Lake Sturgeon Community Science Program Evaluation

Teacher and Student Evaluation Summary

GLFT-GLSI Project 1766 - Developing virtual learning opportunities to train citizen scientists about lake sturgeon and coupled Great Lakes-tributary ecosystems

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INTRODUCTION

The Lake Sturgeon Community Science program pilot targeted engagement of middle and high school students and educators focusing on STEM classrooms in both Michigan and across the Great Lakes basin. Nineteen classrooms were selected to participate in the pilot and beta-tasting of this community science project. These selected school project teams (educators and youth) represented elementary (1), middle (12), and high (13) classrooms. Thus far, 14 educators and 483 students engaged in and piloted this Lake Sturgeon Community Science project, reflecting program engagement across four Great Lakes states. Using different Google learning tools, we developed and shared resources related to the pilot along with evaluation tools for both students and educators. This report summarizes program pilot evaluation summarizes program participation, values, learning outcomes, and feedback provided by both educators and students participating in this program.

PARTICIPANT SURVEY

This evaluation implemented a post-program survey with 14 educators and 483 students participating across four Great Lakes states (Figure 1).

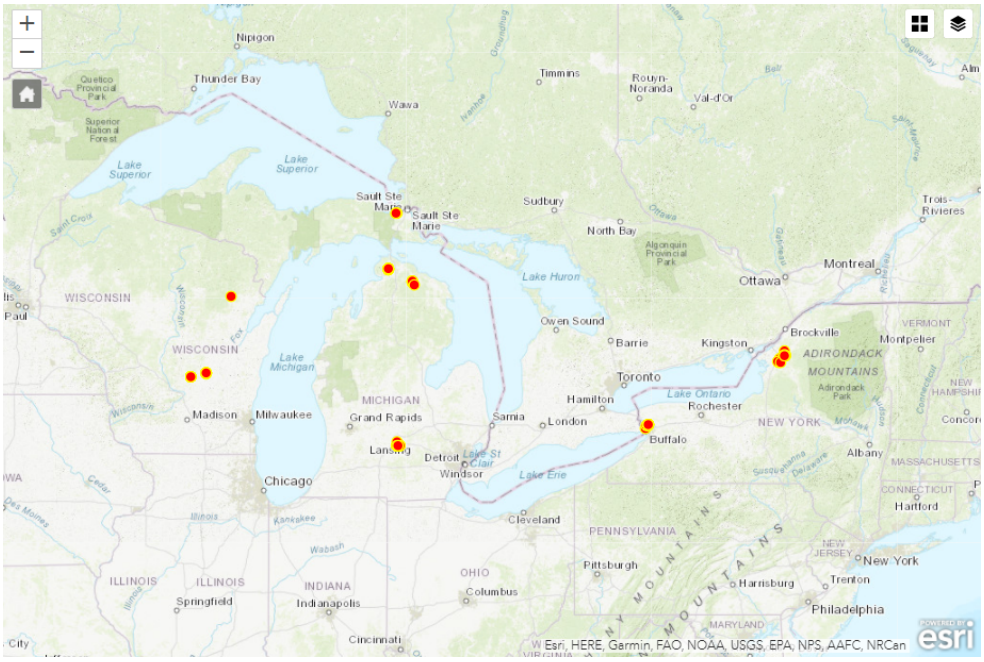


Figure 1: Geographic distribution of schools, educators, and students participating in the Great Lakes Community Science project.

Educator and student participants were asked to complete an online post-program reflective evaluation including both qualitative and quantitative items. In addition to basic demographic information (participant name, school, state, and learners' grade levels), participants were asked to reflect on the following survey prompts.

