Formative Evaluation: Museum of Science - Boston Live Animal Shows

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Executive Summary

Evaluation Purpose

The Museum of Science in Boston, Massachusetts is one of the world's largest science centers and the most visited cultural institution in New England. Located in Science Park, a piece of land that spans the Charles River, the museum is conveniently situated close to Boston and Cambridge. The museum has more than 700 interactive exhibits and a number of live presentations offered daily. One of these daily shows include live animal presentations, where museum visitors can learn more about some of the many animals that the museum cares for in its live animal center. An evaluation of these live animal shows was conducted in order to collect information about the museum visitors attending the shows and in order to contribute to continued improvement of the live animal presentations.

Key Findings

To answer the evaluation questions, we used four survey instruments: surveys, interviews with children and caregivers, and observations. All data was analyzed and synthesized and organized within the framework of our evaluation questions.

Motivation to Attend

Visitors were motivated to attend live animal shows because of their interest in seeing a live animal up close. Announcements and signs in the museum informed visitors about the live animal shows and allowed them to act upon their interest.

Points of Interest and Engagement

Participants frequently cited the live animals and the presenters as the most engaging aspects of the live animal shows. During the live presentations, the audience was engaged when presenters asked questions and shared interesting facts about the animals. People reacted to these moments by shouting out and raising their hands. The moment that the animal was revealed during the show was consistently a high point of excitement. Technology use, particularly using videos and cameras to show the animals up close, were effective for engaging the audience.

Inspiration for Learning

After the presentations, many children enjoyed going up to the stage to see the animal up close and ask questions based on their observations of the animals. In surveys and interviews it was revealed that many audience members remembered specific facts that were shared during the presentation about the animals, particularly if those facts were shared with humor or were explicitly connected to people's prior experiences. Many caregivers and children expressed interest in having more opportunities to see the animals up close and seeing the animals interact or move around more. Children in particular were interested in learning more about the individual animals and their habits, for example, learning their names, ages and favorite activities. Overall, many families expressed satisfaction with the live animal shows and did not provide any suggestions for improvement.

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Introduction

The Museum of Science, located in Boston, Massachusetts offers a variety of presentations where educators bring science topics to life for viewers in accessible and engaging ways. A variety of venues at the museum house presentations that introduce audiences to live animals, current science topics, the science of electricity and lighting and more. The presentations offer a different mode of knowledge transfer through audio/visual and in-person interaction that encourages the audience to ask questions and actively engage in the topics. In compliance with specific covid safety protocols, educators adapt their exciting offerings to best meet the needs of each audience, while offering some new knowledge for the audience to take away. Audience members of all ages join the shows to learn from experts while joining an environment that is non-judgemental and accessible to their learning and physical needs. The live shows compliment the rich and diverse content in the museum exhibits. They enhance the museum visit through connection with experts and deep engagement with a specific topic.

Live animal shows are offered daily at the museum. They are taught by educators who are trained in handling the animals and the educators develop their own lesson plans for the presentations. These live animal presentations, which are currently being hosted in two different theaters at the museum, are 20 minutes long and are recommended for children in grades K-12 and their families. The shows are free with museum admission and open for all museum visitors to attend. The live animals featured in the presentations come from the museum's AZA-accredited Live Animal Care Center, which supports a collection of over 120 animals and many colonies of invertebrates. These animals make appearances at more than 4,000 programs throughout the year.. Although the live animal shows have been a feature at the Museum of Science since its opening, they have never previously been formally evaluated. This report outlines details of an evaluation that was conducted for the live animal shows, by a student team from Harvard Graduate School of Education, as part of their Formative Evaluation course.

Evaluation Purpose and Objectives

The aim of this evaluation is to assist the Museum of Science in gaining insight about how the live animal presentations are impacting young children (ages 0-10) and their caregivers. Specifically, the Museum is interested in learning more about what is motivating families with young children to attend the live animal presentations, and what they are gaining from the presentation after leaving.

Evaluation Questions

Our formative evaluation on the live animal shows will focus on the following three questions:

1. What motivates families with children ages 0-10 to attend live shows?
2. What aspects of the live presentations, if any, do visitors find interesting and engaging and why?
3. What are audience members (children ages 0-10 and caregivers) gaining after engaging in the presentation?
    a. In what ways, if any, are audiences inspired to learn something new?
    b. What, if anything, do visitors find surprising or interesting about the information presented?

