

National Ocean Sciences Bowl – 2019 Fall Past Participant Survey Report

Introduction and Method

The Consortium for Ocean Leadership annually implements the National Ocean Sciences Bowl (NOSB) as a regional and national competition-based program for secondary students in the United States. A tracking survey has been implemented to follow students after high school graduation, through college, graduate school, and into the workplace beginning in 1999 and continuing annually since that year. Drs. Tina Bishop and Howard Walters, of the College of Exploration and Ashland University respectively, have developed the surveys associated with this longitudinal tracking study, as well as numerous other instruments and data collection procedures.

For purposes of this current report, the data and summaries following are based on a follow-up survey, which was disseminated in late September, 2019, by the NOSB program office to its most current database of past participants. A total of 136 individuals provided responses to the survey.

Survey Response Summaries

Items one through four on the survey were demographic response items to describe the sample of respondents. **Item one** notes that 43 of the 136 (31.6%) of respondents have graduated from post-secondary school. The next largest groups of respondents were college freshmen (31% or 42 individuals), graduate students (18% or 25 individuals) and high school students (12% or 16 individuals). The remaining respondents were distributed across their undergraduate college years. From **item two**, 52% of the respondents were male and 46% were female. Two individuals (1.4% of the total)

responded as non-binary. **Item three** requested voluntary identification of ethnicity. 67% of the respondents indicated Caucasian. The largest proportion of the remaining respondents were Asian (34 individuals). And finally, **item four** requested the number of years individuals had been on (or were on) an NOSB team. Of the 136 respondents, 17% were on for one year; 38% for two years, 26% for three years, and 19% for four years.

Items five and six drilled into the college curriculum and majors of past participants. One goal of the NOSB has been to encourage and foster continued study of the ocean sciences among students. In describing their current, past, or intended college majors, 40% of the respondents indicated Biological Sciences, followed by 18% in Engineering, 16% in Physical Sciences, 8% Chemistry/Biochemistry, 7% Pre-Medicine, and 6% Mathematics. The remaining students were distributed across a widely diverse set of other majors that were likely not science majors, except for a fairly large pool of Environmental Science responses (7 individuals) and two responses of Ocean Sciences. As has been noted in the past, ocean science is typically a graduate degree in the United States, and so the undergraduate major is not necessarily a definitive indicator. Nevertheless, a large proportion of these respondents have continued to study science or mathematics post-secondary. **Item six** asked the respondents, regardless of major, how many had taken courses in marine, aquatic, or ocean sciences. Interestingly, again regardless of major, 54% or 73 respondents indicated affirmatively. And more significantly, in item seven, 42% or 57 respondents indicated that they perceived that their career would ultimately include an emphasis on marine, aquatic, or ocean sciences. From baseline data on the proportion of students selecting majors in ocean sciences, these responses in items six and seven are statistically and significantly stronger toward ocean science than the general U.S.

population of traditional secondary to post-secondary transitioning students. This remains a strong indicator of the effectiveness of the NOSB program for this issue.

Items eight through twelve explored the NOSB as a durable, social community, a theme that has emerged regularly over the twenty years that the evaluators have been studying this program. This feature is observed again in this survey response data. Of the 134 individuals who responded to these items, 84% or 112 individuals remain in communications with members of their high school NOSB teams, and 71% or 94 individuals remain in communications with their secondary teachers who served as the NOSB team coaches. This particular aspect of the community, i.e. the relationship that develops and is retained between the secondary teachers and the team members/students, is a remarkable demonstration of the significant role of a valued, secondary teacher in the life of impressionable adolescents, particularly when there are subject area affinities: science teachers and science-leaning students as the example here. For this survey, we asked respondents about other scientists or science mentors they had met through the NOSB involvement, and whether there was any continued communication. There were only five responses which seemed to match the criteria: and were each related to a science judge a respondent had met who had been instrumental in recruiting a student into a college or graduate program. The potential of the NOSB to serve as a conduit for recruitment of college and graduate students has been explored in the past, and this remains an interesting possibility given COLs interest in service to its higher education partners, and strategic interest in supporting the ocean sciences pipeline.