Teacher participants were asked the following questions utilizing an appreciative inquiry (Hammond, 1998; Cooperrider and Whitney, 2005) structure to frame feedback sought from respondents. Evaluation questions included:

- What did you most appreciate about this project?
- What are some specific improvements that would have made this project even better?
- What are 2-3 specific learning goals, objectives, or topics that you directly engaged students with through this project?
- How would you rate the VALUE of the following aspects of the Lake Sturgeon Community Science Pilot FOR YOUR STUDENTS?
- How would you rate the VALUE of the following aspects of the Lake Sturgeon Community Science Pilot AS AN EDUCATOR?
- Would you participate in the Lake Sturgeon Community Science Pilot again?

Student participants were asked the following questions, largely designed for students to reflect on their starting knowledge comparing to what they learned in this project (Harvard Project Zero, 2019), as well as their most meaningful value, experience, or change as a result of this project (Davies and Dart, 2005). Evaluation questions included:

- What did you know about Lake Sturgeon BEFORE starting this project?
- Can you identify one or more ways that humans (or human activities) have negatively affected Lake Sturgeon populations?
- Can you share one (or more) things people are doing (or can do) to improve Lake Sturgeon populations in the Great Lakes?
- What did you learn about Lake Sturgeon because of this project?
- What was most meaningful to you about this project (and your contributions to the project)?

Data and Methods

Twelve educators (63% response rate) responded to the online program evaluation survey. Student participation included a total of 374 student survey respondents (77% response rate), representing students engaged in this project from across 19 unique school districts (Figure 2). Additional feedback is anticipated by end of the 2020-21 school year (June 2021).

Figure 2: School, Student Participation Summary

Likert scale question responses were tabulated, summarized, and visualized using bar charts. Post-program surveys were used to evaluate both educator and student experiences, values, and learning resulting from their involvement. Open-ended responses provided by both students and teachers were compiled, organized, and an open coding process was used to identify and categorize ideas or sentiments within each survey prompt. Responses were then analyzed for similarities, patterns, and common examples in order to identify broad, thematic concepts describing participant experiences and the resulting significant changes. Gathering open-ended response allowed us to investigate and compare (among other teachers and our own program goals) the values and outcomes most salient and foremost in the minds of each individual program participant. Many respondents expressed multiple ideas, thoughts, or key ideas within their responses, and in these cases, each individual idea was coded and organized separately within similarly themed categories. Finally, coded responses were summarized quantitatively by calculating the percentage of teachers (12 total teacher respondents, 374 total student respondents) who expressed a thought or idea in each category.

RESULTS

These results summarize the responses, reflections from participating educators solicited using the most significant change evaluation strategy and open-ended survey tool. Participants' reflections were categorized and summarized as follows:

