K-12 Environmental Education Needs Assessment

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Introduction

The Chesapeake Bay Research Reserve in Virginia (CBNERRVA or Reserve) is one of 29 protected areas that make up the National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Research Reserve System (NERRS). At the state level, CBNERRVA is administered by the Virginia Institute of Marine Science (VIMS) at the College of William and Mary. The Reserve was established for long-term research, education and stewardship in support of informed management of our Nation's estuaries and coastal habitats. The Reserve's Education and Outreach Program strives to increase awareness, understanding, appreciation and responsible-use of coastal resources by kindergarten through twelfth grade (K-12) education programs, teacher training, participation in college intern programs and implementation of family and community-oriented programs.

Objectives of the CBNERRVA Needs Assessment were two-fold:

(1) determine science education informational needs of K-12 teachers and desired format; and

(2) incorporate information and findings into CBNERRVA and partner planning efforts to better meet the needs of students and teachers in the study region.

Study Area

Our study area for the needs assessment was formal K-12 classroom teachers across the Commonwealth of Virginia, with no emphasis on specific counties. The survey was completed by 178 educators at 132 different schools, encompassing 47 different Virginia counties. The district with the most survey respondents was City of Chesapeake with 35 respondents, followed by York County with 19 respondents, and Williamsburg and Virginia Beach at 10 respondents each. Gloucester County had 9 respondents, while City of Newport News, Richmond City Schools, and Henrico County each had 8 respondents. No other district in the survey study area had more than 6 respondents. CBNERRVA's previous needs assessment focused on the Hampton Roads region of Virginia, with an emphasis on Gloucester, Mathews and York Counties. Given the expansion of CBNERRVA target reach, along with the expansion of the area

that is currently receiving educational materials from the program, there was a subsequent expansion of the study area of this survey.

County	Land Area (mi^2)	Population (ACS 2018)	Population Density (people/mi^2)	% Population under 18	Median Household Income (2018 Dollars)
Chesapeake City	340.8	242,634	711.95	24	75790
Gloucester	217.81	37,161	170.61	20	66701
Hampton	51.41	134,313	2612.59	21	54550
Henrico	233.7	329,261	1408.9	23	68572
Newport News	68.71	178,626	2,600	23	51884
Norfolk	54.12	244,076	4509.9	20	49146
Richmond	59.81	223,787	3741.63	18	45117
Virginia Beach	249.02	450,189	1807.84	22	74186
Williamsburg and James City County	142.44	76,397	536.35	20	83048
York	104.78	67,846	646.51	24	90367

Table 1: Demographic information of counties with most responses.

Survey Process

An online Google Forms survey, distributed via email through Constant Contact, was used to collect information for use in the K-12 Environmental Education Needs Assessment. The survey was initially developed by Reserve General Education Program staff, in conjunction with VIMS Marine Advisory Program (VMAP) educators. The needs assessment consisted of some similar questions from the original need assessment conducted in 2010, but also included new questions. The finalized survey consisted of 23 questions, and is provided in Appendix 1. Both CBNERRVA and VMAP use a teacher listserv generated over many years to advertise programs and make announcements to K-12 educators. This list was used to contact teachers directly to complete the survey. The open period for survey response was May 8, 2020 through June 12, 2020. A total of 762 individuals were solicited directly for the survey, but teachers were also encouraged to share the survey with others at their school. CBNERRVA received a total of 181 survey responses. Survey results were tabulated, analyzed, and presented to the project team for review and discussion prior to the writing of this report.

Results

Survey results were analyzed based on specific grade levels and binned by K-5th grade (elementary), 6th -8th grade (middle) and 9th – 12th grade (high school) responses. Survey results based on binned grade level information is provided when noticeable differences between full (pooled) survey and binned grade level results were noted.

Background Teacher Related Information

Educational Setting and Grade Level

Of the 178 individuals that participated in the survey, 94.6% taught in the *public-school* system, and 4.4% taught in *private schools*, while no respondents indicated serving in other education support roles (e.g. science supervisor). Respondents could, and in some cases did, select multiple grade levels, in which case they were categorized and counted among the different categories that they were placed. The respondents were able to be categorized into elementary, middle, or high school. Comprising 47.2% of the survey response, high school grade level teachers provided the highest response rates. Response rates by middle school and elementary grade level teachers were 38.8% and 16.3%, respectively.

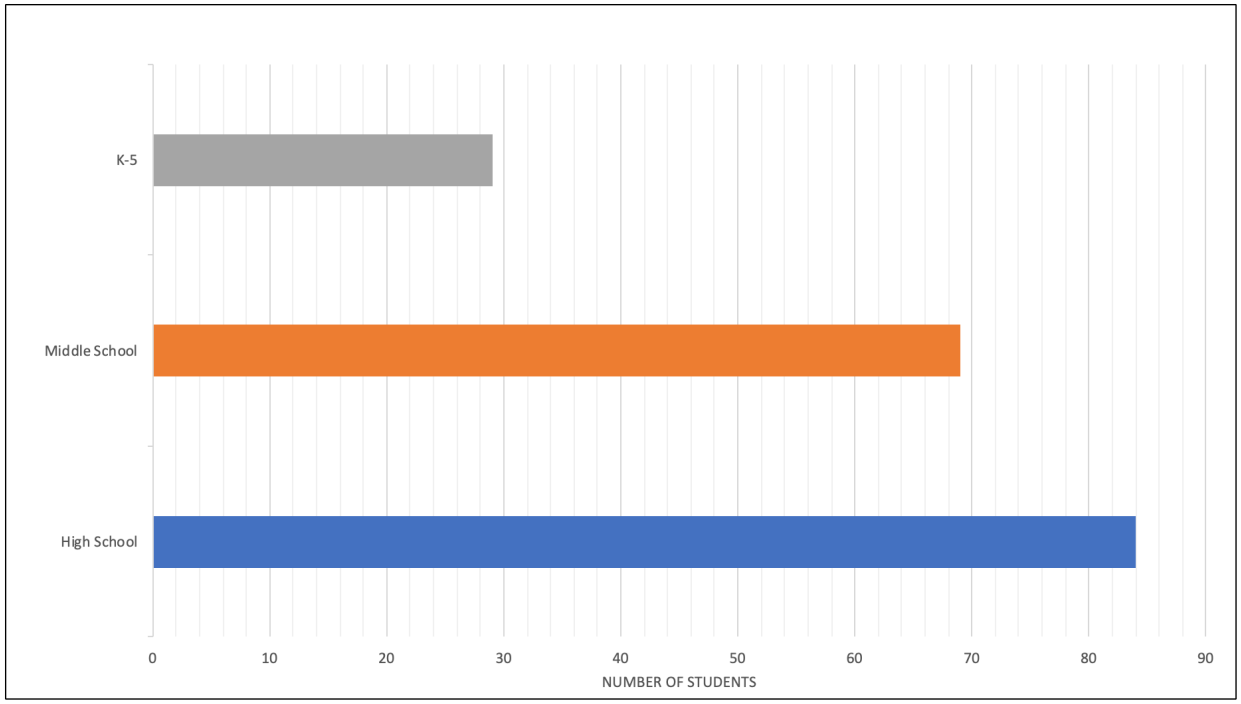

Figure 1. Total number of respondents, by grade level taught.

Subject

Response rates for subject area taught by binned grade levels are provided in Figure 2. Survey participants were allowed to select multiple answers and therefore summed response rates are greater than 100 percent for each binned grade category. All **elementary grade level teachers** (K-5) indicated teaching Elementary Science, the next highest in terms of responses was Physical Science, and a minimal amount of responses indicated teaching Life Science, 6th Grade Science, and Physics. For **middle school grade levels**, the top four response rates by subject area in descending order were 6th Grade Science, Physical Science, Life Science and Earth Science. The top four **high school grade level** responses were, in descending order, Biology, Earth Science, Environmental Science, and Marine Science/Oceanography. In addition to the specific subject areas for high school level teachers, nearly 25% of respondents indicated teaching Advanced Placement (AP)/Dual Enrollment/International Baccalaureate (IB) courses. In Virginia, the following subject categories are typically represented as high school level: biology, chemistry, physics, environmental science and marine science. The following subject categories are typically represented as middle school level: physical science (6th grade), life

science (7th grade), and earth science (8th or 9th grade). Elementary school science teachers may cover a variety of these subject categories as their curriculum is broader (Virginia Department of Education, www.doe.virginia.gov/testing).

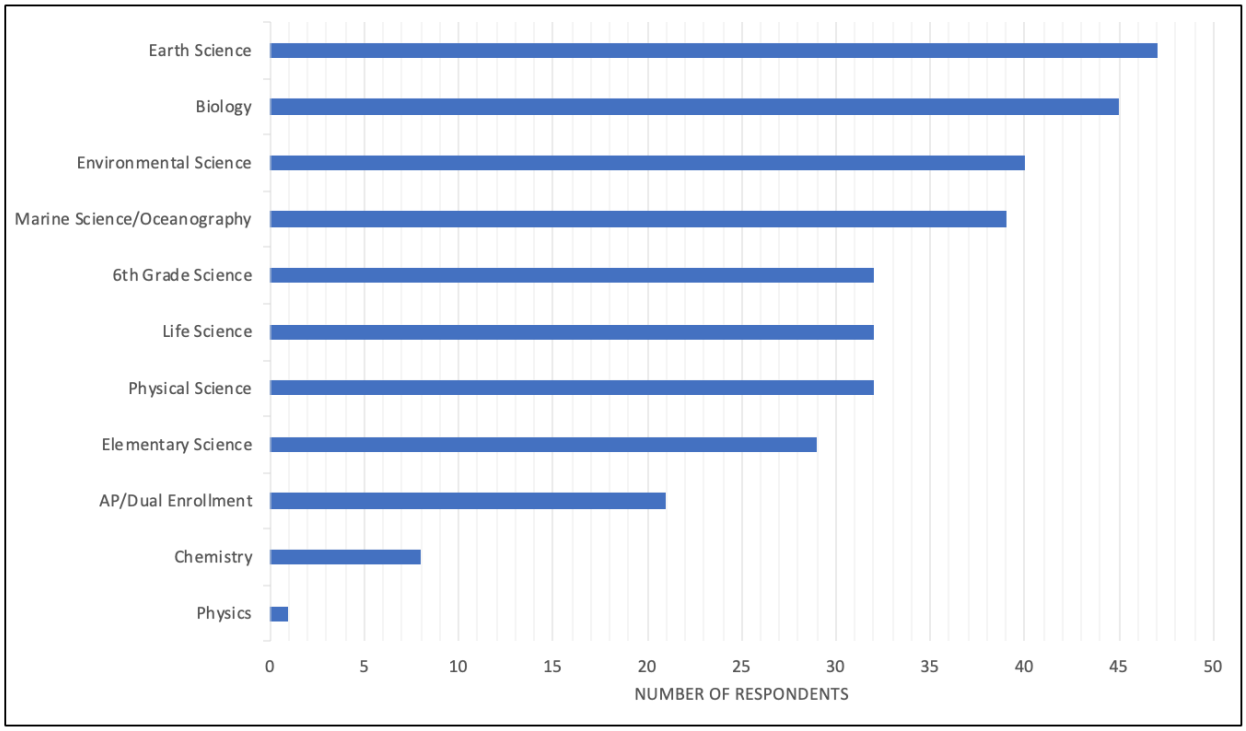

Figure 2. Subject taught by number of total respondents.

Years Teaching

Respondents exhibited a wide range of teaching experience, but generally had more than 10 years of experience across each of the three binned categories. Among elementary and middle school respondents, the most common response was *>20 years* at 45.16% and 36.49% respectively. For high school respondents, the most common response was *16-20 years* at 26.74%. There is reasonable variation among the three binned categories, but in general survey respondents had been teaching for a relatively long amount of time. The least common response for elementary and high school respondents was *0-2 years* at 0% and 2.33% respectively, while the least common response for middle school respondents was *3-5 years* at 4.05%.

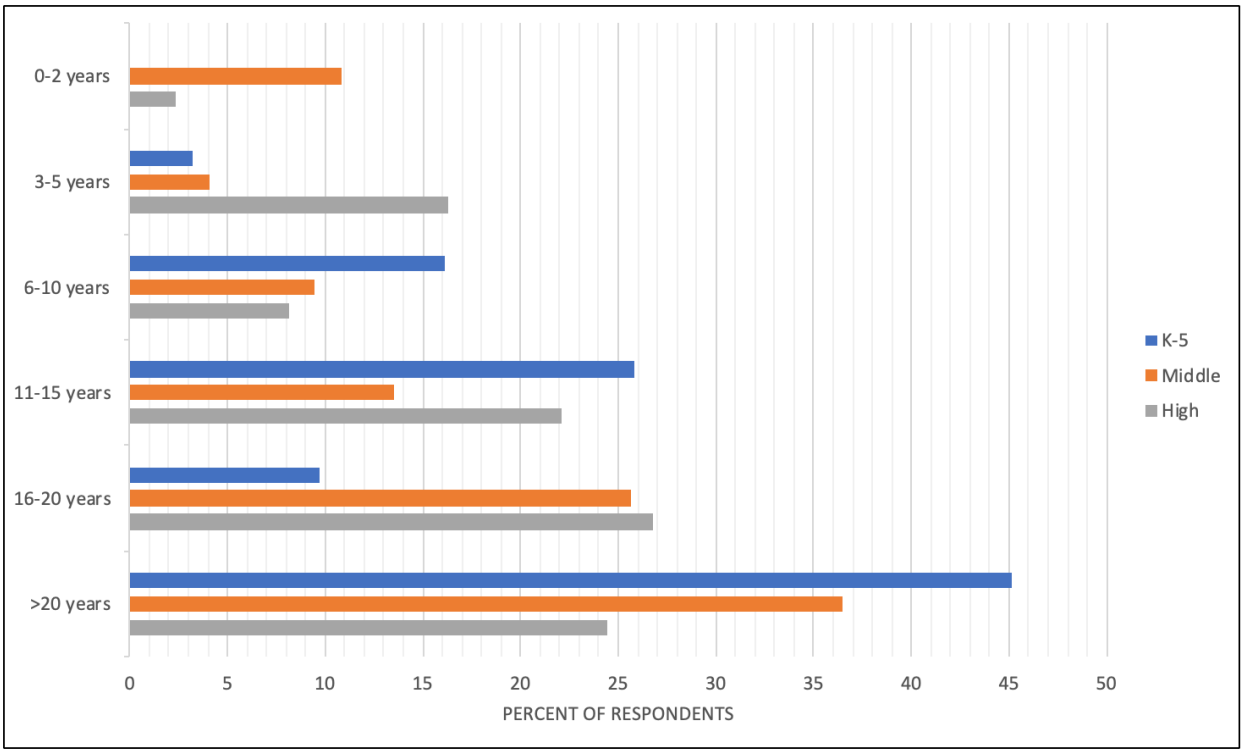

Figure 3. Years teaching by binned grade level.

