Advisory Council on Teaching and Learning

Progress Memo

To: Advisory Council on Teaching and Learning & APS Department of Teaching and Learning
From: Science Advisory Committee
cc: Dat Le, Science Program Supervisor
Date: December 7, 2020
Re: December Progress memo on science curriculum teaching and learning

Summary and Main Findings[1]

Throughout November, the Science Advisory Committee (SAC) gathered student, family, and teacher feedback on science curriculum teaching and learning experiences during the first quarter of the 2020-21 school year. Because of the relatively small number of responses to the two surveys compared to the overall APS enrollment and the use of convenience sampling, the survey responses are not necessarily representative of APS families, students, and teachers overall. These results should therefore be interpreted not as a comprehensive depiction of families', students', and teachers' experiences this year but rather as a partial snapshot that can help suggest patterns of effective teaching and learning practices as well as highlight issues and areas that need attention, improvement, or further investigation.

What's working well

Some respondents highlighted examples of teaching and learning excellence that in some cases surpassed in-person experiences from previous years. Not surprisingly, for example, a respondent praised the organizational and student connection skills of IB Biology and Chemistry teachers, and these teachers likely also excelled with in-person learning.

The 'takeaway' theme is that teaching excellence in 'normal' times tends to carry over into the much more challenging virtual environment.

What needs to be improved

There are no surprises that virtual learning comes up short when compared to in-person learning. The key topics cited by survey respondents for improvement include:

- Clarity and organization of synchronous instructional material and delivery
- Hands-on activities
- Student participation and engagement (including camera use)
- Consistency in use of asynchronous time
- Challenging the highest achievers
- Taking care of the most vulnerable learners

Also, not all of the feedback on where improvements can occur is unique to distance learning.

SAC believes that action to effect change for this academic year requires urgency. SAC recommends strong, **immediate** coordination between ACTL and the Department of Teaching and Learning's (DTL) recent parallel efforts to gather similar feedback to:

- Compare the ACTL committee findings to the results of DTL's November focus groups for both commonalities and differences, especially at the granularity of specific subject matter areas.
- Establish a linkage between ACTL and the soon-to-be-appointed new task force to improve virtual learning.[2]

[1] A PowerPoint presentation summarizing the survey's findings can be accessed here.
[2] Announced at the December 3, 2020, School Board meeting.

- Provide ACTL the data collected by DTL thus far, including student performance summary data for the first quarter, particularly as it relates to achievement gaps.

What needs to happen next

A 'growth mindset' approach that seeks to identify and replicate best practices already being modeled within APS is the logical place to start. SAC recommends that identification of this year's best practices for science curriculum delivery be pursued rigorously in the coming weeks, accompanied by a 'skills transfer and training' boot camp-style program for all teachers.[3]

SAC is extremely concerned about the disproportionately negative impact of virtual instruction on already disadvantaged families and urges APS to take appropriate actions to mitigate these deleterious effects. A concerted effort must be made to reach out to those families with students who are performing below expectations, if it is not happening already. There could also be opportunities to pair high performers with students experiencing these challenges that both might find enriching and rewarding.

Survey and Data Analysis Methods

Based on direction from DTL to avoid the use of a widely-distributed community survey tool, SAC conducted a targeted survey model with committee members reaching out to known contacts and circles to gather feedback using a convenience sampling approach.

These groups included (with target participants in parentheses): Wakefield High School PTSA (families and students); Wakefield High School students; Gunston Middle School administration (science teachers); Oakridge Elementary administrators (science teaching); Green Valley Civic Association (families and students); Yorktown (families and teachers); and other families across elementary, middle school, and high school levels. SAC developed two 'Google Forms' survey instruments, one targeted to families and students and the other targeted to teachers.[4] The questions asked for narrative responses, with the exception of one quantitative question which asked participants to rate the quality of science instruction this year on a 1-10 scale. Both survey instruments are attached as Appendix A.

The 50 responses to the Family Feedback on APS Science Instruction Survey and the 12 responses to the Teacher Feedback on APS Science Instruction Survey were analyzed using a qualitative database analysis program called Dedoose. Each response was coded in order to identify common themes. Visualizations, which can be found in Appendix A, were created in both Dedoose and Excel.