Educator Evaluation Results Summary

Overall

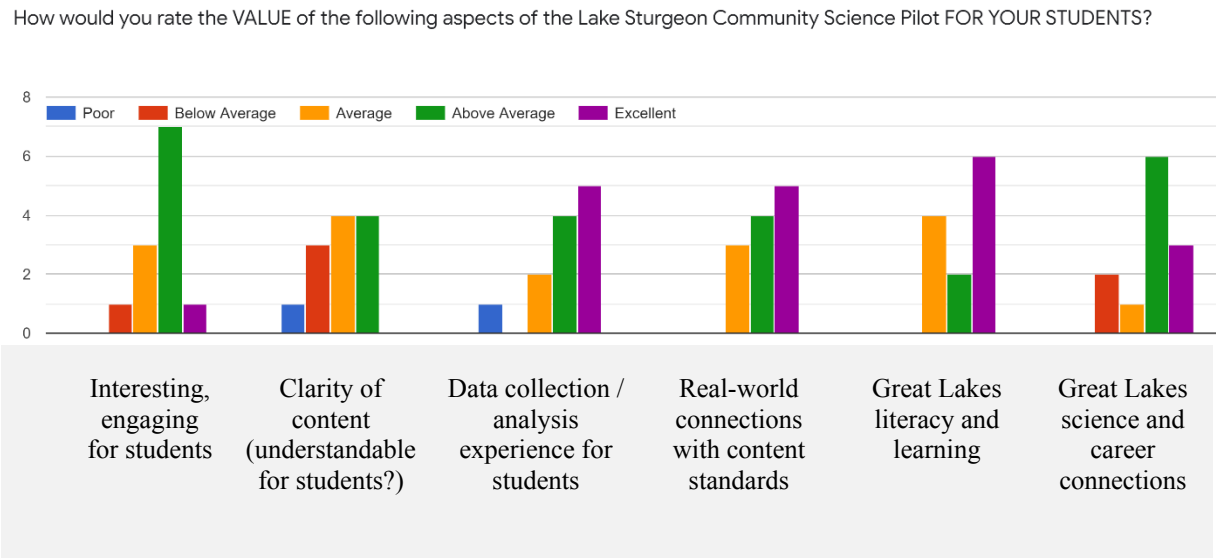


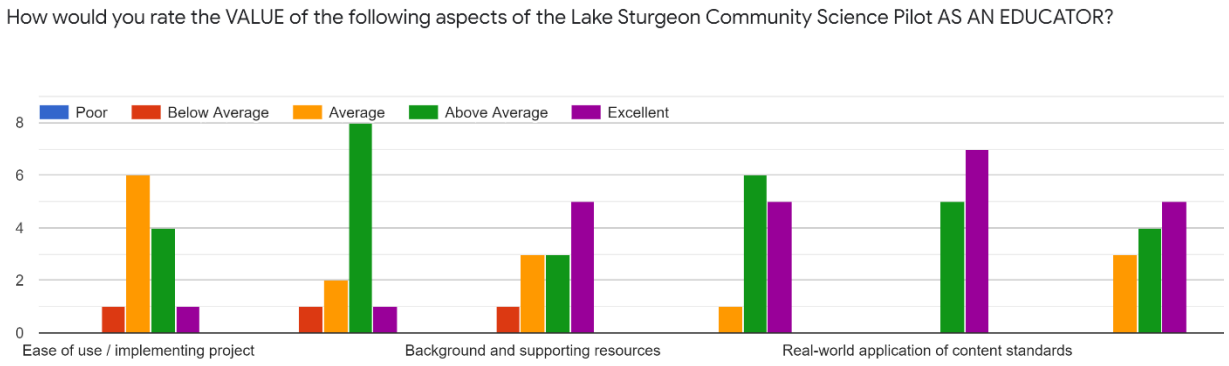
Table 1: Teacher responses rating the VALUE of these aspects of the Lake Sturgeon Community Science Pilot FOR THEIR STUDENTS

Successes (% above average)

- Data collection / analysis experience for students (83%)
- Real world connections with content standards (75%)
- Great Lakes science and career connections (75%)

Areas for Improvement (% below average)

- Clarity of content (understandable for students) (33%)
- Great Lakes science and career connections (17%)



Ease of use / implementing project	Data collection / analysis procedures	Background and supporting resources	Opportunity to learn new materials / content	Real-world application of content standards	Clear connections with your student learning goals

Table 2: Teacher responses rating the VALUE of these aspects of the Lake Sturgeon Community Science Pilot AS AN EDUCATOR

Successes (% above average)

- Real-world application of content standards (100%)
- Opportunity to learn new materials/content (92%)
- Clear connections with student learning goals (75%)
- Data collection / analysis procedures (75%)

Areas for Improvement (%below average)

- Ease of use / implementing project (8%)
- Background and supporting resources (8%)
- Data collection / analysis procedures (8%)