General Class Structure

Students per Year

Class size and time available for instruction are two important determinants when developing classroom curriculum and/or other instructional materials. Response rates for students taught on an annual basis, by binned grad levels, are provided below. Class size was smaller for the K-5 grade levels, where the greatest response rates were *1-25* and *26-50* student classroom size categories. Small class sizes would be expected given that most students at this level are assigned to a single teacher. In responses from middle and high school educators, where teachers are assigned to teach specific disciplines to rotating classes, the most common responses were *101-125* and *126-150* respectively.

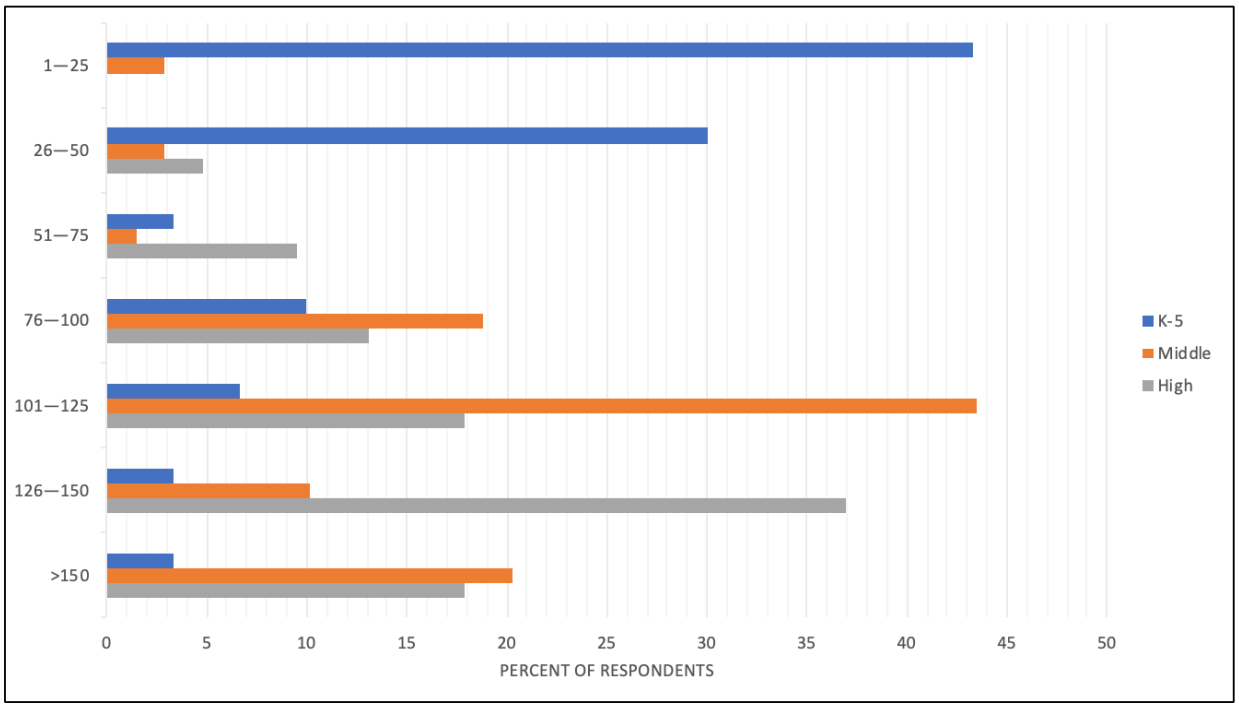

Figure 4. Number of Students taught in each binned grade level.

Length of Class

Regarding time for class instruction, there was a general trend of increasing time for science instruction with increasing grade level (see Figure 5). Eighty-seven percent of K-5 grade level respondents reported having *less than 60 minutes* dedicated to science each day, whereas middle school responses were split somewhat evenly between *40-60* and *>80 minutes* per science class. Seventy-five percent of high school respondents indicated that classroom time for instruction was *>80 minutes*.

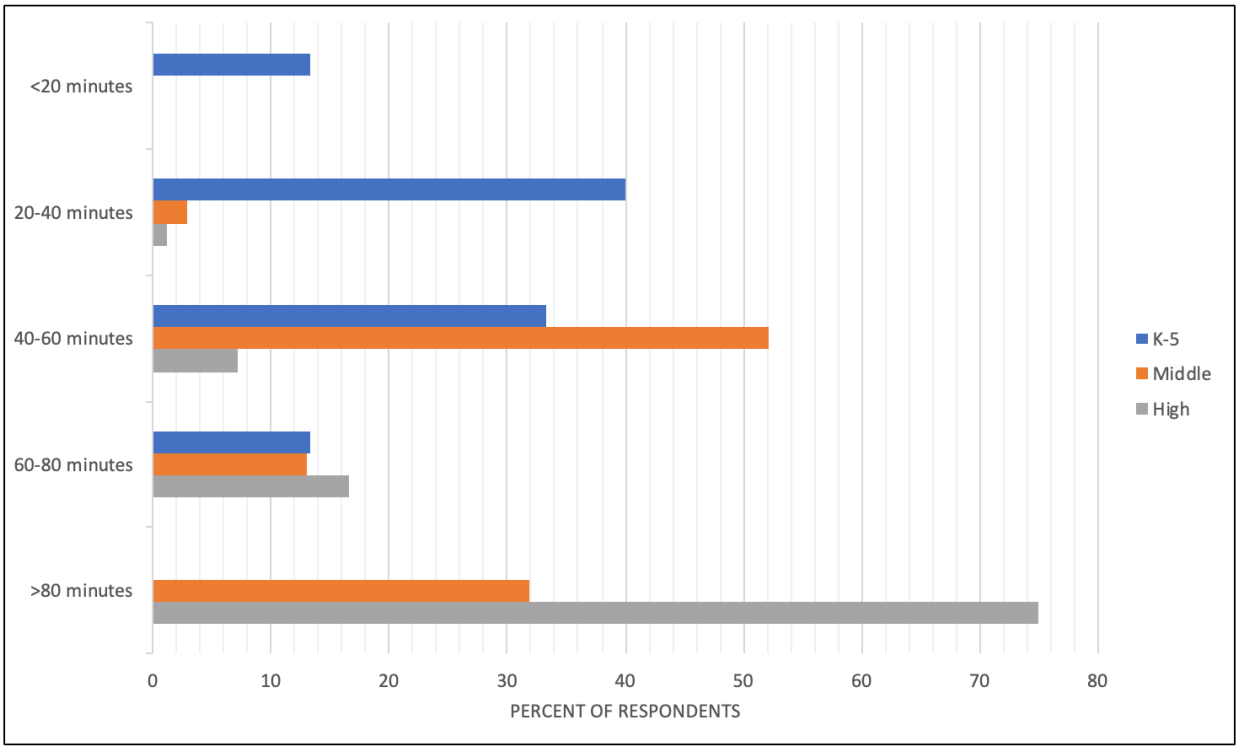

Figure 5. Average class length in minutes by binned grade level.

Computers

Computers may be used to access online or digital educational resources in the classroom, and the majority of educators across all three levels of binned data reported having access to a computer. Ninety-seven percent of K-5 educators reported access to a computer, while 88.1% of high school educators reported their students having access to a computer. Middle school educators reported the lowest percentage, at 72.46%. It should be noted that the specific survey question did not ask if computers were 1:1 per student, or if just one computer for the entire classroom.

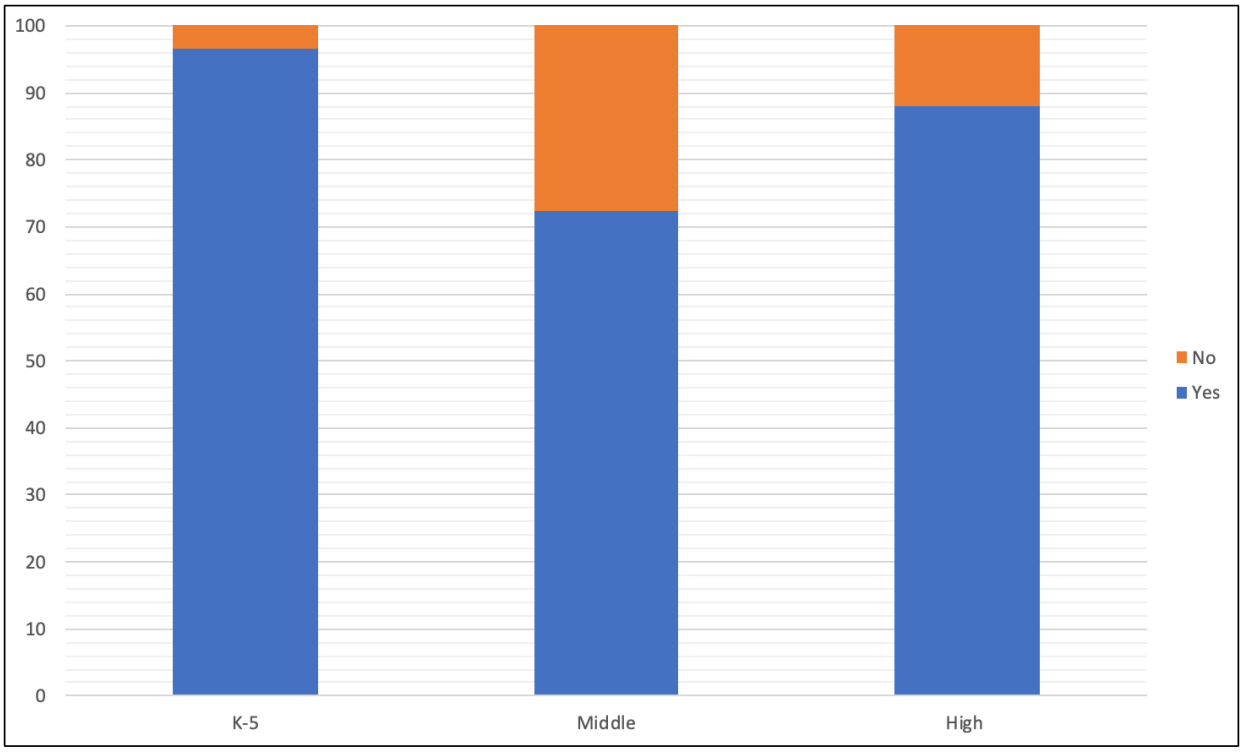

Figure 6. Percentage of teachers with access to a computer in the classroom, by binned grade level.

Course Planning and Content

Emphasis

Educators were asked about their current emphasis on different subjects on a scale of high emphasis, moderate emphasis, low emphasis, and not applicable (n/a). The area with the most emphasis currently among all three binned grade levels (K-5, Middle, High) is *scientific inquiry skills,* at 60%, 79.7%, and 61.9% respectively. There currently is not high emphasis on *outdoor experiential* among the three binned grade levels (K-5, Middle, High) with only 10%, 5.8%, and 14.3% respectively, nor is there high emphasis on *stewardship projects or activities* at 10%, 17.4%, and 14.3% respectively.

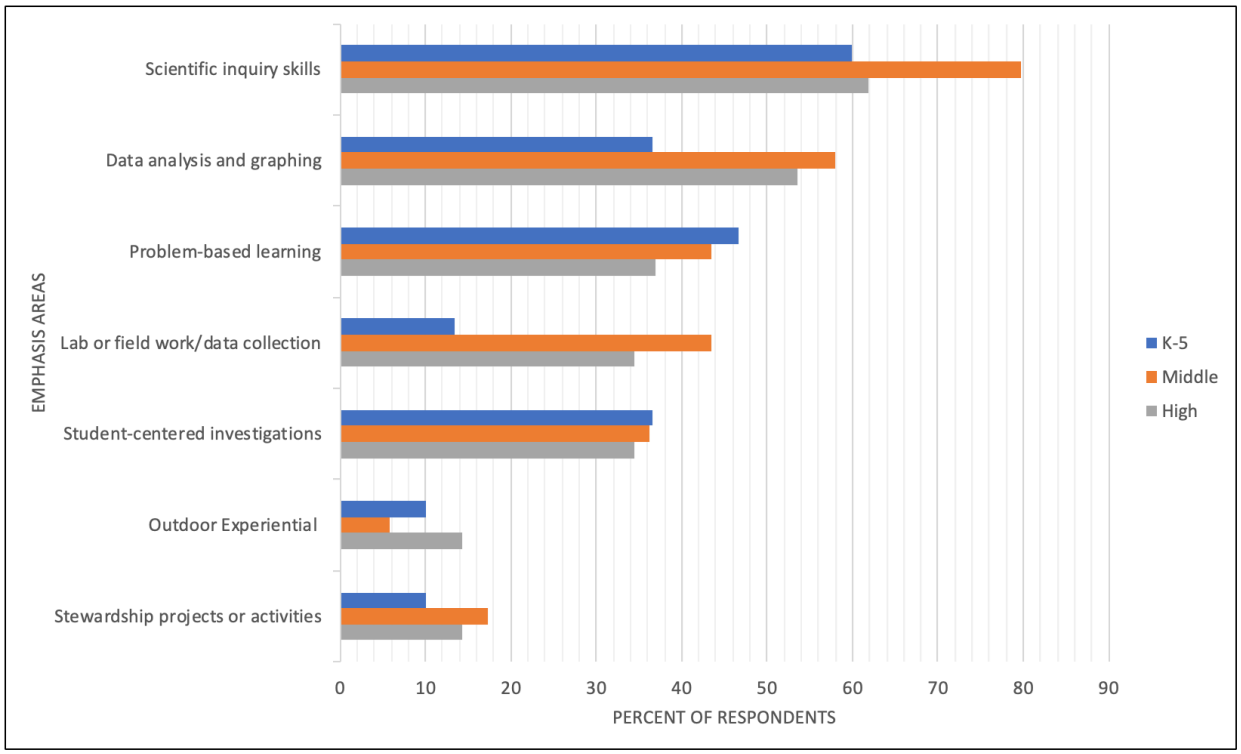

Figure 7. Percent of high emphasis responses in different areas among the binned grade levels.