Item twelve continued to drill into the concept of academic mentoring, asking respondents to identify an individual they consider to be an academic mentor. Of the 119 responses, 56% or 67 individuals indicated a Professor served that role, and 42% of the respondents or 50 individuals noted a former high school teacher fills that role. The next two largest categories were parents (18%) and other college students (17%). It has been a recurring finding over the decades that the evaluators have asked these kinds of questions that respondents consistently point to high school teachers as academic mentors in far larger proportions than they point to their own parents. Earlier surveys and studies have revealed that, when comparing mentoring for academic content selections, teachers have always exceeded parents in the response data; but on the other hand, when the question has been framed regarding selecting an academic institution for post-secondary, parents have exceeded the teachers. One possible interpretation of these data is that legacy family issues may be more powerful in institutional selection, which academic expertise is more valued for selecting the actual majors. This has not been studied formally for nearly a decade in the NOSB, however, and could be reconsidered.

Item thirteen reframed the previous question and asked respondents to identify a career mentor. Responses were similar, with 57% or 62 individuals identifying a Professor in this role. Parents did exceed high school teachers in the second rank, however, with 23% of respondents selecting parents and 22% selecting high school teachers.

Item fourteen asked respondents to “Tell us how the NOSB helped you understand your career and college interests better.” Numerous respondents indicated that the NOSB increased their interest in a variety of science areas and fostered a love of science. They

stated that the NOSB supported and guided their career choice in general. More significantly the NOSB increased interest in oceanography and marine science and related fields for nearly a quarter of the respondents. Several respondents said the NOSB helped them pick their major. Others said it helped them decide on their future university as the competition offered access to specific universities.

Beyond targeted career impetus, the respondents also noted that the NOSB helped them explore research, gave new perspectives on the world, built foundational science knowledge, and introduced them to successful people in the field.

An interesting impact of the NOSB that was mentioned by more than a dozen respondents was that the NOSB helped acquaint them with multiple disciplines with the realization that marine sciences are multidisciplinary. Respondents stated that they learned about the multiplicity of ocean topics and processes and that there is much variety in the marine sciences.

An additional theme which emerged in the data set was the mention of life skills that they received from their participation in the NOSB. This goes beyond the science content knowledge and learning about the ocean. These types of responses included:

- Presentation skills
- Writing a formal research paper
- Learning how to study/better study habits
- Working as a team or group
- Using applied knowledge not just theory

Several respondents mentioned that the NOSB helped them meet people with similar interests, and emphasized the development of community. One person stressed

“this was a place where I felt valued and where I could shine.” Other respondents’ comments described an increase in passion and concern for the ocean and the environment. The idea of *stewardship* was attributed to the NOSB participation.

Select narrative responses that were typical of these kinds of ideas included:

- I learned that I love science and that science is the career path I want to do.
- It helped me strengthen my interest in marine science.
- It illustrated that science is involved in everything we do.
- The NOSB changed my life and led me to physical oceanography.
- I left the NOSB having a deep and great appreciation for the ocean as a system and how interdisciplinary oceanography is.
- I learned about the crucial importance of the world’s oceans and the unprecedented problems that they face today as a result of human negligence.
-helped me see the world from so many new perspectives and the NOSB fostered a love of discovery.”

Item fifteen asked respondents, “ If you were going to improve the NOSB program in only one way, how would you do that?” The dominant theme that emerged in answers to this question was the desire to meet and learn from more oceanographers and people in the field. Five individuals stated that they *wanted to meet career oceanography professionals* , and potentially have webinars with marine professionals. Others stated their desire to have more opportunities to meet other teams.