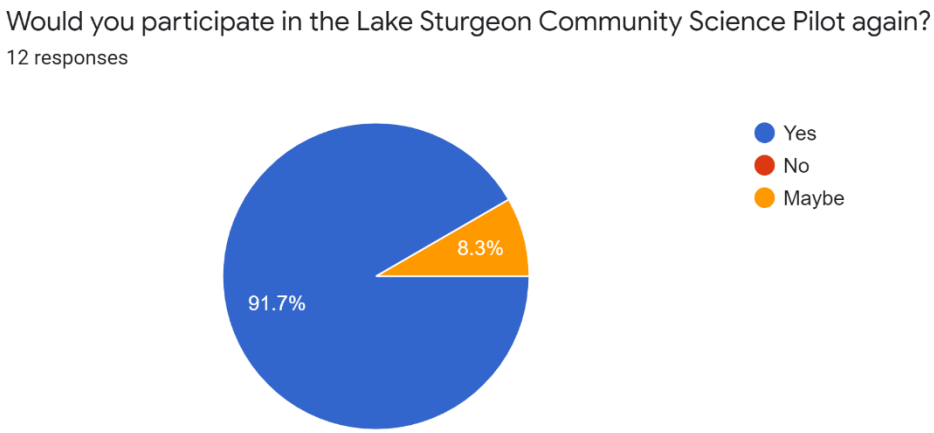


Figure 3: Summary of teachers indicating their interest in participating in the Lake Sturgeon Community Science project again.

Most appreciated about this project

- Organization, delivery and supporting resources/materials for program (58%)
  - *The project as whole was solid.*
  - *This is great and it ties in well with my goals for the class. I really appreciate all the work this must have taken.*
  - *The organization, set up, and resources available for students to use while watching the videos.*

- Great Lakes literacy and learning topics and content materials (42%)
  - *I also appreciated having a regional look at the Great Lakes rather than focusing on my specific area.*
  - *All of the resource material. From Ecology and Biodiversity to fish ID. I like that I could pick and choose which lessons to use and not use.*
  - *The actual fish ID material is great!*

- Real project/problem-based learning – students engaged in applied science viewing real video, collecting real data, and collaborating with real science/scientist (42%)
  - *The ability for students to…hear directly from some of the scientists involved in the project (via the videos), was really great.*
  - *Having students actually collect data for researchers is very cool.*
  - *I loved the idea that it was actual footage from the river! The kids loved looking at the videos and always wanted to share when they saw a fish on their video!*
  - *I loved the opportunity to connect my students in NYS with scientists working in Michigan. The students benefit from seeing that collaboratively, scientists can accomplish so much more than when they work in isolation.*

- Professional learning opportunity - videos/materials most useful for teachers* (33%)
    - *I liked the slideshows and the document describing the fish. I found the narrated slideshows informative for me as the teacher.*
    - *I liked the videos…for ME - they were great. As I teach middle level students, the videos were way above their heads, and sometimes too long. I used them for me to learn and then shared what I felt they could handle.*

    * noting videos/materials were noted later as sometimes too technical for students directly.

- Place-based, Great Lakes-connected community science (community/stewardship) (17%)
    - *I try to involve my students in "place-based" activities when I can, and this usually includes studying the fish of the Great Lakes*
    - *The ability for students to contribute to community science…*

- Clear connections with curriculum and learning goals (17%)
    - *This ties into that curriculum, and I supplemented with some of those activities to start us out. As part of that, the fish ID activities tied in well.*

Improvements that would have made project even better

- Enhancement of training, facilitation guides, supporting materials for educators (50%)
    - *Include questions that could be used to help with discussion with students specific to each video. Also, maybe having teachers go through more of it [review of videos] with the experts so that we could help the students more.*
    - *Really needed a way to share the data with students afterwards so the "why" could have made more of an impact.*
    - *Providing a document of questions the kids should be able to answer after listening to the slide shows. What were the key elements you would want kids to know after having viewed the slideshow?*
    - *How to get the data about my kids' "test scores". In other words, I'd like to see how they did on the fish ID quiz. The process of getting the data sheet and entering data was very clunky. It would be nice to streamline that portion of it.*