Family Survey Results

Fifty families[5] responded to the survey. In total, these families have 59 children in the following schools:

Elementary schools: Long Branch (2); McKinley (2); Oakridge (2); ASFS (1); Ashlawn (1); Key (1)
Middle schools: Gunston (2); Kenmore (2); Swanson (2); Jefferson (1)
High schools: Wakefield (36); W&L (3); Yorktown (2); HB Woodlawn (1); Arlington Tech (1)

In response to the survey question, "On a scale of 1 to 10, how would you rate the quality of the science instruction your child is receiving this year?" the families' average ratings were highest for elementary school instruction and lowest for high school instruction, as can be seen in Figure 1. (See Appendix B.) These ratings should be interpreted with caution, however, because of the very low numbers of elementary and middle school families.

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[3] See positive deviance approach.

[4] SAC also developed a survey instrument for administrators but ultimately did not pursue this stakeholder group due to time constraints.

[5] In some cases, students responded directly to the survey rather than their parents.

A number of families reported satisfaction with their children's science instruction so far this year, stating that their children's teachers were either doing a great job or at least were doing the best they could given the circumstances. Some respondents even indicated that this year's science instruction was better than last year's. Factors that contributed to these positive experiences included clear explanations from teachers, hands-on labs that students could conduct at home, and interesting virtual labs. (See Figure 2 in Appendix B.)

Many families reported difficulties and frustrations with science instruction so far this year, however. (See Figure 3 in Appendix B.) The most common complaints involved disliking online schooling altogether, being bored or confused, and not learning much at all. The reasons for these complaints included teachers who explained concepts poorly; difficulties with labs (either those conducted virtually or in a hands-on manner at home); science fair problems; and technology problems. Some respondents said there was too much work in their science classes, while others felt the pace was too slow. Several respondents mentioned that their science classes revolved around worksheets or rote memorization. A number of respondents indicated that there had been no labs so far in their science classes this year, and two elementary school families stated that there had been no science instruction at all so far this year.

Families responding to the survey made a number of suggestions for improved science instruction. Most commonly mentioned was the need for more hands-on activities and labs. Families also felt that greater interactivity and student participation would help to make science classes more interesting and educational, both during online instruction and once in-person schooling resumes. Some families also requested more structure and better organization for science classes because some students are finding it hard to follow disjointed lessons and make the best use of periods of asynchronous instruction. (See Figure 4 in Appendix B.)

Several families also indicated a concern that online instruction would exacerbate existing achievement gaps, with one parent writing the following:

> About 18 of the kids in my daughter's class are doing the excellent bean growing experiment that I mentioned above. About 6 kids aren't doing it because their parents didn't provide them with the materials. . . Desired change: For APS to provide hands-on materials to under-resourced students so that all students can participate in the full scope of Science learning.

Another parent wrote: "I worry more about the inequities in Arlington County and how classes will be even more differentiated than we have ever been."

Across almost all of the families' survey responses was a recognition of the importance of teachers. A small sampling of comments regarding teachers included the following:

- "I think teachers have a big impact on how well you learn something. Online makes it harder to learn but I think I'm learning around the same as last year."
- "The teacher has a lot of technical issues this year and we are expected to know things we were never taught."
- "The IB Biology and IB Chemistry teachers are EXCELLENT. They have created strong learning partnerships with their students. Great teachers before (face-face) and great teacher during (virtual)--so the theme here is that they were really excellent in their organization skills and connection with students, which made the virtual class very good. . . Prior to having teachers who teach IB science classes, my kid has not had good science instruction and it negated any curiosity in observation, in hypothesizing, in any scientific method of asking why. Class was about memorizing facts."
- "She is doing several interactive labs a week, and the teacher is very good at explaining and making difficult concepts both easy and fun. Last year they did many fewer labs, and the teacher didn't make it nearly as fun."
- "I know finding science teachers is hard. I hope APS can make an effort to really hire good ones and make sure they are supported because we need good ones."

There were many, many requests for more hands-on activities -- both for now during online instruction and once in-person instruction resumes. Here are a few representative comments:

- “The first two years of high school science have lacked hands-on learning and experiments, so it isn't just about being virtual. Middle school had project learning and we don't know why lower high school doesn't.”
- “Hopefully there are a lot more hands on activities such as labs.”
- “I hope that my teacher will be doing more hands-on activities and actually give us the necessary time to do our work, because right now we don't even get enough time to write notes down.”

Families’ responses to the survey included several suggestions worth considering, such as the following:

- “I would have some optional sessions on weekends or after school for some labs...it could be a way to access periodic labs for students.”
- “It would not be hard to engage the PTA to build a packet of regular household items that could do experiments. No one has asked for parent help putting together supplies.”
- “Some topics that interested my child include waves, since she got to do some interesting labs with a slinky and observing how waves traveled down a slinky.”
- “I would be happy if science fair took a year off and was replaced by perhaps a months-long, whole-class project examining some scientific topic, modeling how a real scientific investigation might go, with lots of time and trial and error at the topic choice, experimental design, and data interpretation phases.”