To broaden and improve the competition some respondents wanted more regions and to increase the number of teams, e.g. two teams per region. Other suggestions were to increase the number of schools in non-ocean areas, have a more balanced regional

competition, including more public schools, and increase funding for low income school areas. Responses were disaggregated to suggestions that would be applicable prior to competitions, suggestions for during the competitions, for after the competitions, and finally, suggestions applicable for interactions with program Alumni. These suggestions by category included:

Prior to the competition:

- Need more practice before the event. This comment surfaced a number of times in the responses
- Several people wanted more published practice questions and online practice
- More problem solving and less memorization
- Release the themes earlier
- Offer wider area of categories for study; more study resources for the team
- More prep sessions for nationals
- More training for judges
- Make sure all volunteers know the rules
- Improve the moderators

Suggestions for changes during the competition included:

- Less memory for questions, especially biology
- Simpler rules
- Clarify SEB
- Making sure questions are to up to date
- More current events
- Increase the value of the research paper

- More physical oceanography questions
- Allow teams to choose reader for final games
- Give more time to the science expert briefing
- Add loser's bracket competition
- Have double elimination for regional competition
- Improve the organization and timelines of schedules.

Suggestions for after the competitions end included:

- Have an online forum discussion of what works well and what doesn't for all the Regional Coordinators
- Have a showcase in which alumni can talk about their careers
- Hold outreach for team members at regionals e.g. volunteer at a museum, presenters for providing internships
- Expand to non-ocean-based locations to get them involved
- More activities and opportunities for alumni
- Expand opportunities to network with other teams; post-competition get together with team

Suggestions for Alumni interactions included:

- Alumni to mentor current teams.
- Alumni should showcase their career

Item sixteen asked "If you are in college now, what is the one thing you wish someone had told you about college and career issues while you were in high school?"

There were sixty-eight responses to this question. The responses ranged from thoughtful, philosophical comments to practical tips. Some took the perspective of what to

do in high school and others offered insights with future oriented career tips. One dominant theme was to be open minded and try everything. Many respondents echoed the sentiment that exploring is key in college. Respondents encouraged students to find out and pick what they are interested in, where their passions lie. They cautioned about pigeon-holing or narrowing focus too early and recommended not doing what you don't like.

While some respondents said that college courses were hard, others equated high school and college difficulty and warned that high school courses matter. Critical thinking was deemed to be very important. They warned that college is expensive and academic funding is competitive. One should look at what one can afford and apply for scholarships. Regarding science content, two students noted that few schools have ocean sciences and a third respondent recognized that all areas of science are interconnected.

Practical tips related to college success included:

- Stay on top of your work
- Build connections early
- Be organized
- Try to be productive; hard work is worth it
- Build up your resume and cover letter

In regard to careers, respondents recommended getting involved in undergraduate research and finding other practical exposure to careers. One respondent said "choose a career that will make you employable." One person wished they had known what graduate schools were really looking for. Two respondents cautioned that *your degree does not define your career.*

Several alumni encouraged that “things will work out.” Don’t dwell on failure. Don’t stress too much and enjoy college.

Item seventeen asked respondents to describe any post-high school academic competitions in which they have participated. Only eleven of the respondents affirmed they had done this, of which three had volunteered at a regional NOSB competition. The remaining eight individuals had participated in:

- A College Bowl (content not provided)
- The Model UN in college
- As a judge at a science fair
- On a quiz bowl in college
- In a computer science team competition
- NASA sponsored engineering competitions in college
- An Ethics Bowl competition
- And a science bowl-type competition in college

Item eighteen asked respondents “What life skills or college or work/study skills did you develop or enhance as a result of your participation in the NOSB?” Several themes emerged in the responses to this question, although the most common response to this question was *teamwork*. Nearly two dozen people indicated that working as a team and learning how to organize as a group resulted from their time in the NOSB.

The next most common response was the expression that the NOSB helped them learn how to study. This broad comment was also supported by statements about Independent study skills mentioned by half a dozen respondents. Closely related to this were the responses that participants *learned how to teach others also*. Leadership was also mentioned frequently.