Stage Presentations Logic Model

Resources	Activities	Outputs	Outcomes	Impact
MoS Education team	Powerpoint viewing	Total time spent present/engaged in the presentation	Cultivate curiosity in the topic (animals, their habitats, interesting facts, etc)	Foster confidence in viewers as they engage in science-learning
PowerPoint presentation (Including videos, images, text, and other visuals)	Question asking/answering	Verbal Responses (ex. Gasping, laughing, shouting out, responding to questions from the presenter, etc)	Seek to answer said curiosities by engaging with the rest of the exhibits/museum activities	Encourage audiences to stay curious about animals, their roles in the world, and the uniqueness between animals
Microphone	Video viewing	Physical responses (ex. Raising hands, gesturing etc)	Spark discussions at the museum and after the visit about the concepts presented during the presentations	Make learning and exploring curiosities about animals and nature (locally and globally) appear more accessible in audience's daily lives
Cameras	Observations	Asking questions during the presentation to caregivers, friends, siblings, etc	Increase awareness or understanding of abstract scientific concepts through concrete presentations	Promote passion, interest, and curiosity for science learning through engagement with live animals and beyond
Computers		Asking the presenter questions following the show	Ability to identify at least one interest or thing that you learned	Increase awe and engagement with museums
Stage and seats		Getting a closer look at the animal after the show	Increase connection between audiences and museum education staff	Offer participants new perspectives to inquire about the world around them
Animals			Employ accessible live presentation practices so a wide range of audiences are able to participate and learn from stage presentations	

Methods

Evaluation Design and Data Collection Methods

For the evaluation of the live animal presentations at the Museum of Science, data was collected using four instruments: Interviews with children and with caregivers, observations during presentations, and surveys post-presentation. Due to the nature of live stage presentations, this formative evaluation was conducted with a blend of qualitative and quantitative methods. The sampling method used to choose participants from within the target audience was convenience sampling, meaning that any visitor who was willing to be interviewed or be part of the observation study and made themselves accessible was part of the sample.

Observations

Purpose

While the live shows were being presented, participants were observed for specific behaviors, including whether participants raised hands, asked or answered questions, and if they left before the show was over. The best way to track this information is by using an observation guide. By conducting observations, this behavior could be recorded as it was occurring (Merriam, 1998). According to Merriam (1998), conducting observations allows for researchers to "see things firsthand, and to use his or her own knowledge and expertise in interpreting what is observed, rather than relying upon once-removed accounts from interviews" (p. 88). Conducting observations allows for researchers to collect data about information that may not be revealed in an interview or survey (Merriam, 1998). The evaluation questions of the live animal presentations are focused on three main areas: First, what motivates families to come to the presentation? Second, what aspects of the live presentations do audience members (children and their caregivers) find engaging? Third, what are audience members gaining after watching the presentation?

The purpose of conducting observations was to collect data for the second evaluation question: "What aspects of the live presentations do audience members find engaging?" Elements included in the observation guide focused on setting, estimated number of participants, participant behaviors and interactions with the presentation, frequency and duration as well as nonverbal communication. Conducting observations was important for developing a better sense of how audience members are interacting and engaging with the specific parts of the live presentation. It also assisted in collecting information about the estimated demographics of the participants. Gathering observational data about the estimated age of children in the audience and the number of attendees was useful information for the evaluation, because there was no guarantee of how many survey respondents there would be. Finally, the live animal presentations are disparate in nature. They include different live animals, different presenters with varied teaching techniques, and different technologies (some use videos, others only use slides). Using an observation guide that allows for consistent information to be collected in a standardized format is useful for data analysis. Collecting this information allowed for a more in-depth analysis of any particular trends in the format or style of the presentation and how it affected engagement.

Protocol

Everyone within the evaluation group observed the live animal shows and collected data on printed copies of the observation guide (included in the appendix). In order to ensure accuracy of the data, the observation data was collected separately on two copies of the observation guides, and researchers sat on opposite sides of the room. Researchers acted as an "observer as participant" (Merriam, 1998) and collected data during the entire live presentation until the program ended. The completed observation sheets were collected and the data was analyzed and compiled in an excel sheet.