Teacher Survey Results

Only 12 teachers responded to the Teacher Feedback on APS Science Instruction Survey, so the findings reported here should be considered suggestive rather than definitive. The respondents teach at the following schools:

- McKinley Elementary School (n=1)
- Gunston Middle School (n=7)
- Wakefield High School (n=2)
- Yorktown High School (n=2)

Most teachers rated the quality of their science instruction fairly high. (See Figure 5 in Appendix B.) The teachers’ survey responses echoed many of the experiences and concerns expressed by families. The most common theme in the teachers’ responses was their recognition that their classes did not incorporate enough hands-on activities. The next most common theme was their frustration at not being able to tell whether kids were “getting it” because of the online modality of instruction. A number of teachers expressed concern that at least some of their students were not doing as well as they would have in an in-person format. The themes that appeared at least twice across the teachers’ survey responses are the following:

- Insufficient hands-on activities (6 responses)
- Can’t tell if kids get it (5 responses)
- Students not doing as well (5 responses)
- Using virtual labs (5 responses)
- Need more labs (4 responses)
- Low student participation (3 responses)
- Concerns about in-person safety (3 responses)
- Asynchronous time challenges (2 responses)
- Canvas problems (2 responses)
- Slower pace (2 responses)
- Time-consuming to plan (2 responses)

An example of some teachers' responses that illustrate these themes include the following:

- "I feel as though students are not as engaged in science instruction this year due to virtual learning. The loss of in-person labs and hands-on activities is negatively affecting their learning."
- "I cannot see if students are paying attention, if they are connected or not connected since when I call on them they do not answer."
- "We are averaging at least a hands on lab a week. We spent a lot of time this summer cultivating ideas for labs and then built labs kits full of supplies so the kids could do actual labs. It allows us to keep physics phun and allows the kids to still cultivate ideas on their own."
- "I think the greater incorporation of technology that we are using this year has been a revelation. I would like to make that a greater part of my in-class teaching next year."
- "Is there a way we can have students work in lab groups of around 4 per group to complete a virtual lab TOGETHER virtually for example utilizing Gizmos?"
- "Talk to teachers, especially those you don't know. I live in South Arlington and hear parents talk about my colleagues and most of their comments are loaded with misinterpretations (or misinformation generated by their kid)."

Closing

The results of this initial survey exercise are generally consistent with the 'ups' and 'downs' of teaching and learning experiences in most educational institutions. These findings are not unique to a virtual learning environment, but it is clear (and already well-known) that virtual learning adds to existing challenges, especially where learners are already at a disadvantage.

The recommendation for immediate coordination between ACTL and DTL is both critically important and logical. ACTL subject matter committees and their members have put substantial effort into gathering feedback from across the APS community that will serve as a powerful 'force multiplier' to the efforts of DTL and the pending new task force to improve virtual teaching and learning experiences for this academic year.

SAC looks forward to partnering with DTL in the weeks and months ahead - and beyond.

Appendix A – Survey Instruments

Family Feedback on APS Science Instruction

1. What school(s) does your child (or children) attend?
2. What is your child's (or children's) current grade(s)?
3. [For upper grades] What science class is your child taking?
4. On a scale of 1 to 10, how would you rate the quality of the science instruction your child is receiving this year?
5. Please explain the rating you gave in the previous question. How do you feel about science instruction your child is receiving this year? How does it compare to last year?
6. Can you provide any examples of science classes, topics, or assignments that really interested your child? Why did they do so?
7. Can you provide examples of things that are frustrating you with science this year? Why are they frustrating?
8. Is your child doing as well as you hoped in your science class this year? Why/why not?
9. What would you change with science instruction this year if you could?
10. What do you hope will be different next year with science when we return to in-person school?
11. Do you have any other feedback about science instruction for the Science Advisory Committee?

Teacher Feedback on APS Science Instruction

1. In what school do you teach?
2. At what grade level(s) do you teach science?
3. Which science classes do you teach?
4. How long have you taught science in total (in Arlington or elsewhere)?
5. On a scale of 1 to 10, how would you rate the quality of the science instruction you are providing this year?
6. Please explain the rating you gave in the previous question. How do you feel about science instruction you are providing this year? How does it compare to last year?
7. Can you provide any examples of science classes, topics, or assignments that you are really proud of? What makes you proud of them?
8. Can you provide any examples of things that are frustrating you with teaching this year? Why do they frustrate you?
9. Are your students doing as well as you hoped in your science class this year? Why/why not?
10. What would you change with science instruction this year if you could?
11. What do you hope will be different next year with science when we return to in-person school?
12. Do you have any other feedback about science instruction for the Science Advisory Committee?