- Incorporating more hands-on, engaging materials,activities or experiences (50%)
    - *Some students had no fish in there assigned video. This was kind of a let down.*
    - *The students lost quite a bit of interest watching the video. I explained to them that this is "real science" and that collecting data can be tedious or monotonous, but some of the camera views were very difficult.*
    - *Interactive something for students to do after the informational videos*
    - *I'm wondering if there's a way to break it up with opportunities for active/exploratory learning on the part of the students, for a more balanced lesson.*
    - *I started out with several different activities that got at how humans have impacted the population of lake sturgeon and why we need to restore the lake sturgeon population because they aren't able to do it on their own, which turned*

out to be really cool and engaging activities. We did one activity that was musical chairs where the population of Lake Sturgeon was only hindered by the lack of chairs (competition) and then introduced things like predation, over fishing, dams (which blocked off a chair) and pollution which eventually killed off all of the lake sturgeon. We also did a graphing activity where we looked at how the lake sturgeon have such a difficult time coming back on their own. Graphing 40 million eggs all the way down to 15 fish that survive through winter was a very cool activity for the kids to see that, it's not enough to just leave the fish alone, we as humans need to step in and help clean up the mess we have created.

- Presentations, materials should be using less technical and more age-appropriate considering student audiences (42%)
    - *The videos were a little bit "undergrad level". They need to be toned down.*
    - *There is a lot of vocabulary and content in some of the materials that could be a bit dense for some students.*
    - *The narrated slideshows the kids were to watch included language that was far too technical for a high school level kid. This made them less usable for educational purposes. Re-narrating them in more kid friendly level discussion would make the more usable to a high school kid (14-15years old.) You may even want to narrate them separately for middle school kids. They are only 12-13.*
    - *The amount of introductory "lecture" material was pretty overwhelming for students, too. It felt sort of like a "eat your vegetables [lecture] to get your dessert [videos]"*
    - *Doing this in-person likely made this a different experience, but I thought the videos were long and arduous, which made them very boring to the kids. I only did one day where I showed videos...They felt like a college lecture and because of this I don't believe that it was the best way to teach the content. The videos were full of interesting information and as an educator I learned a lot, but as I reflect I keep thinking there's got to be a better way to communicate this information in a way that is engaging for the students!*

- More practice videos, examples (e.g. fish ID), supporting resources for students (25%)
    - *More practice videos and materials (different from those already in the presentation or the quiz) if that is at all possible [for ML students]. If you could have a practice video for data collection - a 15-20 minute video that had fish go by at several points so kids could get an idea of what they were going to be watching ahead of time and we could practice filling a data sheet. And that would also give them more practice telling what is a fish and what is debris. :)*
    - *Materials (like the videos) could have been a bit more engaging. Subtitles would also help. The data collection sheet was also pretty difficult to use especially for my spanish speaking students.*

- Opportunities for students to make bigger picture 'why' and 'so what' meaning and connections with their project role and contributions (25%)
    - *Really needed a way to share the data with students afterwards so the "why" could have made more of an impact.*

- *My students struggled to find the connection between the videos they studied and the content on sturgeon, because there were—as far as we could tell—no sturgeon on any of our assigned videos, and frankly very few fish in general.*
- *The students lost quite a bit of interest watching the video. I explained to them that this is "real science" and that collecting data can be tedious or monotonous, but some of the camera views were very difficult.*

Learning goals, objectives, or topics that educators engaged students with through project

- Standard: Human interactions with the environment (75%)
  - *Human Impacts on the Environment and Systems*
  - *The impact (both positive and negative) of human interactions with fresh water/the great lakes*
  - *How Lake Sturgeon populations have decline because of human behavior.*
  - *We had studied the impacts of climate change on Wisconsin during the prior two weeks before this lesson, so human impacts on the Great Lakes system and sturgeon were also a natural connection.*

- Standard: Ecology, ecosystem studies (e.g. fish biology, habitats, predator/prey relationships) (75%)
  - *Ecology - predator/prey relationships, effects of climate change, effects of changing environmental conditions on populations, invasive species*
  - *...external anatomy of a fish and fish identification, as well as life cycles of fish and ecosystems*
  - *Fish ID, water quality, predator/prey*
  - *Describe energy changes in a food web.*