Surveys

Purpose

The response categories for the surveys include open-ended and closed-ended questions, to balance respondent's burden between time spent on checking boxes or writing short-form answers. The two open-ended questions are about engagement and key takeaways. This format would allow the respondent to provide rich, detailed information without the constraints of multiple-choice format (Dillman et al., 2009). The following table includes a breakdown of each section of the survey and connects each question and the contents of the survey to evaluation objectives.

Section of Survey (in the order that it is presented)	**Contents and format**	**Connection to Evaluation Objectives**
Introduction	Description of the survey and contact information.	As respect to persons (Department of Health, Education, and Welfare, 1979), this portion provides transparency into the goal of the survey, how the survey results will be aggregated, and includes a disclaimer about voluntary participation. In case there is feedback or if we are able to sample further respondents for a phone survey, contact information is provided.
Q: How did you hear about the live animal show today? Q: What motivated you to attend a live animal show today?	Nominal closed-ended format (Dillman et al., 2009) with a category to include responses not captured in the options provided. Instructions to check all that apply.	To address the evaluation question: What motivates families with children ages 0-10 to attend live shows?

Q: How many children, if any, are you visiting with today? Q: If you are visiting with children, what is their age(s)? Q: If you are visiting with children, what is your relationship to them?	The first two questions are open-ended to gather precise information (Dillman et al., 2009). The question about the relationship between audience members includes a wide variety of options as well as an option to decline answering. As we expect this to be a primarily offline survey, all questions for those attending with children are grouped together to help the flow of the survey for the respondent.	These questions would help provide basic demographic information. The evaluation objectives are seeking to better understand the visitor experience of children ages 0-10 and parents. Depending on the responses, the analysis may be differentiated between children aged 5 or below and 6-10.
Q: If you attended the show with children, which aspects of the presentation were most engaging for the child(ren)? Q: Which information (if any) did you find most interesting or surprising about this program?	A multiple-choice question to understand which aspects may have been most engaging for the child, if child present in the party Open ended question for the adult's own experience.	To address the evaluation question: What aspects of the live presentations, if any, do visitors find interesting and engaging and why?
Q: Was there anything that you (or your child) heard or saw that made you curious to learn more at home? Please elaborate.	Open-ended question to allow responses that span all the different connections audience members may be making between their lives and the animal show. If there were no such connections to take into the future, this part should capture that as well.	To address the evaluation question: What are audience members gaining after engaging in the presentation?
Q: What is your age?	Nominal closed-ended, with the option to decline answer.	The analysis of the results would be divided by demographic - the adult's experience may differ between parents, grandparents or visitors without children. This

		question is at the end as it is not a high priority question, so in case of survey fatigue, we would still collect valuable information in the beginning.
Conclusion	Thank you note.	

Protocol

The surveys were collected both online and offline. QR codes print outs were disseminated across the seating area. Surveys were initially primarily placed in the seating area, and eventually by the third data collection day, they were handed out to the attendees as they entered the theater. The appendices include the surveys, and the script that was followed before data collection.

Child Interviews

Purpose

Collecting data from the target audience members results in a study that centers the voices and experiences of the audience themselves. While there are many ways to measure knowledge, an interview with this section of the target audience (children ages 6-10) offers the most usable data while not being burdensome on the participants. Self-report measures were considered; however, they can often be inaccurate when measuring knowledge gained, and are not age appropriate for younger learners (Diamond et al., 2016). With the evaluation objective in mind, interviews were conducted with audience members ages 5-11 to gain details about what the child is leaving the presentation with, such as memorable moments, lingering questions and curiosities, and what adjustment they would like to see in future shows.

The proposed protocol allows researchers to measure knowledge retention, recall and recognition from the experience (Diamond et al., 2016) in an age-appropriate and engaging manner. This method was selected with the user in mind (Baxter, 2015), considering the culture of the experience while acknowledging best practices with children. Interviews are accessible to more audience members, acknowledging that for some, they are not able to write and read proficiently. Additionally, this approach allows the research team to be scaled and replicated for the various live animal shows, while providing information that can be compared between the shows. Due to the specific demands of the target audience, the interviews were semi-structured. This format has set questions but allows for some flexibility based on the engagement of the individual participants and for a variety of follow-ups based on the responses of the children (Diamond et al., 2016).