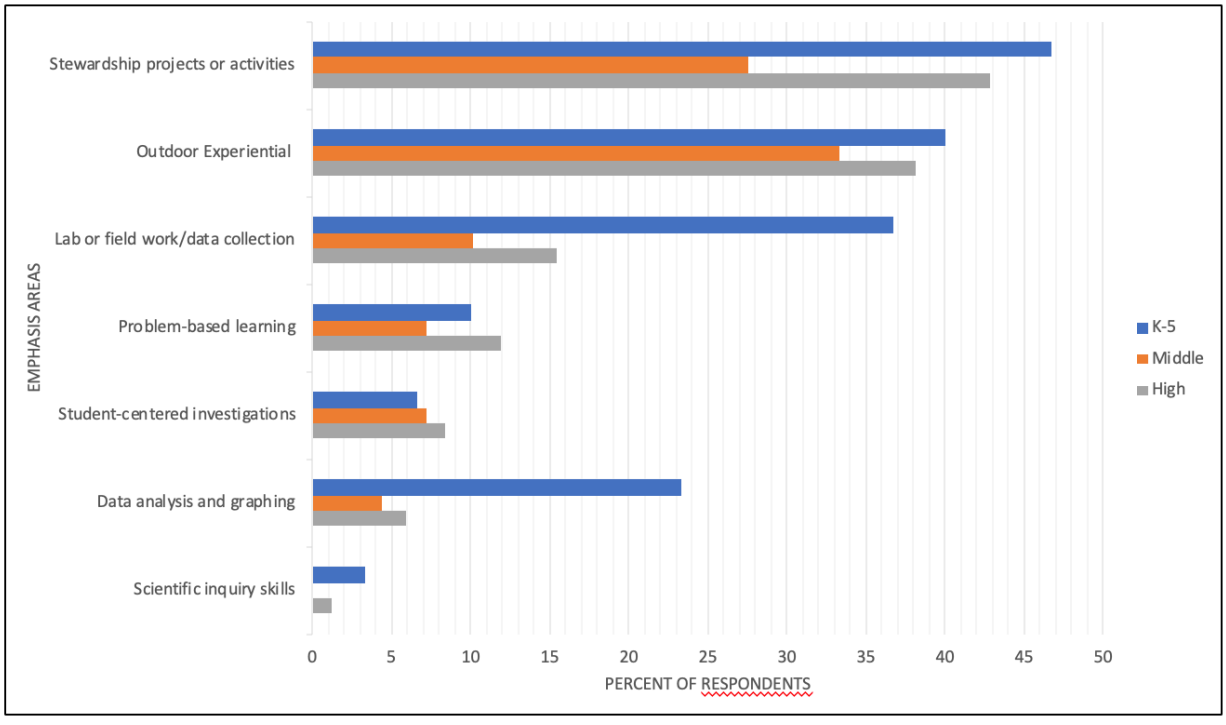

Figure 8. Percent of low emphasis responses in different areas among the binned grade levels.

Outdoor Education Help Needed

There are slight differences in the types of help that educators would like to receive regarding outdoor education. Seventy-six percent of high school teacher respondents reported that they would prefer help with *facilitating field work and data collection* from CBNERRVA. For both the K-5 and middle school teacher respondents, the most common need was with *facilitating inquiry-based activities* at 72.4% and 68.1% respectively. Although almost all of the answer choices did receive substantial support, *guidance on monitoring students' behavior in outdoor activities* received the least support across all three binned data sets (K-5, Middle, High), at 41.4%, 21.7% and 26.2% respectively.

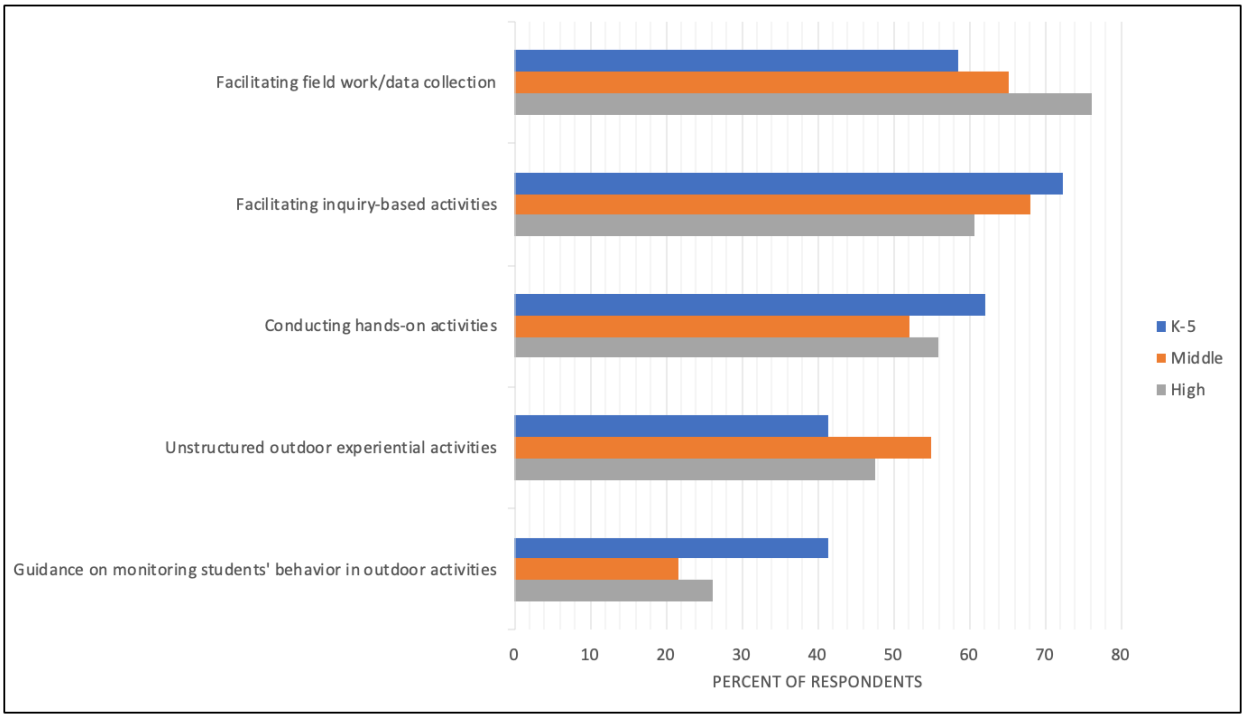

Figure 9. Preferred help for outdoor education, by binned grade level.

Hindrances

Across all three binned data sets (K-5, Middle, High), *funding* served as the most prevalent hindrance for integration of outdoor educational activities, at 62.1%, 68.1%, and 67.9% respectively. The second most prevalent response for the middle and high binned data sets was *transportation issues*, at 52.2% and 53.6% respectively. For K-5 educators, the next most

common responses were *lack of knowledge in outdoor experiential activities* and *lack of knowledge of flora and fauna* in the field at 37.9% each.

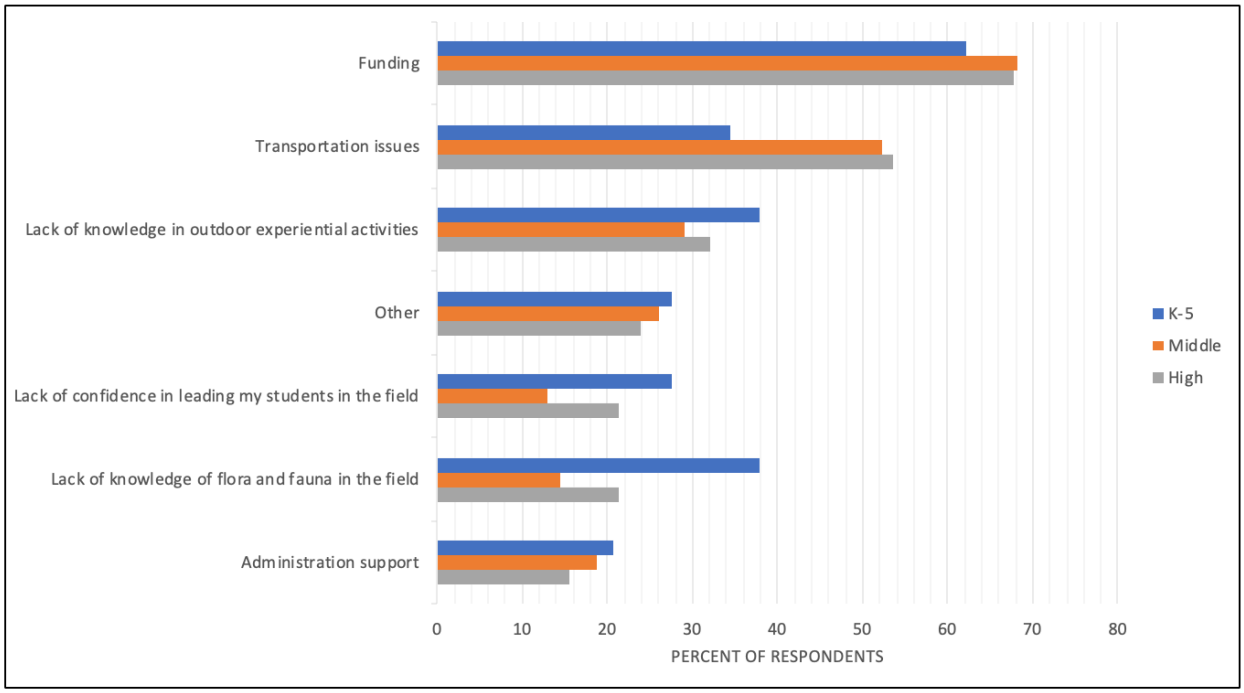

Figure 10. Factors preventing educators from implementing outdoor education, by binned grade level.

Teacher Professional Development

Subject Needs

Figures 11 (K-5), 12 (Middle), and 13 (High) below represent the respondents' indicated need for additional resources and help that CBNERRVA could provide. The respondents were asked the severity of need for the different subjects, ranging from *marine organisms* to *current scientific research*. The rankings of severity included "Do not need", "Need", and "Highly need". On the charts below we have only represented the percentages of respondents with "Need" and "Highly need", with the remaining percentage up to 100% representing "Do not need". Overall, there was a wide range of needs by the different groups of educators, and no subject received a response rate that was less than 30%.

In the K-5 binned data set, the most prevalent subject need was concerning *mid-Atlantic habitats (wetlands, seagrass, oyster reefs, etc.)*, with 86.2% of respondents indicating some severity of need in this subject area. The next two most prevalent subject need responses were *technology & instrumentation* and *human impacts (pollution, greenhouse gases, habitat loss, etc.)* at 82.8% each. In the middle school binned data set, the most prevalent subject need was *current scientific research* at 88.4% respondents. The next most common response was *Chesapeake ecology & watershed*, followed by *stewardship projects*, at 87% and 85.5% respectively. In the high school binned data set, the most prevalent subject need was *stewardship projects* at 91.7%, which was the highest response rate of any of the subject needs in any of the binned grade levels. This was followed by *current scientific research* and *technology & instrumentation*, at 89.3%and 85.7% respectively.

