some "extra" days for re-scheduling those trips that had to be canceled because of inclement weather, either in Arlington or Fauquier County.

[2] Includes Arlington Mill, Career Center, Langston, New Directions, Teen Parenting (until 2013-14), and Stratford.