The table below is a guide to help understand how the semi-structured interview questions are connected to the evaluation plan and objectives.

Interview Question	Connection to Evaluation Objectives
What was the show about? What did you learn?	Through a summary of the experience, gain a better understanding of the key takeaways the child has from the show.
Favorite part of the show and why	Better understand the elements of the show the child(ren) found most engaging and why specifically they were engaged in that moment
Feeling when the live animal was brought out	What, if any, did the audience find interesting and engaging.
Suggested changes for the show	Gain understanding of moments that were engaging and interesting to the child(ren), and identify moments they did not engage with
What, if any, questions do you have about the show	Better understand curiosity and desire to learn more beyond the show.
What did you learn during the show?	Better understanding of what information was new and memorable to the child(ren).

Protocol

Interviews were conducted with children immediately following the live animal presentation, with consent from caregivers and assent from the child themselves. Participation was voluntary and the educators made an announcement about interviews while the researchers approached individual participants. A script (see appendices) was used to ensure consistency between interviews and data was collected on an interview form (see appendices).

Caregiver Interviews

Purpose

We designed the post-attendance interviews with the purpose of gaining insight into the audience's experience of the live animal presentations. This interview seeks to identify which aspects of the show are the most impactful in the audience's co-learning experience within their families and to explore if and how their learning transcends their museum visit. The target audience for this instrument specifically is the caregivers of children aged 5 and under, using them to gather descriptive data about their motivation for attending the show, the learning that resulted from their engagement, and their expectations for similar shows in the future.
The post-attendance interview was semi-structured due to the flexibility that this allows for how each question is asked, enabling us as interviewers to drive it in a way that touches the main ideas we are looking into while also being mindful of how our language may influence our participants' responses (Diamond et al., 2016). Moreover, a semi-structured interview honors the

diversity in the audience members' experiences, leaving room for us to adapt the structure of our interview questions to the needs that our interviewees present. That way, each round in which we implemented the survey served as formative feedback for ourselves by informing us of the effectiveness of each question and how well it related to our Evaluation Objectives (Diamond et al., 2016). Their connection is as follows:

Question	**Connection to Evaluation Objective**
What brought you into the live show today?	Gain a broader understanding of what drives the museum visitors' motivation to attend a live animal presentation.
What aspects of the show were the most engaging to you?	Identify which aspects of the show are the most impactful in the audience's families' co-learning experience.
What learning are you taking away from this live show?	Identify which aspects of the show are the most impactful in the audience's families' co-learning experience.
If you were to visit us again/attend another live animal presentation, what would you like to see done differently/more of?	Obtain feedback surrounding what would motivate a visitor to willingly attend a live animal presentation in the future.

Protocol

The interviews were intended to be conducted with audience members that were caregivers of children aged 5 and under, immediately following the live animal presentation at the Museum of Science, Boston. After the completion of the show, the presenter made an announcement that student researchers would be conducting an interview to inform caregivers that we would approach them and invite them to voluntarily participate in an interview.

Methods for Data Analysis

After data collection, the research team used coding to process the qualitative data, seeking to identify recurring themes. After information was grouped based on codes, the team

revisited the coding to ensure that the data was used the most effectively and in the best way to support the evaluation objects. (Rosala. 2019). The research team convened to reflect on the main findings and interpret the data.

Observations

The process of analyzing the observation data involved compiling information, inductive coding, and identifying the main themes within the data using a thematic analysis method. All of the data from written notes on the observation guides were first manually added into an excel sheet. The numerical information, which included the date and time of the live presentations, as well as estimated numbers of visitors attending the show, counts of people leaving during the show and estimated number of children present were added first. Next, coding categories were developed and the data was sorted into these coding categories. The codes used to analyze the data included activity codes, event codes and strategy codes and were both descriptive and interpretive codes (Bogdan & Biklen, 2007; Rosala, 2019). Each of the presentations were facilitated by different educators and each live show had a different "style, "featuring a different animal. The presenters had varied teaching techniques, and used a variety of technologies (some use videos, others use slides). For this reason, the observation guide was loosely structured to allow observers to write down actions that the presenters or the animals initiated that resulted in significant reactions from the audience. By analyzing the observation guide, it became clear that these actions could be broadly grouped into four themes, or 'types' of actions. These included: Questions and statements shared by the presenters, the moment the animal was revealed, and actions done by the animal. Questions that children and adults asked at the end of the presentation were also manually added into the excel sheet.