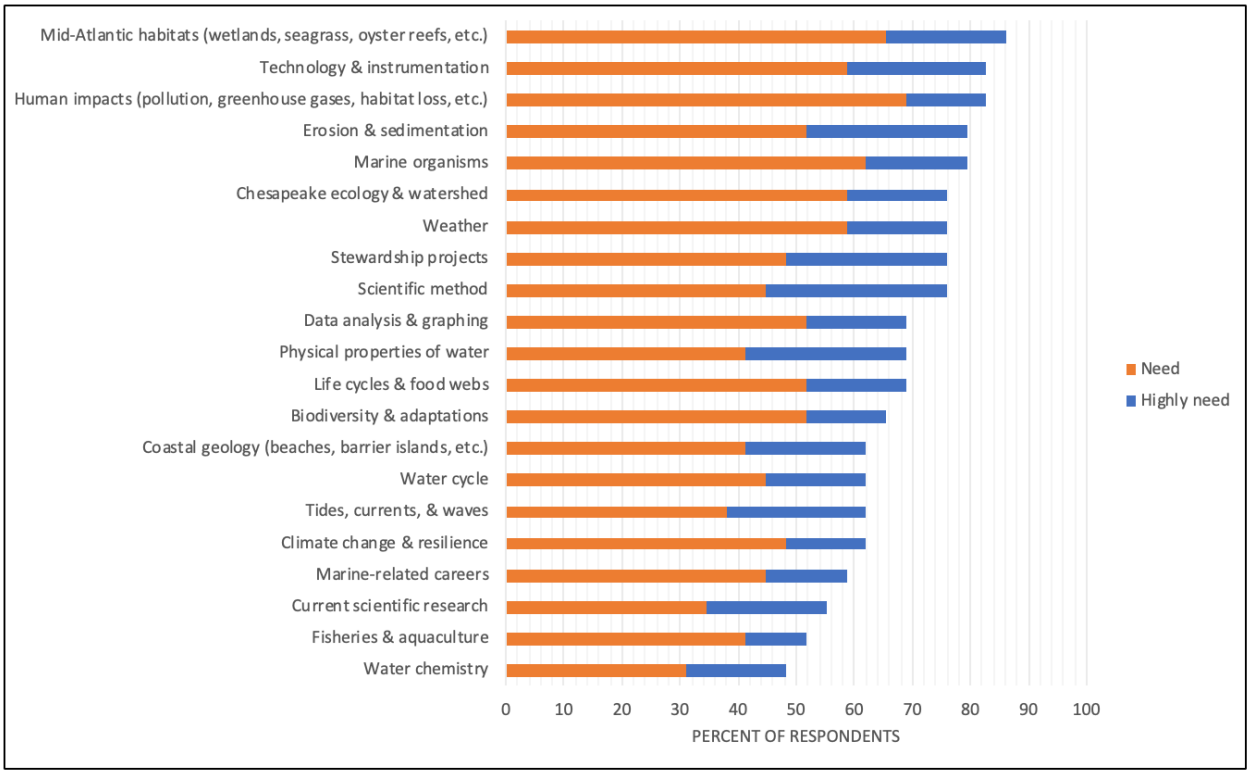

Figure 11. Subject Needs by Percentage of K-5 respondents

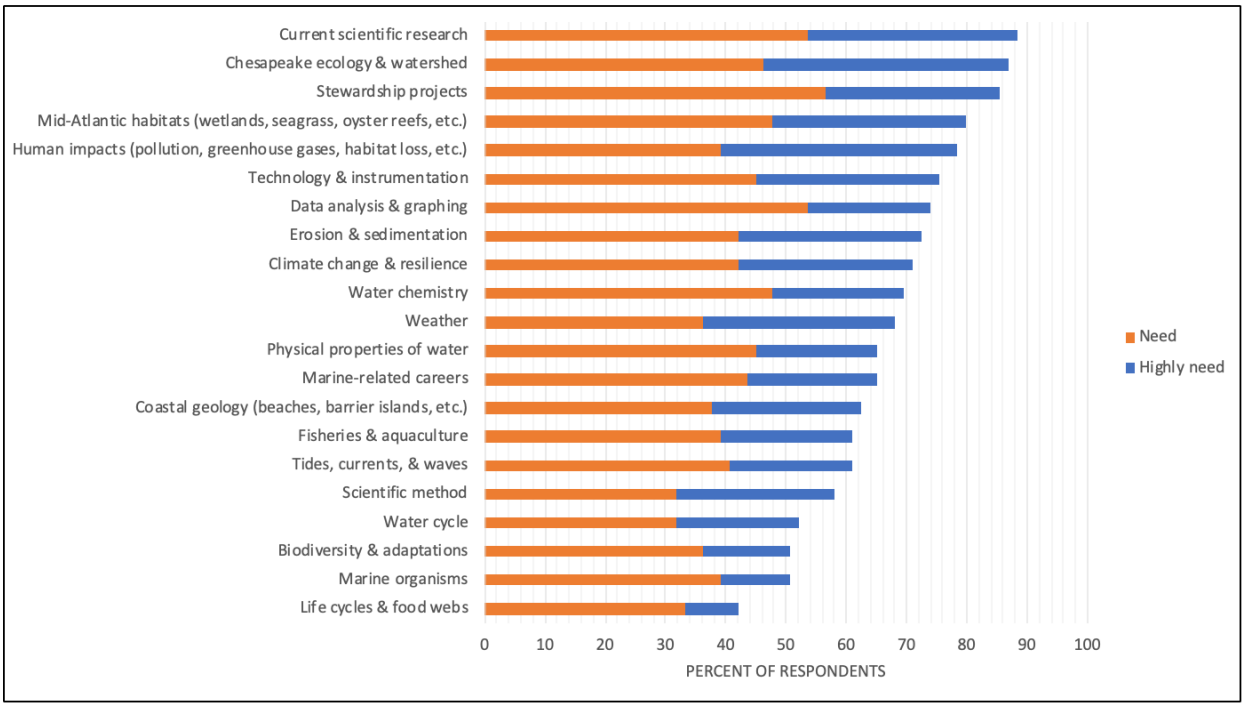

Figure 12. Subject Needs by Percentage of Middle School respondents

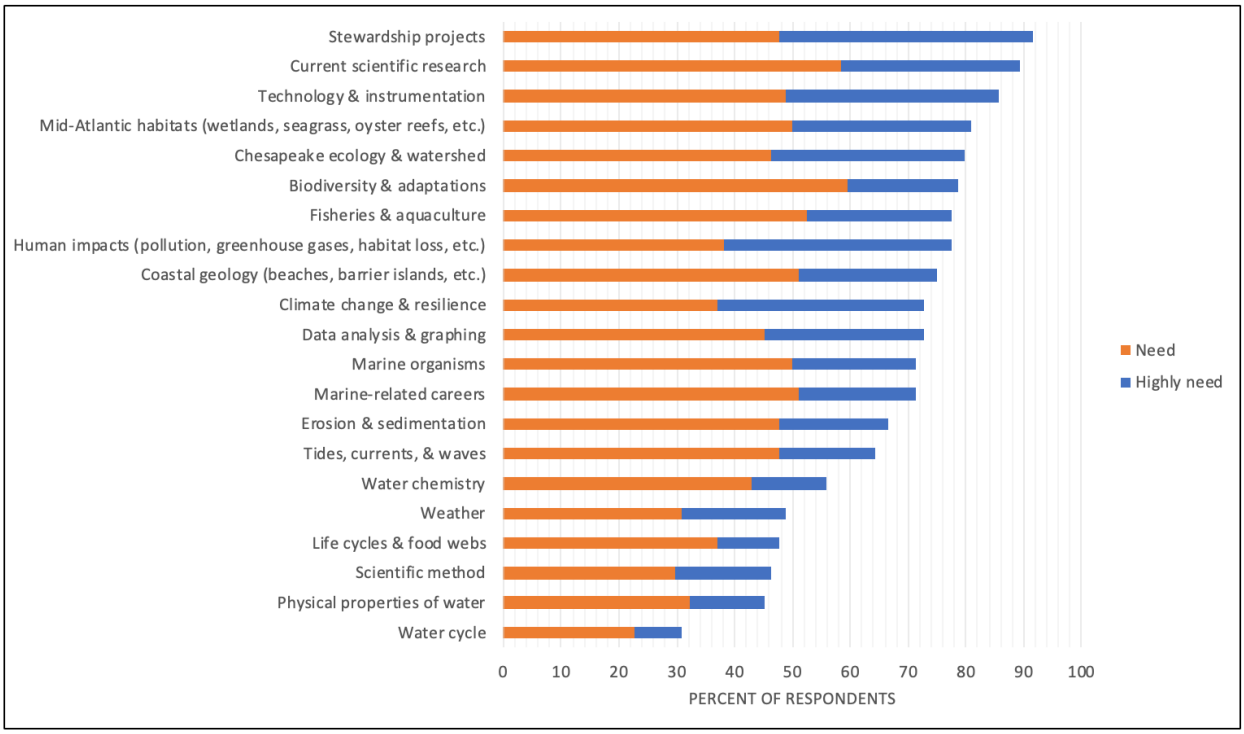

Figure 13. Subject Needs by Percentage of High School respondents

Types of Professional Development

Among the different preferred types of professional development, there is general consensus among middle and high school educators, and slight differences among K-5 educators. K-5 educators' leading answer was *facilitating inquiry-based activities* at 69%, followed by *conducting hands-on activities* and *incorporating new lab activities* at 55.2% each. The top three choices for both the middle and high school bins in descending order were *incorporating new lab activities, facilitating field work/data collection,* and *using real-time or archived data from monitoring sites* (middle school respondents - 73.9%, 63.8% and 63.8% respectively; high school respondents - 71.4%, 70.2%and 67.9% respectively).

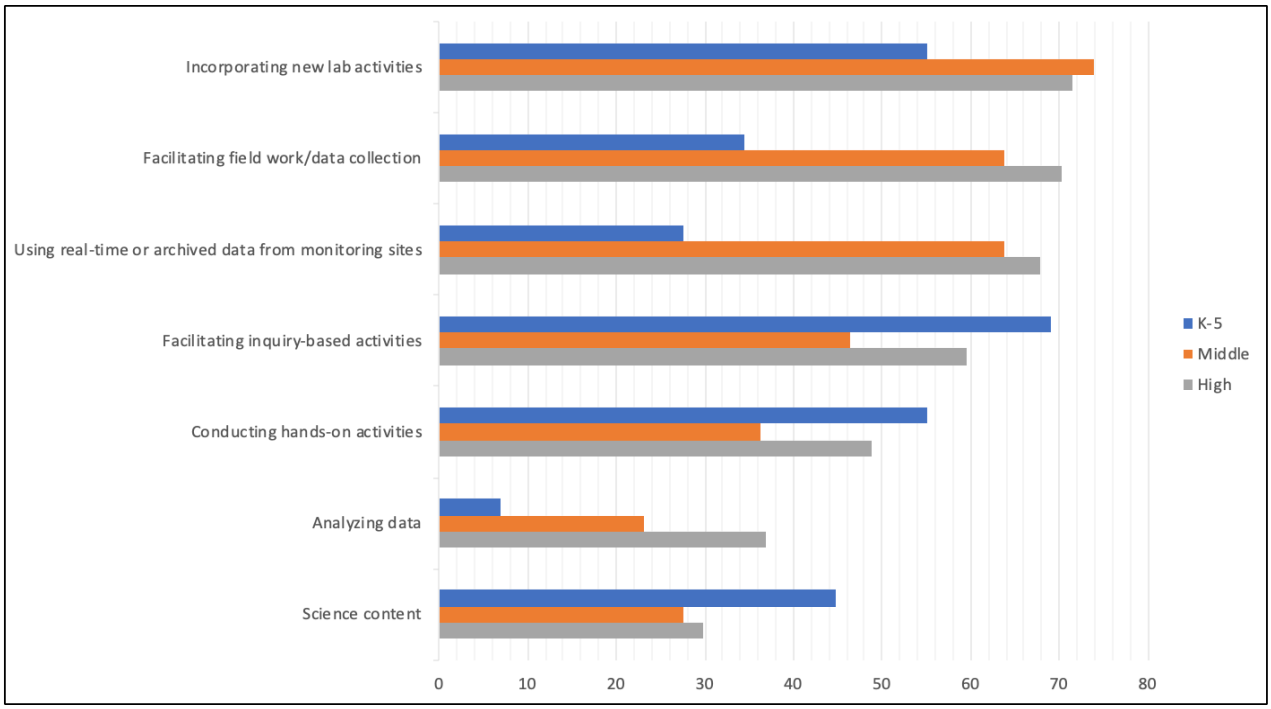

Figure 14: Professional development needs by binned grade levels

Experiences Sought in CBNERRVA/VIMS Training Program

CBNERRVA and VIMS professional development trainings may include experiences such as field studies, lab investigations, and classroom sessions. All three options are generally popular with each binned grade levels, but there are key differences. K-5 educators' preference was

classroom sessions at 82.8%, while the least popular option was *field studies* at 44.8%. Middle school educators' most popular option was *classroom sessions* at 73.9%, while the least popular option was *field studies* at 71%. High school educators' most popular option was *lab investigations* at 84.5%, and their least popular option was *classroom sessions* at 73.8%.

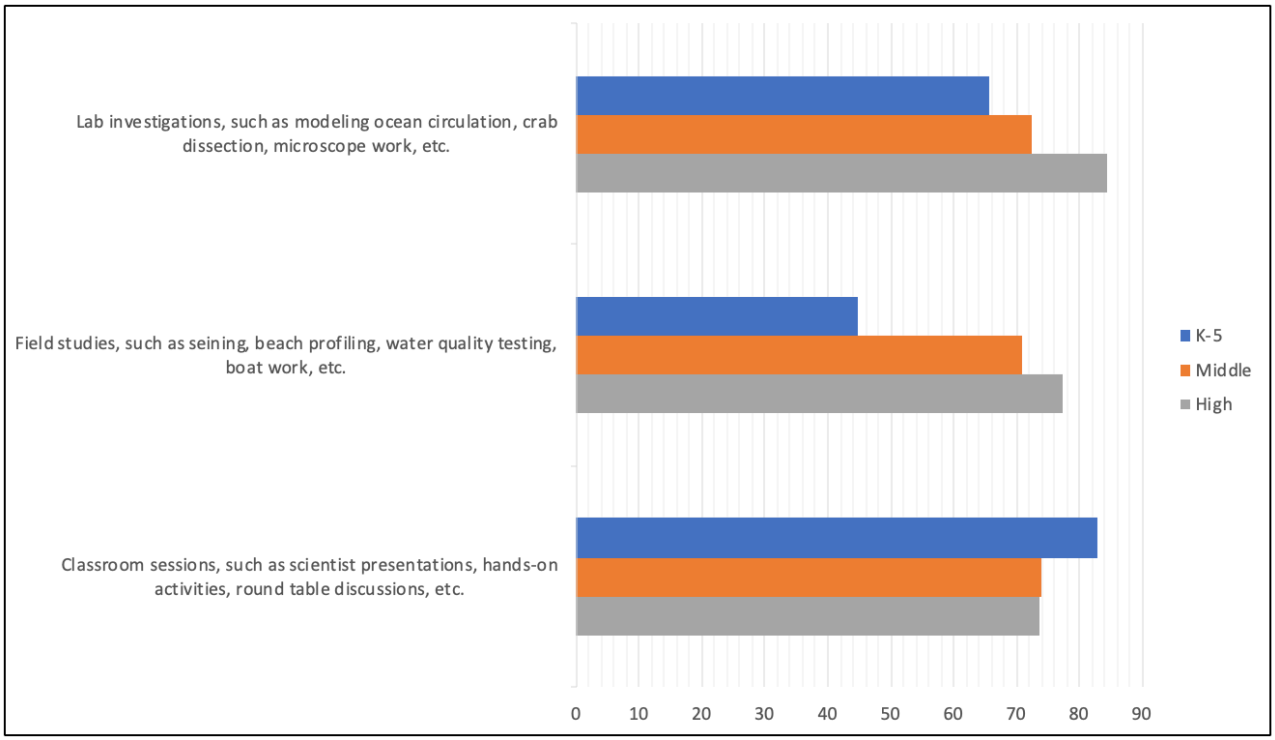

Figure 15: Types of experiences sought in professional development.

Data sets

CBNERRVA has the ability to provide real-time and archived data sets to educators as a part of professional development trainings, and as a general classroom resource. Figures 16 (K-5), 17 (Middle), and 18 (High) show the educators' preferences for different types of data sets. There was a wide range of preferences among the three binned data sets, with major differences inherent from different educational standards.

Among K-5 educators, the most common response was *weather data* at 58.6%, followed by *temperature: air* and *temperature: water* at 48.3% each. The least common response of those listed was *pH* at 20.7%. Overall, there was less enthusiasm for these data sets among the

surveyed K-5 educators compared to the surveyed middle and high educators. Among middle school educators, the most common response was *dissolved oxygen* at 73.9%, followed by *algal blooms* at 69.6% and *nutrients* at 66.7%. The least common response of those listed was *water depth* at 14.5%. Among high school educators, the most common response was *algal blooms* at 71.4%, followed by *sea level rise* at 65.5%, and *dissolved oxygen* and *nutrients* at 63.1% each. The least common response for high school educators was the same as that for middle school educators, *water depth* at 27.4%.