Appendix B – Survey Findings

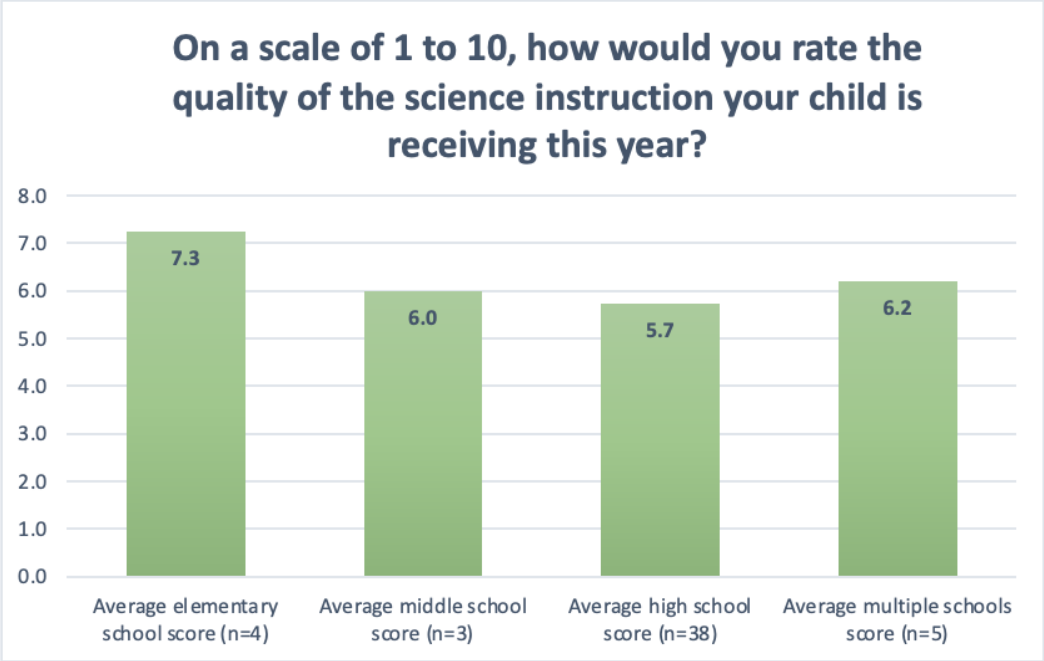


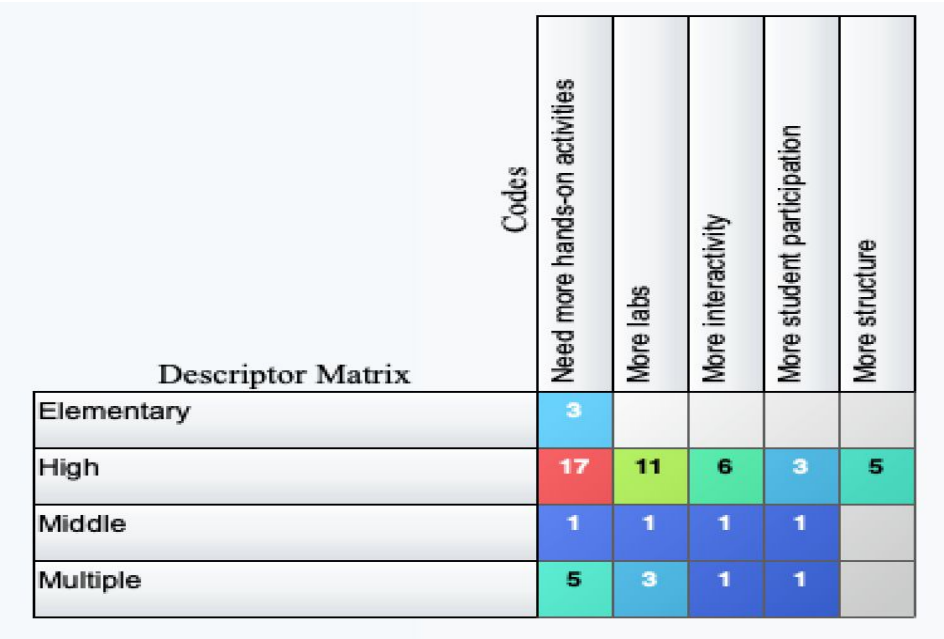
Figure 1. Families' average ratings for science instruction according to school level.