After the data had been compiled digitally, it became clear that the actions that initiated the qualitative behavioral data within the coding categories needed to be further broken down into subcodes. Bogdan & Biklen explain, "If the code consists of data that would break down further for convenient handling, develop subcodes to take your analysis further" (p. 186). The data within each coding category was analyzed to identify trends that could be grouped into subcodes. In the "Questions" category, questions asked by the presenter were sorted into different types of questions: Yes/No Questions, Closed Questions and Open Questions. This made it possible to analyze different reactions by the audience based on how the questions were framed by the presenters. Questions asked by the audience were also grouped into categories. In the "Statements" category, the things the presenter said during the presentation were further broken down into subcategories: "fun facts" and general facts about the animal shared by the presenter, jokes, and moments when something significant was revealed by the presenter.

Surveys

In terms of the mechanical handling of data (Bogdan & Biklen, 2007), 14 online and 53 paper surveys were gathered which were scanned into PDFs in chronological order of each show. It was then manually entered into Excel in a SharePoint drive, and all the data was read from beginning to end in the process, as recommended in the Nielsen Norman Group article. Since the surveys captured self reported information on audience opinion's, the open-ended questions allowed for qualitative attitudinal data and a thematic analysis was conducted on the information

received (Rosala, 2019). Overall, the paper is organized first into descriptive analysis and then goes onto adding an interpretive lens to it.

The data collected in close-ended questions from the survey are represented in bar graphs, with descriptions following them. Where applicable, these responses have been looked at in tandem with other responses and taken into account in analyzing the responses as a whole. The open-ended questions highlighted some themes and patterns that were categorized into coding categories, including setting/context codes, subjects' ways of thinking about people and objects, as well as activity and event codes (Bogdan & Biklen, 2007). These themes are either consistent with analysis from the other data instruments or provide additional color to them. Upon feedback, some of the coding categories were broken down to subcodes to make the insights more digestible

Child Interviews

Based on the qualitative nature of the interviews, data has been analyzed and organized by codes and coding categories to find common themes and patterns from the raw data (Bogdan & Biklen, 2007). Some of these codes are specific to the individual tools, while others connect to feedback that was consistent between multiple tools. The codes used to analyze the data includes event codes, codes that connect to activities that occur in particular setting, and codes connected to subjects way of thinking about people and objects, meaning codes are given based on subject's understanding of each other, outsiders, and the objects in their world (Bogdan & Biklen, 2007). Using the coding system, the research team is able to better understand their meaning making and learning subjects engaged in during the show and get a better idea of their sparked curiosity.

The research team created themes that allow for the most valuable and connected data to the objectives to be categorized and highlighted in a way that will lead to meaningful and digestible results for researchers to share with stakeholders (Rosala, 2019). While coding and identifying themes was the most effective way to organize and share the results for the interview tool used, there were a few limitations. The sample size was rather limited since we only interviewed children within a specific age range (6-10 years old). Additionally, participation was optional for interviews, and some patrons of the museum chose not to participate which can result in some bias. These limitations should be considered when viewing the below results, analyzed data, and initial interpretations of the data.

Caregiver Interviews

The caregiver interviews sought to provide insight into visitors' self-reported motivators and thoughts of the live presentations, resulting in substantial qualitative attitudinal data. In order to best organize this data, we decided to take on a thematic analysis approach. This analysis method consisted of tagging the interviewees' responses with appropriate codes, which proved itself to be effective since our data was concise and specific (Rosala, 2019). Our coding facilitated the identification of important themes that we could then focus our analysis on. These themes translated into codes, which we developed based on the regularities that we saw across the interviews (Bogdan & Biklen, 2007). Due to the nature of the questions that made up the interview, some of the codes were descriptive, describing what the data was about and directly

summarizing the participants' responses, whereas others were interpretative, which included an analytical interpretation of the data (Rosala, 2019). Overall, this system enabled us to better understand the live presentation attendees' motivators for attending the show, their most significant learning takeaways, and the areas of potential future engagement.

Each of our interview questions was drafted directly in relation to an evaluation objective; because of this, the data obtained in response to each question was also directly related to a specific evaluation objective, providing structure for its analysis. In correlation with these objectives, the three following themes emerged: (1) Motivation for attendance; (2) Vehicles for engagement; (3) Representations of learning; and (4) Further interests.