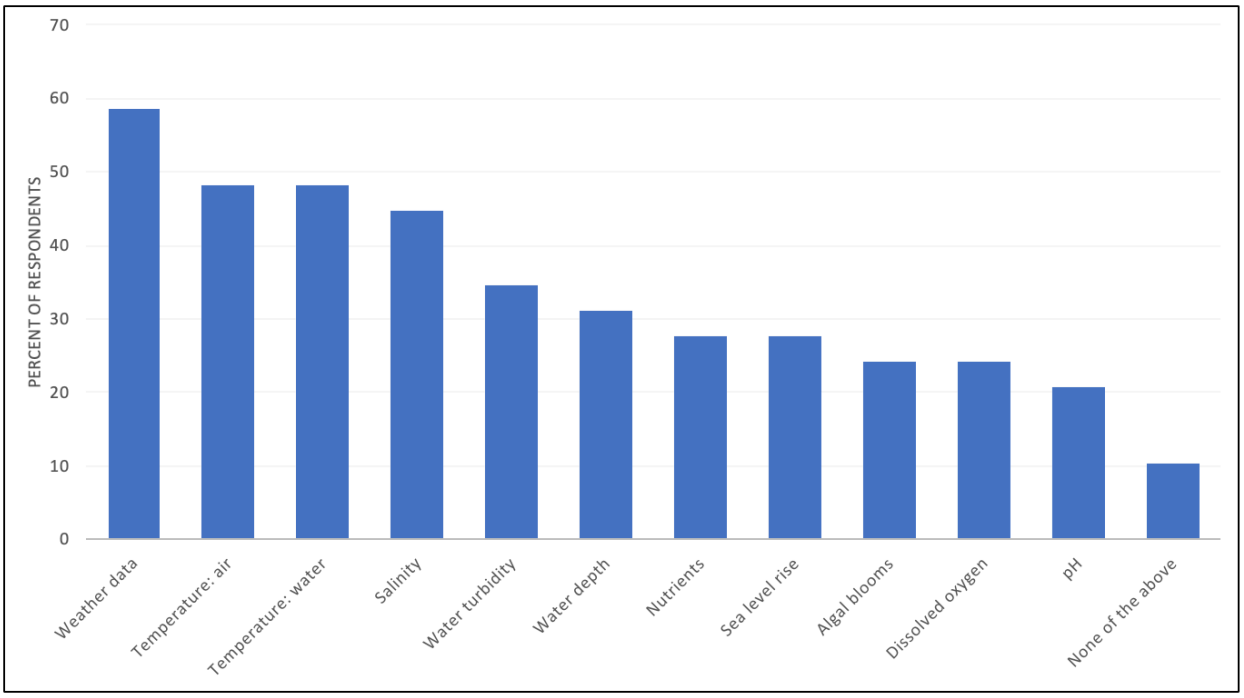

Figure 16: Preferred real time and archived data sets of K-5 educators

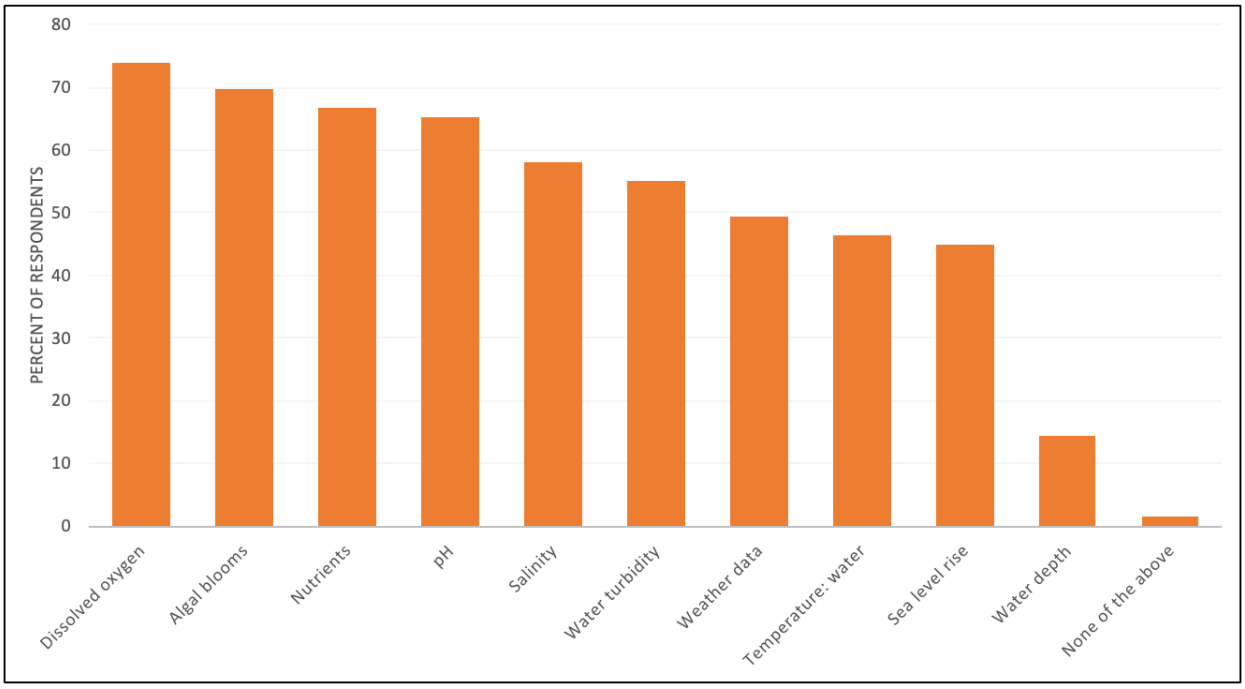

Figure 17: Preferred real time and archived data sets of middle school educators.

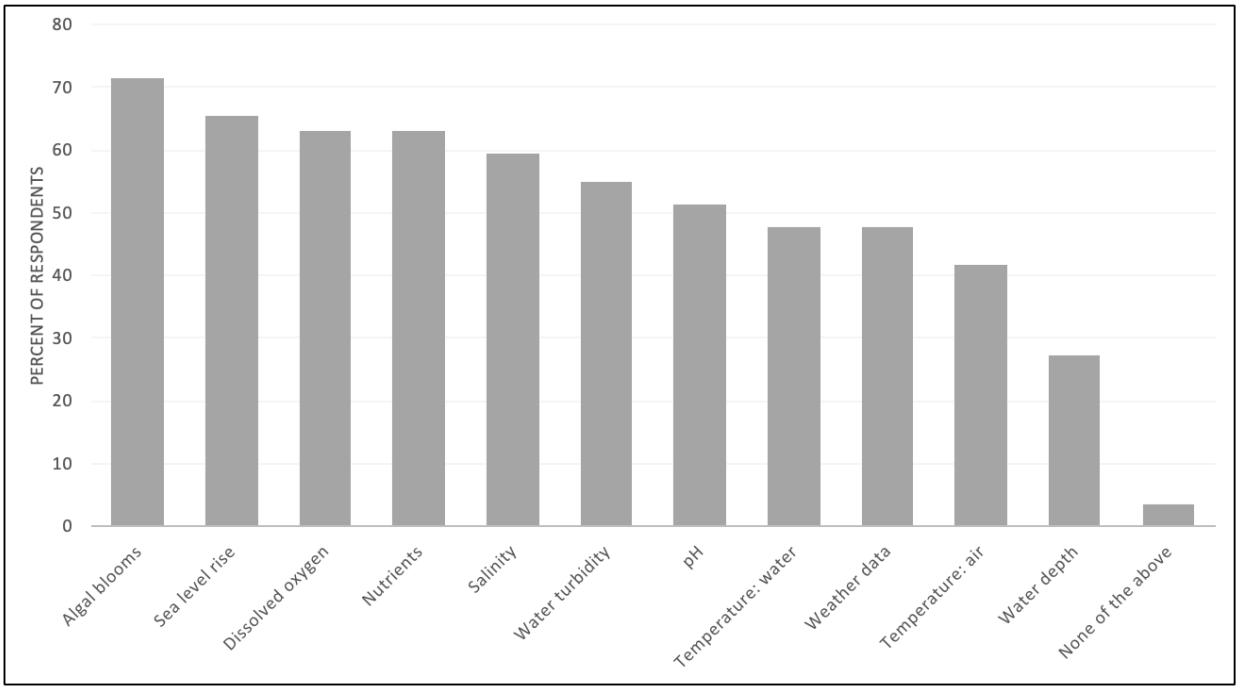

Figure 18: Preferred real time and archived data sets of high school educators.

Motivations

The motivations for attending professional development of the three different binned grade levels surveyed were very similar across the eight options that were available to them. Educators were asked to rank the motivations from 1 to 8, with "1" being their primary motivation and "8" being little to no motivation. The highest ranked motivation among K-5 and middle educators was *interest in subject matter* with average rankings of 2.7 and 2.8 respectively, closely followed by *desire to increase my knowledge base in teaching and subject matter* with average rankings of 2.8 and 2.9 respectively. For high school educators the results were inversed, with *desire to increase my knowledge base in teaching and subject matter* being the top average ranking at 2.6, with *interest in subject matter* following with an average ranking of 2.7.

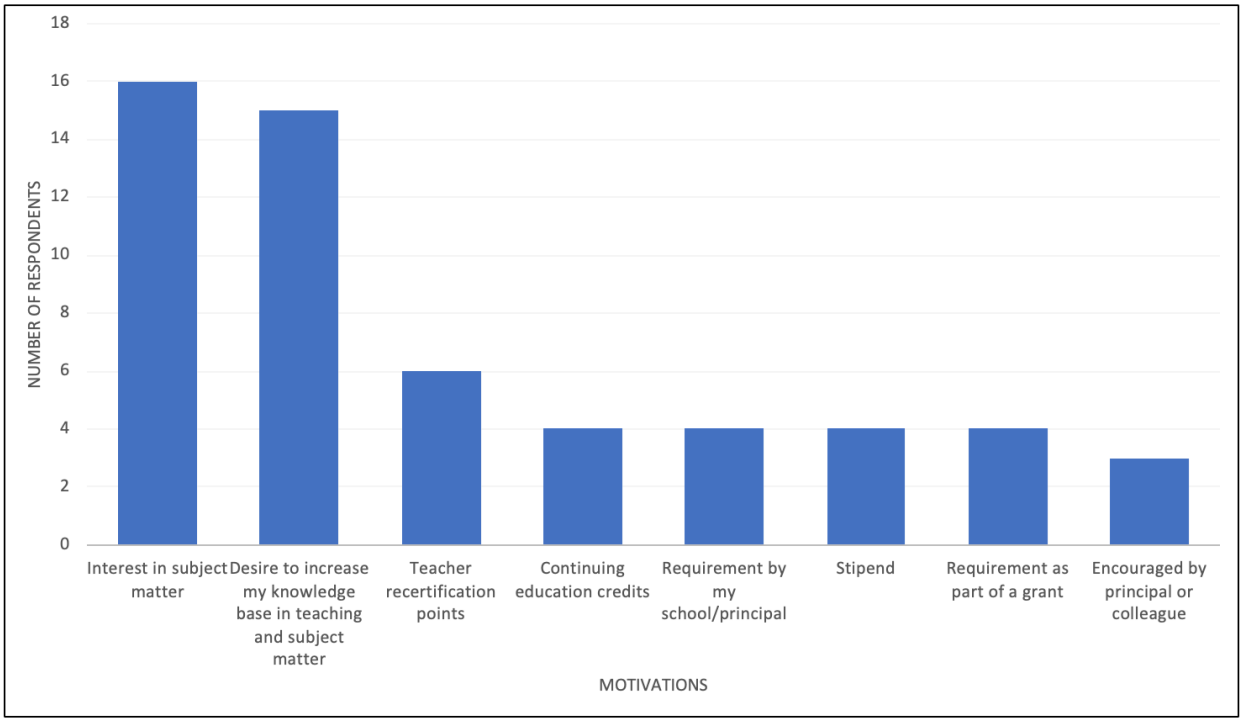

Figure 19: Motivations to attend professional development training of K-5 educators.

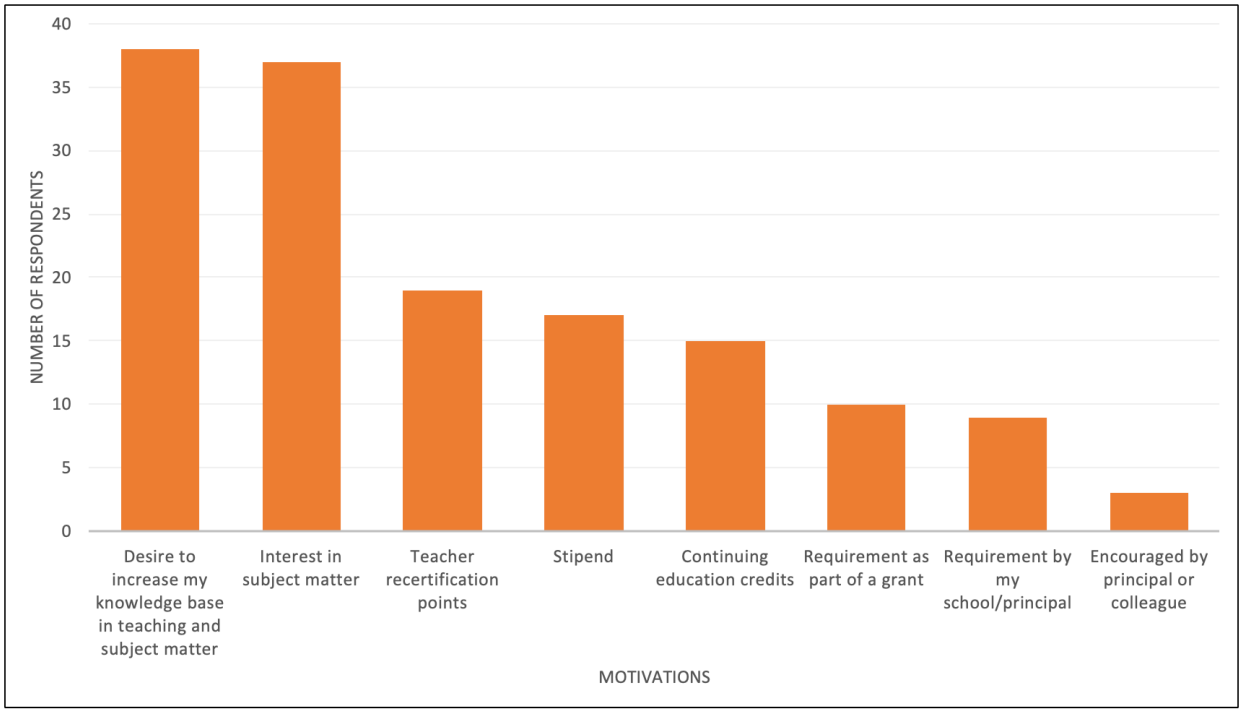

Figure 20: Motivations to attend professional development training of middle school educators.

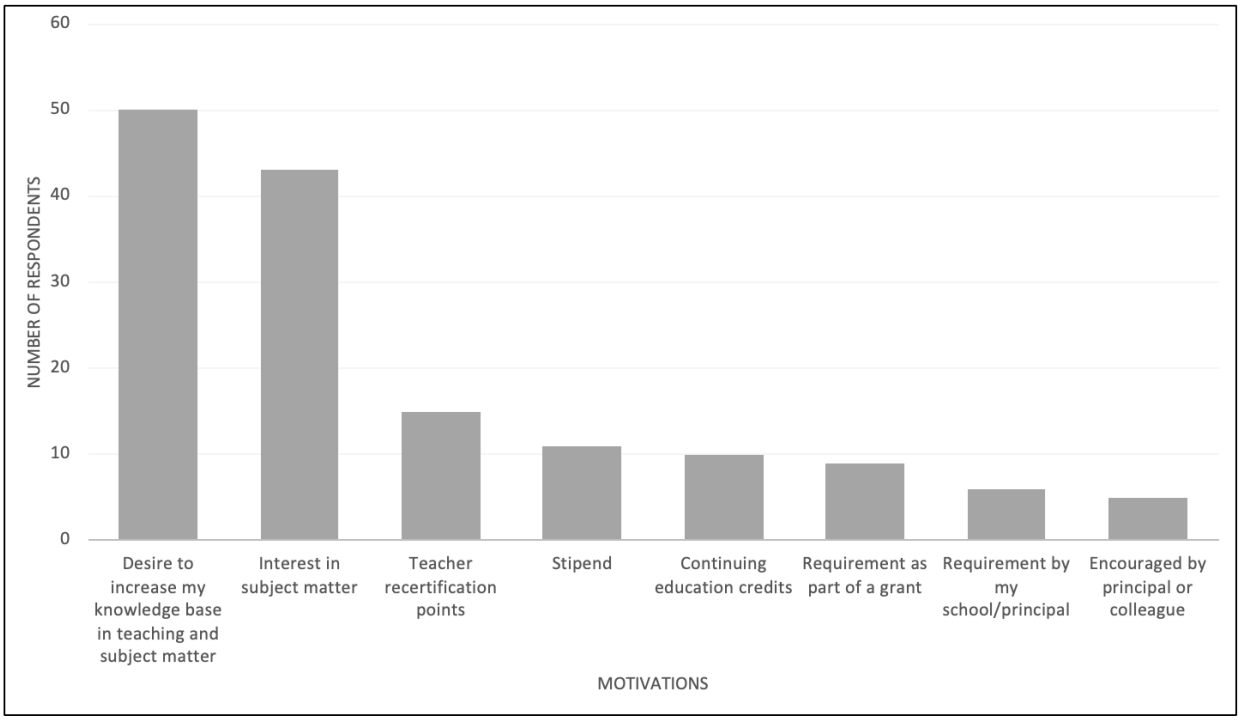

Figure 22: Motivations to attend professional development training of high school educators.