Descriptor Matrix	This year better	Teacher doing great job	Labs at home	Interesting	Teacher explains well	Teacher doing best they can	Virtual labs
Elementary	3		1	1			
High	5	8	6	7	6	3	5
Middle	1		1			1	1
Multiple	1	1				2	

Figure 2. Families' most commonly mentioned positive experiences with science instruction across different levels of schooling. The numbers indicate how many families mentioned each item, with heat map color coding ranging from blue (least commonly mentioned) to red (most commonly mentioned).

Descriptor Matrix	Dislike online	Not learning much	Boring	Teacher explains poorly	Difficulties with labs	Science fair problems	Teacher absent	No labs	Last year better	Teacher communication problems	Technology problems	Confusing	Too much work	Pace too slow	Canvas problems	Rote memorization
Elementary		1												1		
High	14	12	6	10	7	9	9	6	8	6	5	4	3	1	4	4
Middle	2	2	1		1			1		1	2	1		1	1	
Multiple	2	2	3		1			1		1		1	2	2		1

Figure 3. Families' most commonly mentioned negative experiences with science instruction across different levels of schooling. The numbers indicate how many families mentioned each item, with heat map color coding ranging from blue (least commonly mentioned) to red (most commonly mentioned).



Descriptor Matrix	Need more hands-on activities	More labs	More interactivity	More student participation	More structure
Elementary	3				
High	17	11	6	3	5
Middle	1	1	1	1	
Multiple	5	3	1	1	

Figure 4. Families' most commonly mentioned suggestions for improved science instruction across different levels of schooling. The numbers indicate how many families mentioned each item, with heat map color coding ranging from blue (least commonly mentioned) to red (most commonly mentioned).

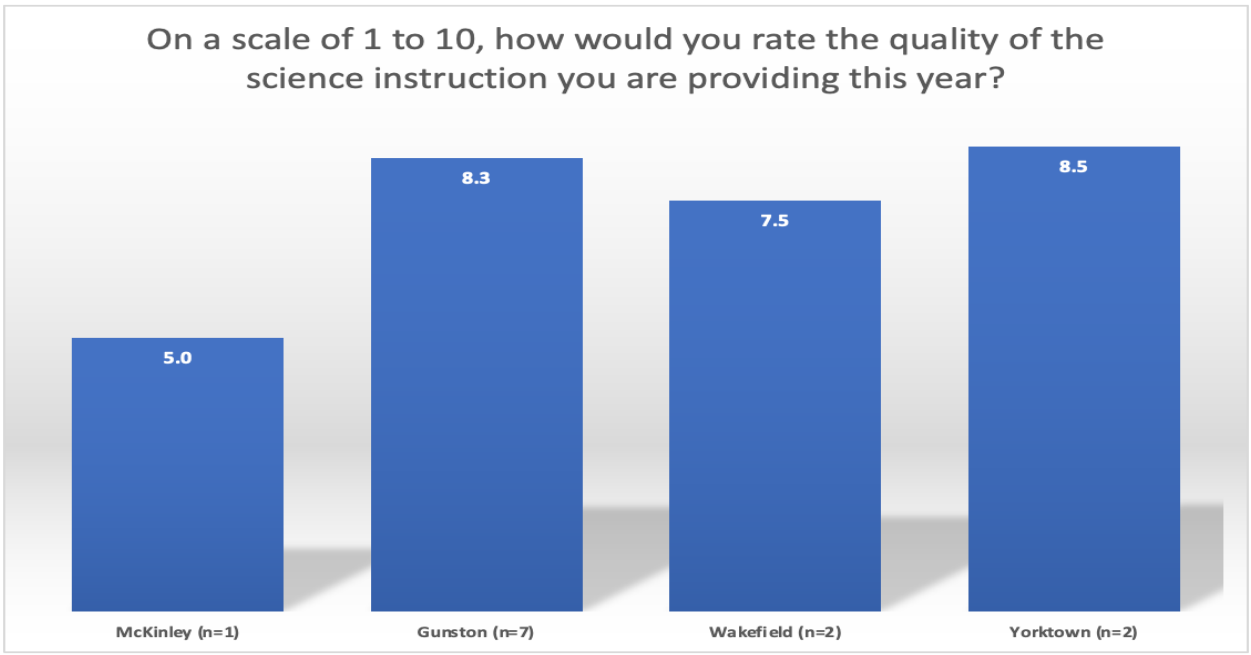


Figure 5. Teachers' ratings of their own science instruction, averaged by school.