Ethical Considerations

The evaluation study was carried out with the review and approval from the Museum stakeholders, and was consistent with the Museum's culture and values in interacting with their visitors. At the start of the live animal show, the educator informed the audience that researchers were present to observe the audience and collect data to improve the quality of the live animal shows. Educators reiterated that participation in data collection through surveys, interviews, and observations were all optional and audience members did not have to participate if they did not want to. A sign was also posted at the front of the room that informed museum visitors that the theater was being observed. The interview protocols clearly outlined the ways for museum visitors to opt out of the study. See appendix for scripts and more information shared with audiences.

Convenience sampling helped limit personal biases that can impact the selection of participants for this study. Sensitivity to the adult's time and the accompanying children's needs was maintained. Children were interviewed with the explicit consent from adults accompanying them and assent, or approval, from the child themself (Diamond et al., 2016).

The interview and survey questions were designed and revised to be user-friendly with straightforward language. The interviews, and the surveys and all contents within it were entirely optional, and reluctance to participate in no way altered the experience at the museum. When disseminating the surveys to individual attendees, it was again mentioned that the surveys are voluntary. The interviewers and survey introduction paragraph emphasized that the participants' opinions are valued and that their valuable feedback will positively impact their future visits and the Museum community at-large. All survey materials and additional materials used for data collection were cleaned up before leaving the premises and returned to museum staff.

Any data or field notes shared beyond the evaluation team was anonymized. Even in cases where identifying information like child names were mentioned, they were redacted. None of the interview questions prompted answers that could then be used to identify the interviewee (Diamond et al., 2016). Moreover, this preventative measure sought to reduce the inevitable subjectivity that results from implicit biases underlying our interpretation of the data, aiming to keep this process as objective as possible. Avoiding bias and maintaining participant authenticity was also of great importance, so we have included quotes and documented interview responses

verbatim in order to remain true to the participant that spoke them. Finally, the scanned files and raw data were stored on SharePoint in order to ensure maximum security.

Evaluation Timeline

Activities	Timeline
Complete Evaluation Plan Draft Submitted to Stakeholders	23 February
Stakeholder Review of Draft	Suggested: Within 2 weeks following draft submission Completed: 8 March
Human Subjects Training Complete	8 March
Draft of Feedback Instruments Complete	8 March
Start of Data Collection	26 March
End of Data Collection	4 April
Data Analysis Complete	15 April
Evaluation Findings Presented to Stakeholders	26 April
Final Report Submitted	May 9

Findings

Below are the findings from each of the instruments. Data was collected for a total of six live animal presentations on both weekdays and weekends, in the Science Live Stage and the Cahners Theater. The data was collected on March 26th, April 1st, and April 3rd, 2022, for the morning and the afternoon live animal shows.

Observations

Over the six live presentations that were observed, an average of 95 people were estimated to be present in the audience. Of these 95, an average of 28 children under the age of 10 were estimated to be in attendance. During the shows, an average of 18 people left the theater. The total estimated number of visitors for each live presentation are shown in Figure 1 below. The difference between the number of people present in the audience was not found to be statistically significant on weekend vs. weekday showings. It should be noted, however, that researchers only observed shows on a Friday, and not during any other weekdays.