Format

There are slight differences in preferences among the three binned grade levels in terms of the preferred format of future professional development sessions. Respondents were able to choose one or several options depending upon their own preferences. Given that this survey was completed during the COVID-19 pandemic, it is important to note the possible effect upon the survey respondents towards the choice *online training or course* compared to the other options.

The most common response among K-5 and high school educators was *focused 2 or 3-day workshop* at 58.6% and 77.4% respectively. The most common response among middle school educators was *focused 1-day workshop* at 73.9%. The least common response amongst all three binned grade levels (K-5, Middle, High) was *series of after school workshops* at 24.1%, 21.7%, and 20.2% respectively.

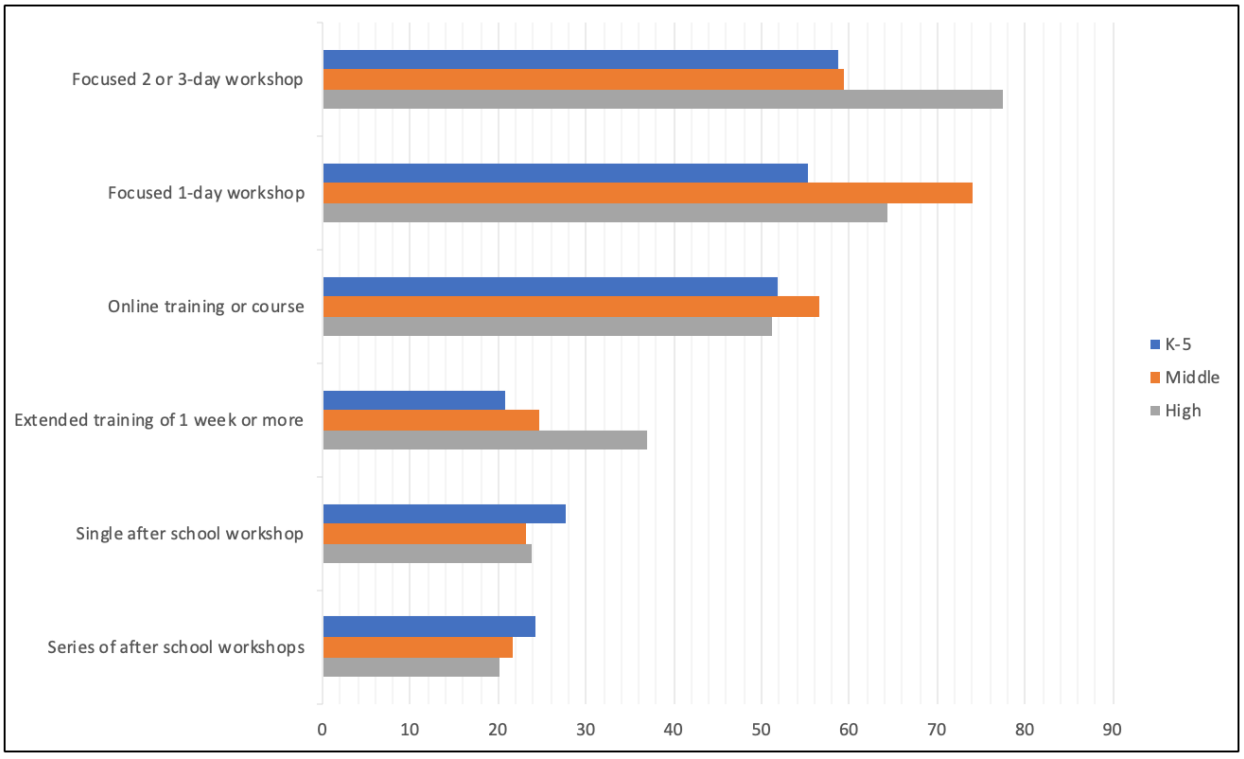

Figure 23: Preferred format of professional development by binned grade level.

Timing for Professional Development

There was consensus among the three different binned grade levels of the preferred timing for professional development training. Respondents were able to select one or several options depending on their preferences. All three binned grade levels (K-5, Middle, High) indicated their preferred timing as *summer* at 72.4%, 76.8%, and 79.8% respectively. No other choice reached 50% among the three binned grade levels. The least preferred option (excluding *not sure/doesn't matter)* for K-5 educators was *weekend* at 17.2%, while the least preferred option (excluding *not sure/doesn't matter)* among middle and high school educators was *evening* at 20.3%and 14.3% respectively.

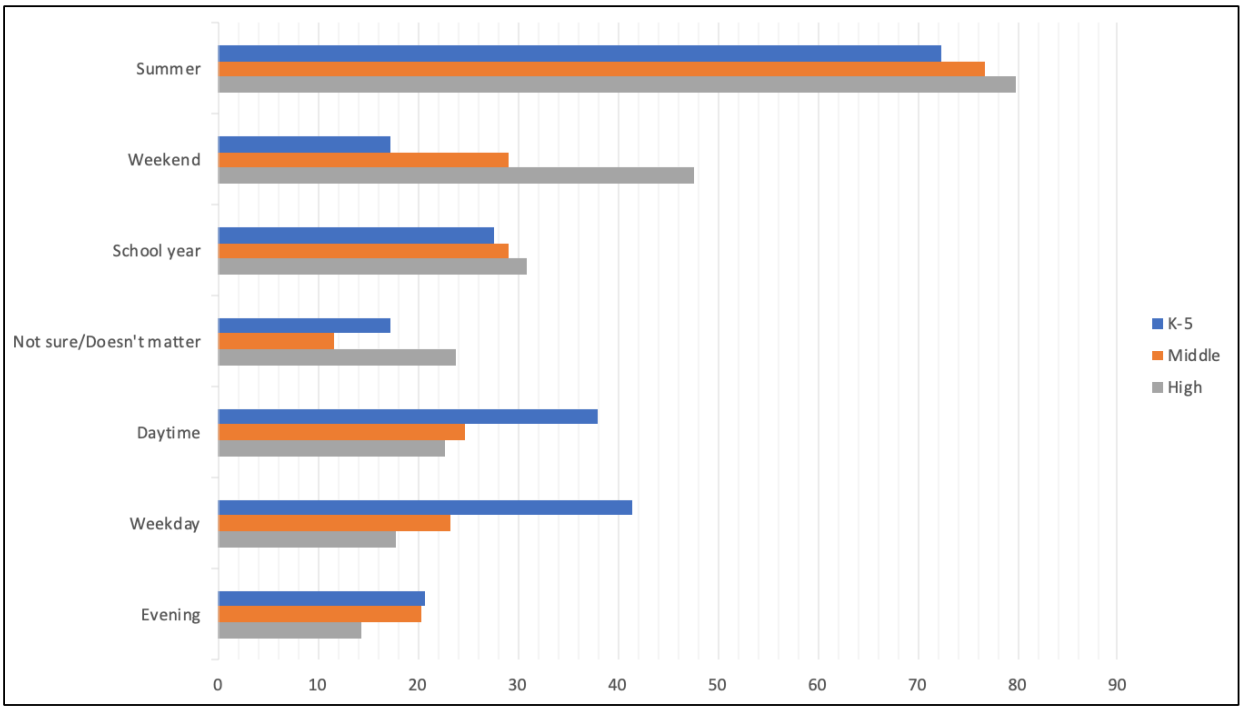

Figure 24: Preferred timing of professional development, by binned grade level category.

Fee

There was variation among the three binned data sets regarding how much they would be willing to pay in fees per teacher to participate in a VIMS workshop or conference. Respondents were only able to choose one response. K-5 educators most common willingness to pay was

<$25 with a response rate of 34.5%, followed by *$50-$100* with a response rate of 31%. Middle school educators most common willingness to pay was *free* with a response rate of 40.1%, followed by *<$25* with a response rate of 23.2%. High school educators most common response was also *free* with a response rate of 29.8%, followed by *$25-$50* with a response rate of 26.2%.

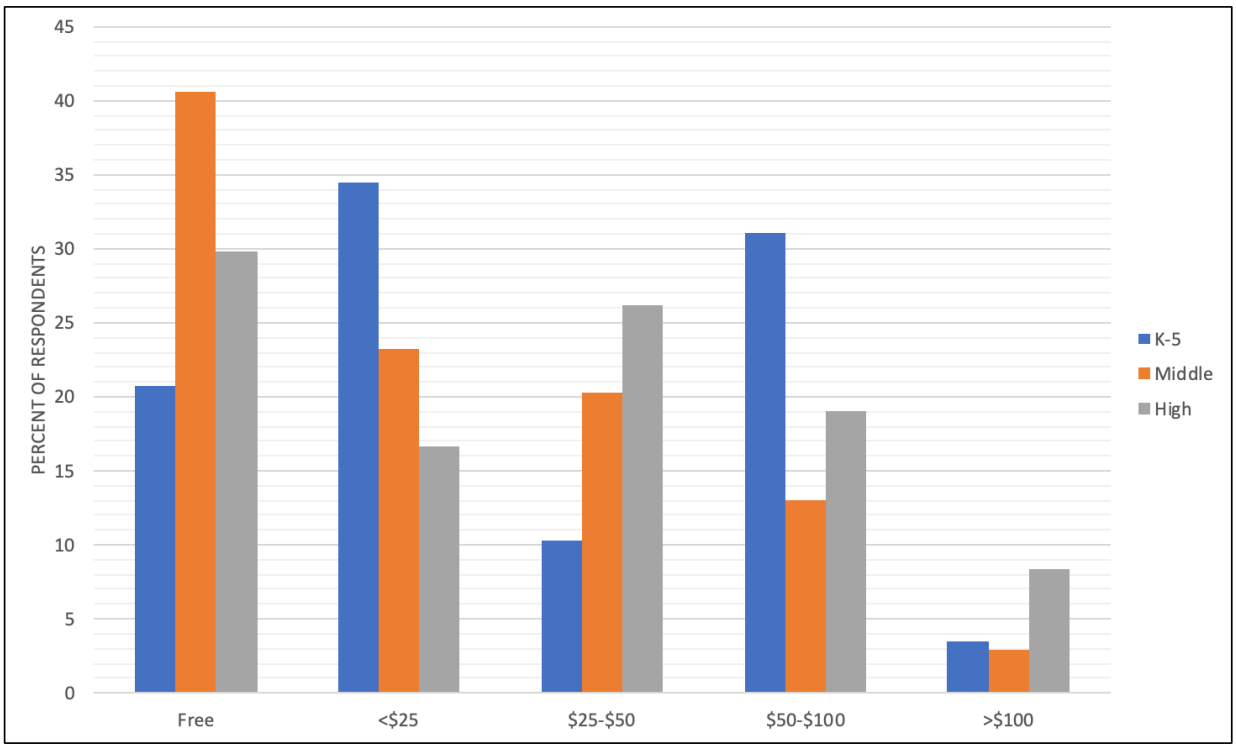

Figure 25: Willingness to pay for professional development, by binned grade level category.

Challenges

Responses were relatively similarly across all three binned grade levels in ranking the different challenges faced in participating in a CBNERRVA/VIMS training program. Respondents were asked to rank the nine options, with "1" being the most challenging and "9" being the least challenging. K-5 educators' highest ranked option was that of *time commitment* with an average ranking of 3.2. Middle and high school educators' highest ranked option was that of *cost* with average rankings of 3.4 and 3.2 respectively. The lowest ranked option amongst all three binned grade levels (K-5, Middle, High) was that of *childcare* with an average ranking of 7.2, 6.9, and 7.1 respectively.

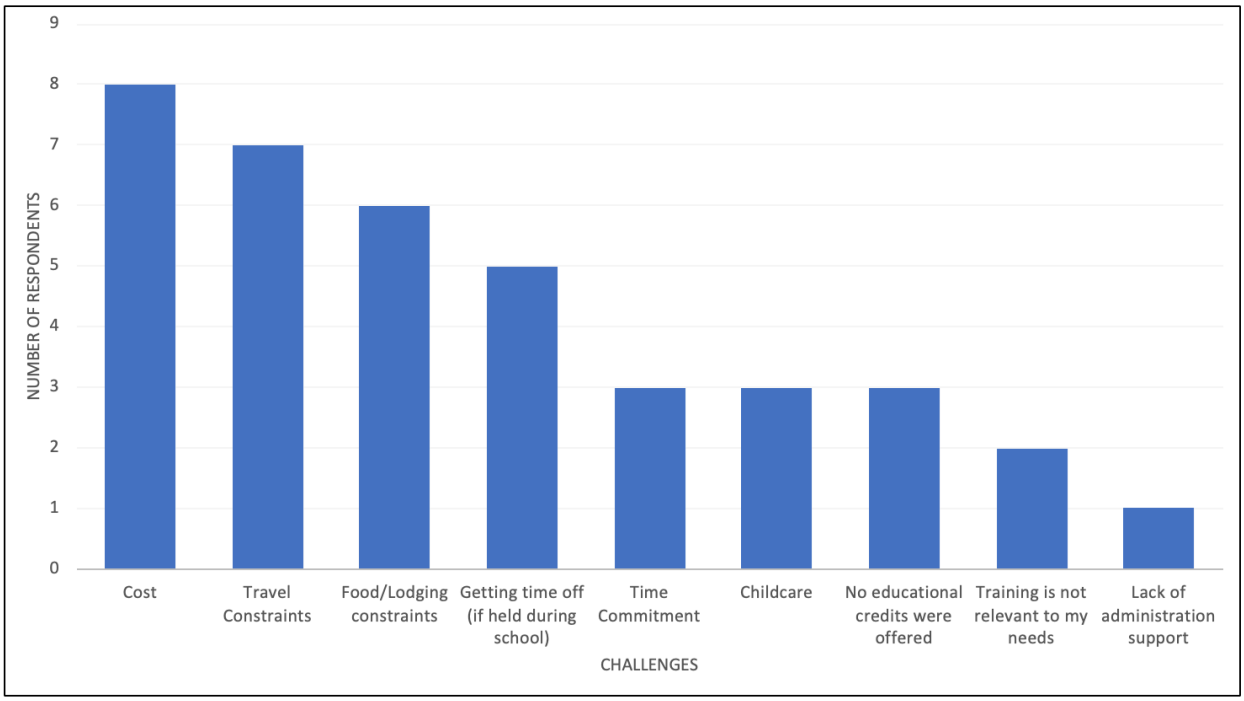

Figure 26: High ranking of possible challenges to participating in CBNERRVA/VIMS training programs for K-5 educators.