Specific study skills which were listed included:

- Applying information
- Critical thinking, problem solving and thinking holistically
- Memorizing information
- Ability to research
- Quantitative reasoning
- Multiple choice skill
- Capability to “Tie things together”
- Vocabulary

Process skills developed included:

- Thinking under pressure; quick thinking
- Time management, not procrastinating
- Communication and public speaking
- Organization, self-discipline, planning
- Collaboration
- Comfort dealing with scientists
- Focus, drive, energy, confidence, and “grit”

There were several quotes from the response narrative that seemed to capture the general tone of the responses to this item, which included:

- I think that more than anything the NOSB taught me how to be a better self-motivated learner.
- I saw the importance of science education programming and involvement for young people.
- How to focus on one subject I actually care about with minimal guidance and turn it into my future career.”

Item nineteen asked respondents who were already out of college to describe their work/careers. There were sixty-three respondents who completed this item. Ten respondents were working in university settings and listed specific universities. Some respondents identified themselves as graduate students or in post-doctoral programs. These respondents in academic settings were involved in laboratory or research work in fields as diverse as economics, creative writing, physics, and oceanography.

In addition to university settings, the respondents listed various sectors as their employment setting including:

- Corporate, (Google, Apple, Deloitte, Teledyne to name a few)
- Small business settings
- NGOs
- Government agencies-such as NOAA, NASA, US Coast Guard, USFWS, EPA, and Sandia Lab.

The largest number of the sixty-three respondents stated science or engineering fields as their work area, including six who listed science or math teaching or informal education.

Item twenty on the survey asked respondents to describe the nature of their work or funding with or by a delineated list of federal agencies (NOAA, NASA, Navy/ONR, BOEM, DOE/NREL.)

More than two dozen respondents indicated that their work or funding came from federal agencies. The largest number of these (7) said they were either an employee or contractor with NOAA. Two more indicated that they had been NOAA interns, and two

additional respondents said they had worked with NOAA sponsored programs.

The next largest number of respondents (four) to this question indicated an affiliation with NSF, although this agency was not specifically on the response list. An additional four respondents mentioned DOE. Three respondents work with Navy/ONR and three were with NASA. One respondent worked for the US Coast Guard and works closely with NOAA and the U.S. Navy. One person listed an internship with the Department of Defense.

Conclusions and Recommendations

- The data demonstrate, as in years past, that a powerful combination of the teacher effect and the program effect seems to emerge from past participant memories. The relationship between a student, a teacher, and the NOSB is evident in the responses, and represents a durable social relationship with some impact on participant college and career decision-making. Given the duration of the competition at this point, the consistency of the reported relationships between students, coaches/teachers, and the NOSB might be considered as a substantive opportunity for research, as well as a possible opportunity for expanded programming toward the high school teachers who are embedded in these relationships.
- Multiple students associated the NOSB with multidisciplinary science and the study of science across or outside of single categories. This perspective on trans-disciplinary science conveys a systems conception of science that increasingly reflects the formal curricula of post-secondary education. It may be that future research on the program should evaluate the degree to which this systems

conception is evolving in secondary level education, and how it is reflected in the programming elements of the NOSB competition itself.

- The comments regarding alumni participation in regional and national competitions suggest another possibility for strategic consideration. Having alumni present their careers at regional or national bowls, and having alumni interact with individual teams would both seem to be excellent ways to showcase careers and the longer-term impact of the NOSB. And finally, alumni might serve as a career panel for the National competition.
- There were numerous suggestions from respondents on the survey for enhancements before, during, and after the competitions. It is recommended that NOSB leadership review these suggestions within the context of the current competition constraints, and with a view to improve the competition, or to make it more meaningful to participants.
- Finally, based on the continued and interesting feedback from the high school students or those slightly beyond high school, it would seem to be important to obtain additional and more highly focused feedback from those students currently in high school who are on the NOSB teams now. This may allow identification of some key program elements which could enhance student learning, as well as the social network of students, teachers, college and graduate students, scientists and volunteers. It is recommended that this survey of the secondary students can be implemented in mid- to late-January 2020.