- Strategy: Community science (33%)
  - *Importance of citizen science*
  - *How everyday people can add to scientific knowledge*
  - *The stated goal I gave students was: "To learn about sturgeon in Michigan's Black River System and contribute to a new community science program." We contribute to many community science programs (e.g., Snapshot Wisconsin, Nature's Notebook), and the results of those partnerships are always interesting and engaging to students.*

- Strategy: STEM learning process and practice (science inquiry, data collection/analysis, peer review, etc.) (33%)
  - *Data collection, good note taking, and ability to teach others about sturgeon.*
  - *...processing of scientific data, experimental design.*
  - *How collective peer review of data ensures reliability of the data: each class had to peer review another class's data to confirm their claims that they saw something that might be a fish.*

- Strategy: Great Lakes fisheries science/management career explorations (17%)
    - *How do zoologists manage wildlife populations in Michigan? (coincides nicely with the history of Lake Michigan's fisheries project with management).*
    - *...as well as fisheries management.*

- Strategy: Place-based education / Great Lakes-connected learning (8%)
    - *Place based science; and Great Lakes curriculum - Fish ID specifically*

Student Evaluation Results Summary

What did you know about Lake Sturgeon BEFORE starting this project?

- Nothing or little known about Lake Sturgeon; maybe never even heard of them (51%)
- Recognize Lake Sturgeon as a fish, can maybe identify or describe features (adaptations like size or shape, scutes or barbels) (27%)
- Found in/native to Great Lakes/Michigan watersheds and ecosystems (12%)
- Human interactions – fishing connections, threatened / human impacted species (11%)
- Knowledge of life history/habitats/ecology (10%)
- Describe as an old, ancient, or prehistoric species of fish (5%)

Can you identify one or more ways that humans (or human activities) have negatively affected Lake Sturgeon populations?

- Overfishing and/or Illegal Poaching (50%)
- Pollution (e.g. marine debris or chemical contaminants) (44%)
- Dams/road crossing/loss of watershed connectivity (14%)
- Economic or food exploitation (meat and caviar) (8%)
- Habitat loss, erosion/sedimentation, or water quality changes (4%)
- Climate Change (3%)
- Invasive Species (2%)
- Other, misc. ideas (7%)
- Don't know/unsure (3%)

Can you share one (or more) things people are doing (or can do) to improve Lake Sturgeon populations in the Great Lakes?

- Fishing regulations/enforcement of poaching (34%)
- Hatcheries/rearing facilities/sturgeon in classroom/stocking (24%)
- Address pollution (nutrient, chemical, litter, etc.) (21%)
- Protect habitat/water quality/spawning habitat (13%)
- Science, research, and monitoring efforts (10%)
- Education to foster awareness and public involvement (e.g. citizen science) (6%)
- Removal of dams/enhancing fish passage (3%)
- Address invasive species (prevention, management, etc.) (2%)
- Other (6%)
- Nothing / unsure (2%)

What did you learn about Lake Sturgeon because of this project?

- Identify them / physical characteristics (34%)
- Rare / threatened species (population health) (21%)
- Reproduction, life cycles (spawning, eggs, juveniles, young fish, slow to mature, old age) (19%)
- Life history, habitat, range (feeding, shelter, water quality river/lake migrations) (15%)
- Human impacts/issues/threats/conservation efforts for species (15%)
- Biodiversity and ecosystem value/interactions (other fish, foodweb connections, etc.) (11%)
- An ancient and prehistoric fish (10%)
- Other (4%)
- Nothing / don't remember (5%)

What was most meaningful to you about this project (and your contributions to the project)?