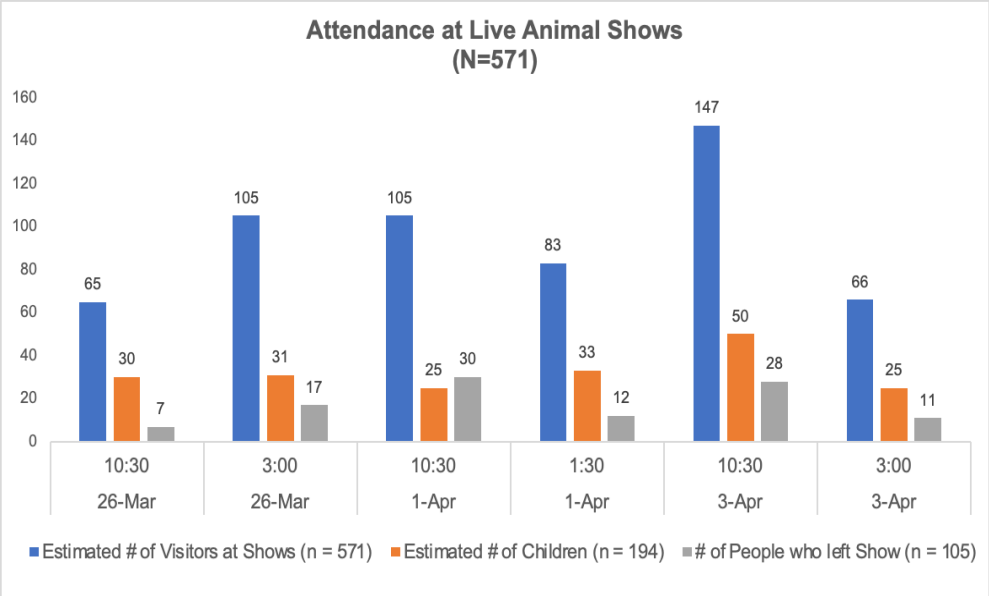

Figure 1. Estimated total # of visitors attending live animal shows. Estimated # of children only includes children estimated to be age 10 or younger.

The educators often used technology as part of their presentations. The presenters used slideshows in 5 out of 6 of the observed animal presentations, to show photos, animations and other visuals that could accompany the information they shared. Cameras that could zoom in on the animal and connected to the projector screen were used in 3 out of 6 of the presentations. One presenter used a video and one used no additional technology at all.

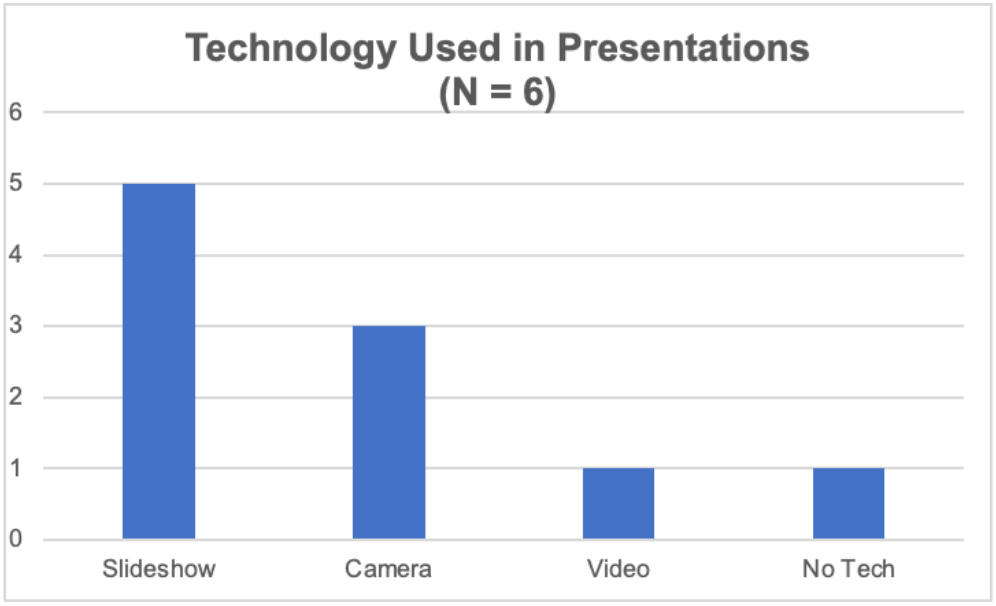

Figure 2. Technology used in presentations by educators. N = 6.

Questions

During the presentations, the presenters asked three types of questions: yes/no questions, closed questions and open questions. Over the course of the six observed presentations, a total of 9 yes/no questions, 12 closed questions, and 11 open questions were recorded as resulting in noticeable reactions from the audience. A large majority of the questions asked during each of the presentations were yes/no or closed questions. In two of the presentations, no open questions were asked at all. A graph showing all of the reaction types across the three questions can be seen in Figure 3. Overall, open-ended questions resulted in the most instances of hand-raising from the audience; this was recorded in 13 instances (Figure 3). Shouting out was consistent with all three question types (Figure 3).