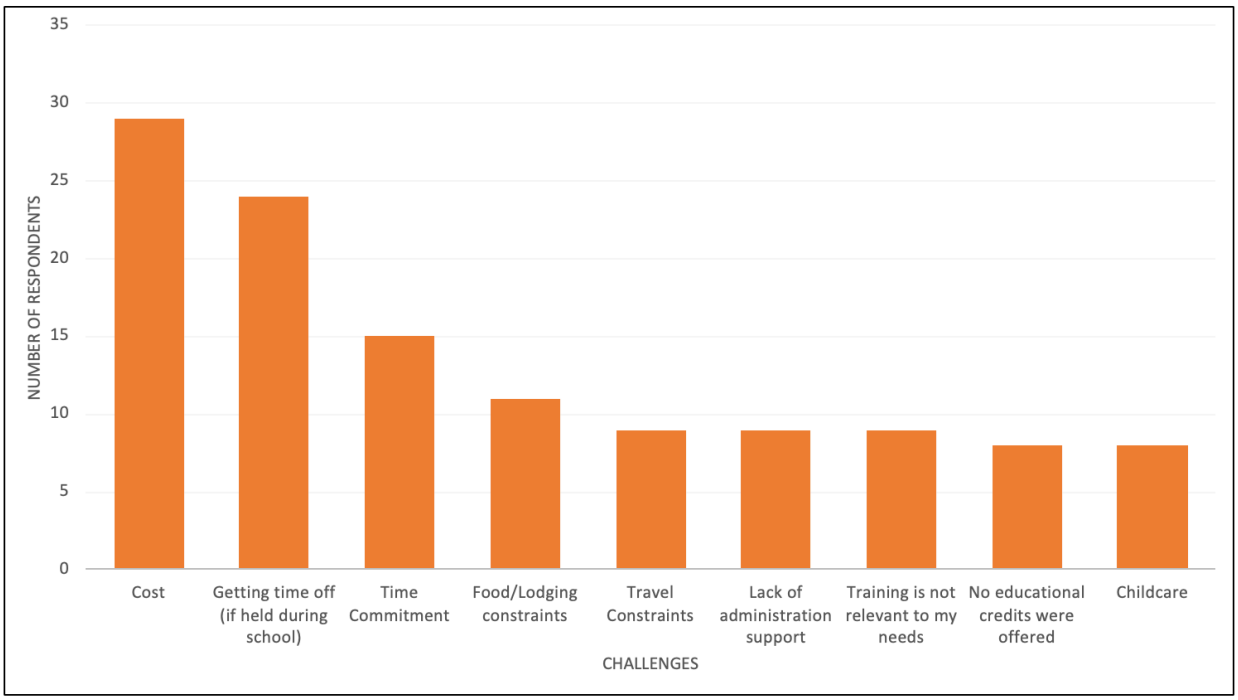

Figure 27: High ranking of possible challenges to participating in CBNERRVA/VIMS training programs for middle school educators.

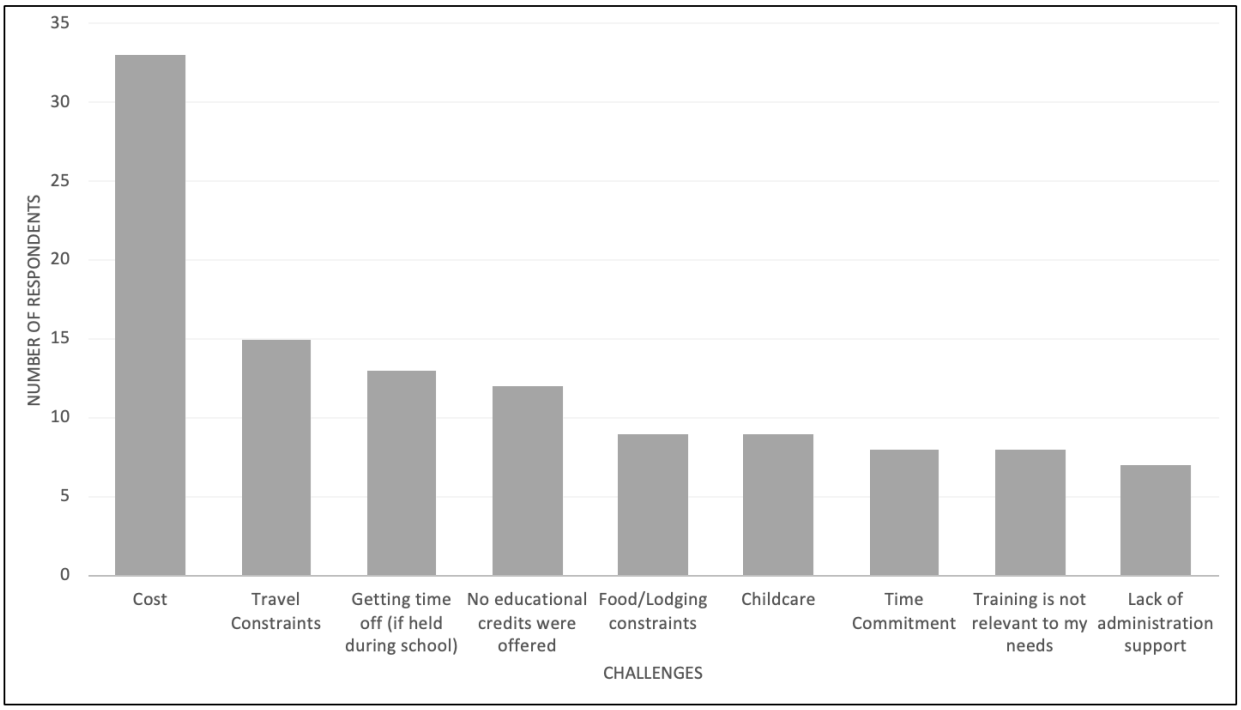

Figure 28: High ranking of possible challenges to participating in VIMS training programs for high school educators.

How do you find out about Professional Development?

Educators in all three binned grade levels generally found out about professional development opportunities in the same ways. Respondents were able to pick one or several options depending on their personal preferences. The most common response for all three binned grade levels (K-5, Middle, High) was *colleagues* at 51.7%, 68.1%, and 66.7% respectively. The next most common response for K-5 educators was *curriculum coordinator* at 37.9%. The next most common response for middle school educators was *department head* at 52.2%. The next most common response for high school educators was *direct mail* at 58.3%. There was only one response for both *local newspaper* and *local television* among all three binned grade levels.

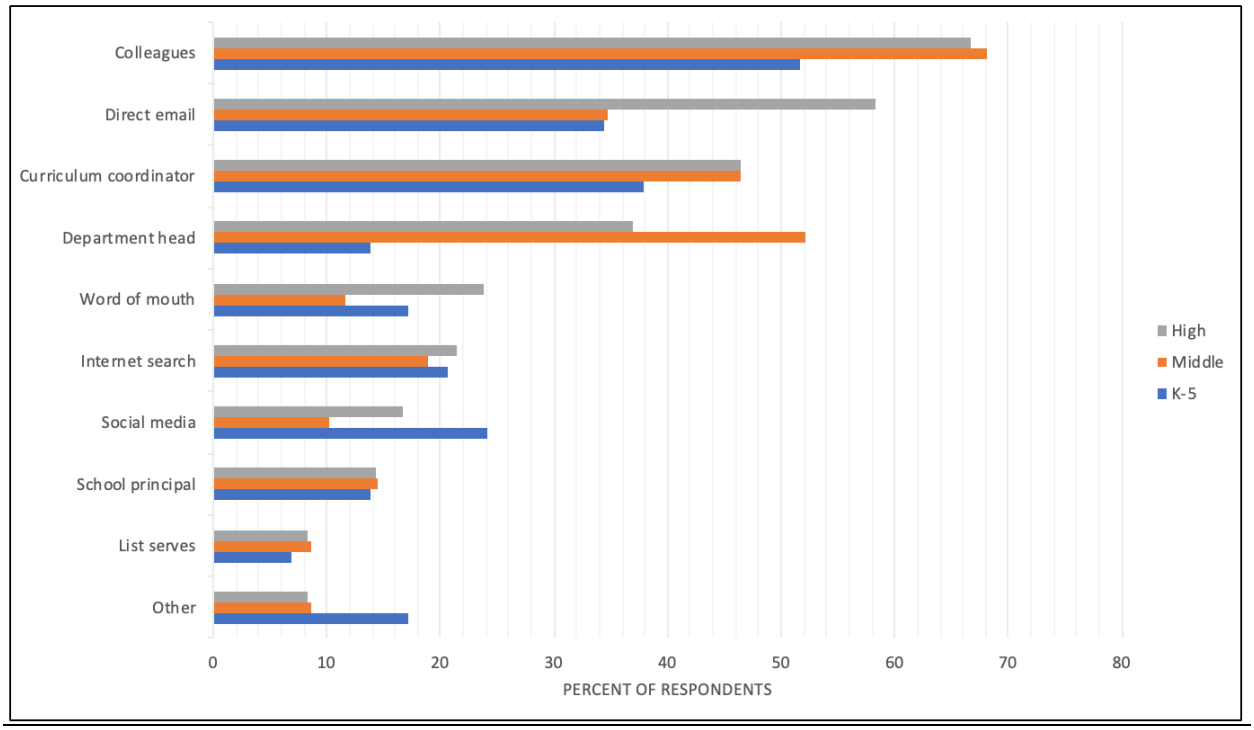

Figure 29: Sources of teacher professional development opportunities, by percentage of respondents.

Discussion

This needs assessment was undertaken to update and identify science education professional development needs of regional K-12 teachers and provide insight on how to improve delivery of programs to the region. Information related to this needs assessment was collected from 178 respondents using an online survey. Respondents were binned according to appropriate grade levels and included elementary (K-5th grade; 16.3% of respondents), middle (6th - 8th grade; 38.8% of respondents) and high (9th - 12th grade; 47.2% or respondents) school teachers. While the Hampton Roads region of Virginia is the target area of most of CBNERRVA and VIMS education programs, its professional development opportunities and new online offerings allow teachers from across the state to participate, illustrating why the survey was open to teachers statewide. Even within the Hampton Roads region, there is great diversity of population demographics, making it difficult to make generalizations about what would be most helpful for all teachers. Most respondents were from the local region, with 54% being

considered from Hampton Roads (see Appendix 2 for list of districts included). It is important to note the context of the participants of this needs assessment, as it does not represent all teachers or districts in the Commonwealth of Virginia. Of our 178 participants, only 12% represented Title 1 schools, or schools that have high percentages of low-income students. Of the 16 Title 1 schools that participated in the survey, all but one was elementary. Therefore, all high schools, and all but one middle school were not Title 1 schools.

Current Mode of Teaching

Teachers were asked about the current emphasis placed on particular types of science instruction including problem based learning, inquiry, lab work and/or data collection, outdoor experiential activities, stewardship projects, student-centered investigations, and data analysis and graphing. Educators across all three of the binned grade levels reported a current high emphasis on scientific inquiry skills. This generally means that teachers recognize the importance of curriculum relating to scientific inquiry, and that teachers have made considerable effort to implement scientific inquiry skills in their classroom. Aligning CBNERRVA resources to support scientific inquiry is of utmost importance due to its heavy use in local schools, and the positive impact that these skills have on students.

The topics that teachers currently place low emphasis on include stewardship projects or activities and outdoor experiential activities, and the results are similar across the three binned grade levels. This trend is somewhat concerning given the focus of it within the National Estuarine Research Reserve system as the reserve system is a set of living, outdoor classrooms working to advance estuary and data literacy through meaningful, hands-on educational experiences. The low emphasis on these types of science instruction is likely a combination of the lack of focus upon these activities within state educational standards, and a limited amount of time to cover required science standards during the school year. Outdoor experiential activities are a main focus of the CBNERRVA education program, both in providing these experiences directly to students, but also in providing professional development to teachers on how to conduct outdoor experiences themselves. Many identified challenges to outdoor experiences (see below) include funding and transportation, as well as a lack of teachers' self-efficacy in

leading them. Continued focus on professional development for teachers to conduct field experiences is needed, but also coordinated efforts to help teachers state-wide address personal challenges, including funding sources. For stewardship projects, this is an area of our professional development training that needs improvement. Additional options for teachers are needed so that CBNERRVA educators can share a variety of ideas.

Outdoor Experiences

While teachers may not be putting as much emphasis on field experiences as they do other modes of science instruction, there is interest from teachers in assistance to improve and increase their outdoor investigations. Two of the top responses in terms of help needed were facilitating field work/data collection and facilitating inquiry-based activities. These skills would most likely involve continued professional development to develop self-efficacy and confidence in teachers, including time in the field themselves to practice individually before they would feel confident taking students in the field. Outdoor experiences may also be a safer alternative to indoor classroom instruction during the COVID-19 pandemic, providing opportunity to strengthen schools' participation in field experiences and outdoor investigations.

Hindrances

There are continued challenges to incorporating field experiences into science curriculum, and among all three of the binned grade levels, there was consensus that the biggest challenge faced was funding. As mentioned previously, field experiences are not included or required in the science curriculum, and the mandate of meaningful watershed educational experiences (MWEEs) is an unfunded one. Although CBNERRVA offers low-cost options for field experiences, schools are competing with other funding needs. With schools experiencing even more reduced budgets due to COVID-19, field experiences have been the first item to go, causing an additional hindrance to implementation. Continued support in the form of grants is needed to support these efforts, as well as flexibility in locations for field experiences. It is possible that field experiences on school grounds may be supported more easily than off-site field experiences to VIMS and CBNERRVA. One of the other major issues, transportation, is

likely directly related to the issue of funding, and may be related to the demographics of the local area. Grants to fund outdoor experiences need to also include funds to support local school divisions' costs, such as bus transportation. The third highest challenge for teachers was the lack of knowledge of outdoor education activities, which was indicated as a top concern of K-5 educators. This relates directly to CBNERRVA's teacher professional development offerings, and is something that CBNERRVA education could prioritize in terms of professional development.

Computers

Middle school teachers reported a lower percentage of access to computers in the classroom, which could be due to a variety of factors undeterminable from the current needs assessment. Due to the wording of the question, our findings do not ascertain whether there is 1:1 technology in the classroom, if there is one (or a few) classroom computer(s), or whether teachers are bringing in carts of computers. The question only asked if computers were available in the classroom. Due to the surge of virtual learning during the COVID-19 pandemic, it is important to clarify this information so that appropriate resources can be developed. If students have high access to computers within physical classrooms, then CBNERRVA could begin to develop virtual resources that simulate the physical lab environment. If students have access to computers at home, and are conducting most of their school work from home, CBNERRVA could create at-home resources using computers. More information is needed to determine the best path forward, although anecdotal evidence suggests that most school districts in the Commonwealth are providing technology for students to use during virtual learning at home.