- Contributing meaningfully to Lake Sturgeon and environmental conservation (that we helped, we made a difference) (29%)
- Contributing meaningfully to real-world science and learning, experiencing science process (e.g. data collection, team collaboration), working with real scientists (20%)
- Identifying, learning about Great Lakes fishes and aquatic ecosystems (19%)
- Learning about, experiencing Lake Sturgeon biology/ecology (17%)
- Better understanding of human interactions with Great Lakes fisheries (both issues and conservation) (17%)
- Experiencing fish (e.g. watching videos, seeing fish)
- Simply that the 'Project was fun' (2%)
- Everything / other (1%)
- Nothing / don't know (7%)

Summary Findings and Recommendations

- **Program Values:** Educators largely valued this project for its place-based, applied project learning opportunity; as well as the supporting educational materials, Great Lakes science (and scientist) connections, and well-organized/facilitated community science process.

- **Alignment with Classroom Learning Goals**: Educators described this project as very relevant and value-added to their learning goals, most readily identifying 'Place-based/Project-based' learning pedagogy and 'Human Interactions with the Environment' learning standards as core values in this project.

- **Student Knowledge and Learning:** As a result of this project, **s**tudents described a great deal of learning about Lake Sturgeon science, issues, and conservation opportunity. A majority (51%) of students entered into this project with very limited or no knowledge of Lake Sturgeon or fisheries biodiversity conservation efforts. For example, one student

noted, *"I knew nothing about them. I didn't even know they existed."* Students most valued the opportunity to contribute to real science and stewardship of Lake Sturgeon in the Great Lakes; and demonstrated varying levels of growth in knowledge and attitudes toward conservation issues and Lake Sturgeon restoration efforts.

- **Students valued real, meaningful Science and Conservation:** Among their experience and learning, most meaningful to students in this experience was described as contributing to Lake Sturgeon or environmental conservation (29%) and/or contributing value to a real-world research effort collaborating with scientists (20%). This finding is best illustrated directly by student quotes:
    - *The thing that was most meaningful to me was becoming an actual kid scientist and helping improve the world.*
    - *That with my help real world scientists might be able to save this species that may go extinct but maybe with a little of my help I can try to help prevent that. Also getting insight into science that happens in the real world.*
    - *I got to genuinely be a part of something with real world effects and impacts.*
    - *I really enjoyed that I was doing something that mattered, rather than collecting data for some experiment made up by a teacher, the data collected in this project was useful and important.*
    - *It is nice knowing that I may have made a difference and it's nice that people are trying to preserve this long lasting species.*
    - *The most meaningful part of this project to me was, knowing that what I am doing is going to be a small help in restoring the lake sturgeon population.*
- **Student Engagement:** Educators felt engagement of students varied, largely dependent on what specific videos they drew to review (e.g. fish in the video engaged students, videos without fish lost student attention). Educators requested more videos and opportunities for engaging students directly with Lake Sturgeon and/or the Lake Sturgeon Research and Rearing Facility. Opportunity to cross-connect with other Lake Sturgeon education efforts was highlighted as a student value. For example, students who were also raising sturgeon in their classroom, another related sturgeon education program, often identified this community science project as adding value (and helping them to better see the value) in their experience of raising and releasing their own fish. One additional project spin-off step toward creating a more immersive experience for future participants was to capture 360 degree photos/videos to explore opportunities to create a virtual tour of the station (proof of concept for 360 research facility and field study tour online here: https://www.thinglink.com/video/1449910078894243843); as well recording a 'thank you' video from researchers with Lake Sturgeon in the Black River for educators and students participating in this current pilot cohort.

- **Educational content and materials** were recommended by educators as higher level, most appropriate for high school/pre-college age learners. Educators overall felt these materials, as presented, were helpful in preparing themselves with background knowledge and learning that helped them to better facilitate the project with students. A recommendation for future cohorts would be to develop additional, more simplified companion materials/videos designed for use directly with students.

- **A Future for the Program?** Nearly all educators (91.7%, Figure 3) indicated they would participate in future. This speaks to value in current effort, and also that educators value and envision this project as a valuable opportunity and addition in their education efforts.

Assessment Literature Cited

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