Topics of Need

As noted in the results, there were significant differences among the three binned groups (K-5, Middle, High) in terms of the different subjects indicated as "Need" and "Highly Need". These differences, in large part, reflect the curriculum differences between the three binned grade levels, but still guide us in the differentiating of resources for educators going forward. For K-5 educators, the top three subjects of need were mid-Atlantic habitats, technology &

instrumentation, and human impacts. CBNERRVA education focuses largely on mid-Atlantic habitats and human impacts on the Chesapeake Bay in elementary programs, but a needed change is a larger focus on technology and instrumentation. Developing programs with easy to use technology for elementary students to master is an area of potential growth for CBNERRVA. In general, the requests from K-5 educators follow the standards of learning at this level in the Commonwealth of Virginia. Given that K-5 educators are interested in outdoor education, finding ways to connect outdoor education with these specific subjects of need will likely be of great benefit to our organization, and to the educators going forward. In terms of the types of data that K-5 educators want to support their teaching of these subjects, they were mostly interested in weather data and water and air temperature data, which also follows the focus of curriculum in the state.

For middle school educators, the top three subjects of need were current scientific research, Chesapeake ecology and watershed, and stewardship projects. These three subjects indicate an opportunity for CBNERRVA to deliver on several of its strategic goals including outdoor education, Chesapeake Bay conservation, and data collection. One way that these topics can be shared with middle school teachers is the Virginia Scientists and Educators Alliance (VASEA) program, where CBNERRVA and VIMS educators train graduate students to translate their research into secondary science lesson plans. Additionally, the need for stewardship projects represents an area of professional development for CBNERRVA and VIMS educators. Middle school educators were most interested in the water quality data that CBNERRVA offers (Dissolved Oxygen, Algal Blooms, Nutrients), which supports our mission and confirms that there should continue to be a focus on gathering and properly visualizing that data.

For high school educators, the top three subjects of need were stewardship projects, current scientific research, and technology & instrumentation. Similar to other educators, current scientific research and technology and instrumentation represent clear connections to the CBNERRVA expertise. The high interest for stewardship projects in particular is of interest, considering it was one of the lowest areas of current emphasis among educators. This may show a wide gap between educators' interest and their self-efficacy, opening the door for CBNERRVA to develop resources and provide assistance across multiple grade levels. High school educators

were similarly interested in water quality data (algal blooms, dissolved oxygen), but were also interested in receiving data on sea level rise, which reflects a focus on current real world problems that is evident in the standards for high school science. Overall, these results will allow for differentiation of resources that better serve the needs of Virginia's educators, and allows for a more efficient allocation of funding into the development of these different resources. Going forward, it will be important to revisit teachers' needs, as we have noted differences between our previous needs assessment and this one.

Professional Development

Teacher professional development provides a way to inform K-12 teachers of effective classroom methods and best practices relating to their content area, while instilling environmental literacy and estuary education across various grade levels. While most of the respondents have many years of teacher experience, there was no information gathered about previous professional development attendance on similar topics to what CBNERRVA and VIMS provide. The need for greater professional development opportunities, more so for some grade levels than others, is evident and represents an opportunity for CBNERRVA and partner organizations to meet teacher needs. K-5th grade teachers represented the largest need for this training, with approximately 69% of respondents indicating they need help in facilitating inquiry-based activities in outdoor activities. There was also a need for incorporating new lab activities for approximately 70% of both middle and high school, following Virginia Standards of Learning which have an increased focus on lab activities as students' progress, allowing for development of critical thinking and problem solving skills.

It should be noted that the main motivation for attendance at professional development opportunities across all grade levels is a desire for greater knowledge of the subject matter they teach, or a general interest in the professional development's subject matter. It appears that educators are intrinsically motivated to attend professional development sessions, and that grant deliverables or requirements given by their school's administration were less motivating. This will help direct our marketing of these opportunities, and suggests a focus on direct communication with teachers. It also suggests that teachers are interested in the topics that we

are offering. It should also be noted that although educators do have these intrinsic motivations, the main challenge that has been identified across grade levels continues to be funding, an obstacle which may require administration support.

Teachers on the Estuary (TOTE) is a requirement for all NERR sites to host each year, and must be a minimum of 15 contact hours. Given the results that educators across all three binned groups (K-5, Middle, High) showed support for focused 2-3 day workshops, the TOTE model still seems to work for most educators, including its typical offering in the summer months. Although a 2-3-day training is the highest ranked option, this could require travel and additional costs for food and lodging. Because of this, a 1-day workshop, respondents' second choice, will still have its place in certain conditions. Finally, due to the COVID-19 pandemic impacting current TOTE workshops, and with the potential for COVID-19 conditions to continue into the near future, it is important to note that online training may also be helpful and may reach a larger and far-reaching audience.

Summary

The results of the need assessment provide the education team at CBNERRVA with a better understanding of what educators in Virginia would like in terms of resources and in terms of professional development.

In terms of educational resources, we now have a better idea of the types of subjects that a wide range of teachers would like to receive from us, along with the types of data sets that they would like to be provided. We also know that educators want to integrate outdoor experiences and stewardship activities into their curriculum, they just need funding support and more accessible professional development on those experiences. One of the things that we need clarification on is the type of access that students have to computers in the classroom. Without that information, we cannot correctly focus on the types of virtual resources that may be most effective in communicating standards that reach our own goals to students.

In terms of professional development, the results of the needs assessment confirm a few things for us, while also giving clarification on what we need to change going forward. Funding continues to be the major challenge for educators in taking part in professional development, so working with educators, especially secondary educators, on grants to help with things like transportation and instituting the training in the classroom. Elementary teachers specifically want professional development in outdoor education, which is an explicit goal of CBNERRVA, so that should be a focus of our team going forward. And finally, the Teachers on the Estuary (TOTE) model that has been used for professional development continues to be an effective and preferred model for educators in the state of Virginia and is one that we should continue to implement going forward.

Appendix 1: 2020 K-12 Needs Assessment Questions

2020 K-12 Teacher Needs Assessment

The Virginia Institute of Marine Science (VIMS) has a three-part mission to conduct interdisciplinary research in coastal ocean and estuarine science, educate students and citizens, and provide advisory service to policy makers, industry, and the public.

VIMS marine science education consists of several departments including the Chesapeake Bay National Estuarine Research Reserve in Virginia and the VIMS Marine Advisory Program. To better serve teachers, we are conducting this needs assessment to help guide the design of our teacher programs.

This needs assessment is voluntary. Non-response will not affect your relationship with VIMS or the College of William and Mary.

Please complete this survey by June 12, 2020.

Please forward this needs assessment to any teacher you think might benefit from the educational programs and services provided by VIMS.

* Required

1. In what educational setting do you teach? *

   Mark only one oval.

   - ◯ Public School
   - ◯ Private School

2. What is the name of your school? *

   _____

3. What grade level do you teach? Check all that apply. *

Check all that apply.

- [ ] K
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [ ] 10
- [ ] 11
- [ ] 12
- [ ] Other

4. Which of the following science subject matter courses do you teach? Check all that apply? *

Check all that apply.

- [ ] Elementary Science
- [ ] 6th Grade Science
- [ ] Life Science
- [ ] Physical Science
- [ ] Earth Science
- [ ] Environmental Science
- [ ] Biology
- [ ] Chemistry
- [ ] Physics
- [ ] Marine Science/Oceanography
- [ ] AP/Dual Enrollment/IB

5. How many years have you been teaching? *

Mark only one oval.

- 0-2 years
- 3-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- >20 years

6. Approximately how many students do you teach science to per year? *

Mark only one oval.

- 1-25
- 26-50
- 51-75
- 76-100
- 101-125
- 126-150
- >150

7. How long is a typical science class that you teach? *

Mark only one oval.

- <20 minutes
- 20-40 minutes
- 40-60 minutes
- 60-80 minutes
- >80 minutes

8. Think about your plans for your class for the entire year. How much emphasis do you give to each o the following? *

Mark only one oval per row.

	Little to no emphasis	Moderate emphasis	Heavy emphasis	N/A
Outdoor experiential activities	◯	◯	◯	◯
Lab or field work/data collection	◯	◯	◯	◯
Stewardship projects or activities	◯	◯	◯	◯
Problem-based learning	◯	◯	◯	◯
Student-centered investigations	◯	◯	◯	◯
Data analysis and graphing	◯	◯	◯	◯
Scientific inquiry skills	◯	◯	◯	◯

9. Are you interested in incorporating more outdoor education activities with your students? *

Mark only one oval.

◯ Yes
◯ No

10. What help, if any, do you need to incorporate more outdoor education in your classroom. Check a that apply. *

Check all that apply.

☐ Unstructured outdoor experiential activities
☐ Facilitating inquiry-based activities
☐ Conducting hands-on activities
☐ Guidance on monitoring students' behavior in outdoor activities
☐ Facilitating field work/data collection
☐ Other
☐ N/A

11. What factors, if any, prevent you from taking your students on meaningful field experiences. Chec all that apply. *

Check all that apply.

- [ ] Funding
- [ ] Administration support
- [ ] Lack of confidence in leading my students in the field
- [ ] Lack of knowledge of flora and fauna in the field
- [ ] Lack of knowledge in outdoor experiential activities
- [ ] Transportation issues
- [ ] Other
- [ ] N/A

12. Do your students have access to computers in the classroom? *

Mark only one oval.

- ◯ Yes
- ◯ No

13. In the past three years, how many hours of professional development training in science have you obtained related to marine science (estuaries, watersheds, field experiences, etc.)? *

Mark only one oval.

- ◯ None
- ◯ 8-16 hours (1-2 days)
- ◯ 16-24 hours (2-3 days)
- ◯ 24-32 hours (3-4 days)
- ◯ 32-40 hours (4-5 days)
- ◯ 40+ (more than 5 days)

Professional Development from VIMS

14. Please rate your level of need for further information or educational materials on the following topics. *

Mark only one oval per row.

	Highly need	Need	Do not need
Marine organisms			
Biodiversity & adaptations			
Life cycles & food webs			
Chesapeake ecology & watershed			
Mid-Atlantic habitats (wetlands, seagrass, oyster reefs, etc.)			
Fisheries & aquaculture			
Physical properties of water			
Water chemistry			
Tides, currents, & waves			
Water cycle			
Coastal geology (beaches, barrier islands, etc.)			
Erosion & sedimentation			
Weather			
Climate change & resilience			
Human impacts (pollution, greenhouse gases, habitat loss, etc.)			
Scientific method			
Technology & instrumentation			
Data analysis & graphing			
Stewardship projects			
Marine-related careers			
c			

15. What type of professional development training do you need? Check all that apply. *

Check all that apply.

- [ ] Science content
- [ ] Facilitating inquiry-based activities
- [ ] Conducting hands-on activities
- [ ] Incorporating new lab activities
- [ ] Facilitating field work/data collection
- [ ] Analyzing data
- [ ] Using real-time or archived data from monitoring sites
- [ ] Other

16. What type of experiences do you seek in a VIMS training program? Check all that apply. *

Check all that apply.

- [ ] Classroom sessions, such as scientist presentations, hands-on activities, round table discussions, etc.
- [ ] Lab investigations, such as modeling ocean circulation, crab dissection, microscope work, etc.
- [ ] Field studies, such as seining, beach profiling, water quality testing, boat work, etc.

17. Which of the following real-time/archived data sets would you like to utilize in the classroom throu learning materials and visualizations? Check all that apply. *

Check all that apply.

- [ ] Algal blooms
- [ ] Dissolved oxygen
- [ ] Nutrients
- [ ] pH
- [ ] Salinity
- [ ] Sea level rise
- [ ] Temperature: air
- [ ] Temperature: water
- [ ] Water depth
- [ ] Water turbidity
- [ ] Weather data
- [ ] None of the above
- [ ] Other

18. What are your motivations for attending teacher professional development training? Rank the following from 1 to 8, with "1" being your primary motivation and "8" being little to no motivation. *

Mark only one oval per row.

	1	2	3	4	5	6	7	8
Continuing education credits	◯	◯	◯	◯	◯	◯	◯	◯
Teacher recertification points	◯	◯	◯	◯	◯	◯	◯	◯
Interest in subject matter	◯	◯	◯	◯	◯	◯	◯	◯
Encouraged by principal or colleague	◯	◯	◯	◯	◯	◯	◯	◯
Requirement as part of a grant	◯	◯	◯	◯	◯	◯	◯	◯
Requirement by my school/principal	◯	◯	◯	◯	◯	◯	◯	◯
Desire to increase my knowledge base in teaching and subject matter	◯	◯	◯	◯	◯	◯	◯	◯
Stipend	◯	◯	◯	◯	◯	◯	◯	◯

19. What type of teacher professional development format do you prefer? Check all that apply. *

Check all that apply.

- [ ] Single after school workshop
- [ ] Series of after school workshops
- [ ] Focused 1-day workshop
- [ ] Focused 2 or 3-day workshop
- [ ] Extended training of 1 week or more
- [ ] Online training or course

20. What is your preferred timing for participating in a training program. Check all that apply. *

Check all that apply.

- [ ] Summer
- [ ] School year
- [ ] Weekday
- [ ] Weekend
- [ ] Daytime
- [ ] Evening
- [ ] Not sure/Doesn't matter

21. What is the highest per teacher fee that your school or division would be willing to pay for a VIMS workshop or conference? *

Mark only one oval.

- ◯ Free
- ◯ <$25
- ◯ $25-$50
- ◯ $50-$100
- ◯ >$100

22. Please rank your greatest challenges, if any, to participating in VIMS training programs with a "1" being the most challenging and "9" being the least challenging. *

Mark only one oval per row.

	1	2	3	4	5	6	7	8	9
Cost									
Time Commitment									
Travel Constraints									
Childcare									
Getting time off (if held during school)									
Lack of administration support									
Training is not relevant to my needs									
No educational credits were offered									
Food/Lodging constraints									

23. How do you find out about teacher professional development opportunities. Please select your to THREE choices. *

Check all that apply.

- [ ] Colleagues
- [ ] Department head
- [ ] School principal
- [ ] Curriculum coordinator
- [ ] Direct email
- [ ] Word of mouth
- [ ] Local newspaper
- [ ] List serves
- [ ] Local television
- [ ] Social media
- [ ] Internet search
- [ ] Other

Appendix 2: Hampton Roads School Districts Represented in Needs Assessment

Mathews

Gloucester

York

Williamsburg James City County

Newport News

Hampton

Norfolk

Virginia Beach

Suffolk

Chesapeake

Portsmouth

Poquoson