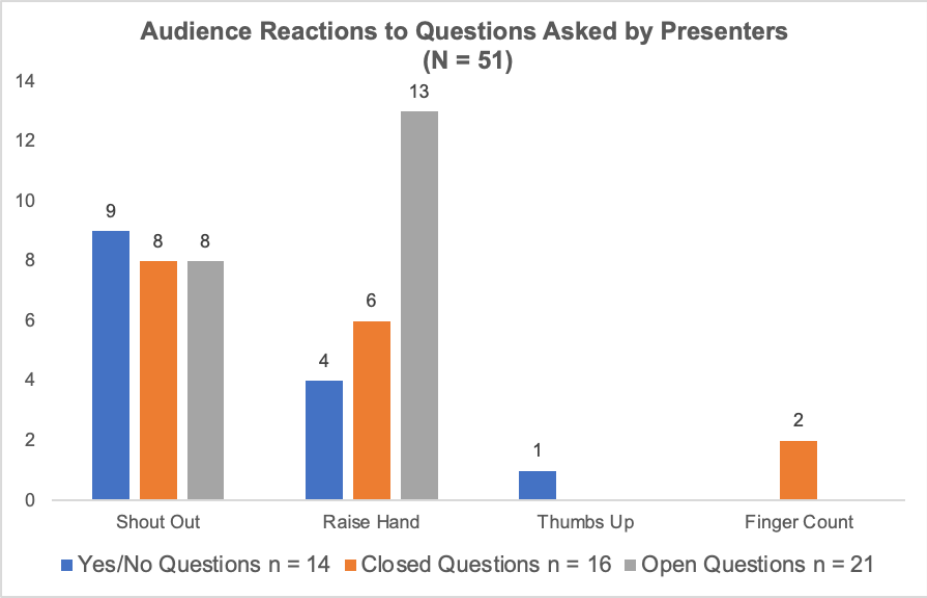

Figure 3. Audience reactions to questions asked by the presenters of the live animal shows.

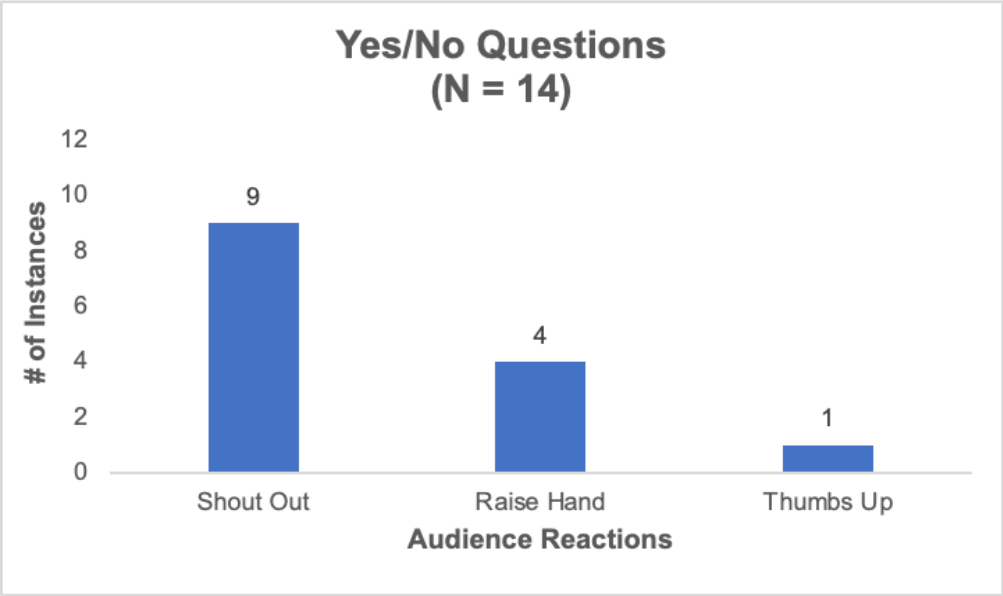

Figure 4. Audience reactions based on Yes/No Questions asked by presenters.

During the six presentations, observers recorded a total of 25 instances when the audience reacted to questions by shouting out answers, and a total of 17 instances when the audience members reacted by raising their hands. A total of 9 Yes/No questions were recorded, which resulted in 14 total audience reactions. Of these instances, shouting out consisted of 9 instances, raising hands had 4, and one individual had a thumbs up (Figure 4).

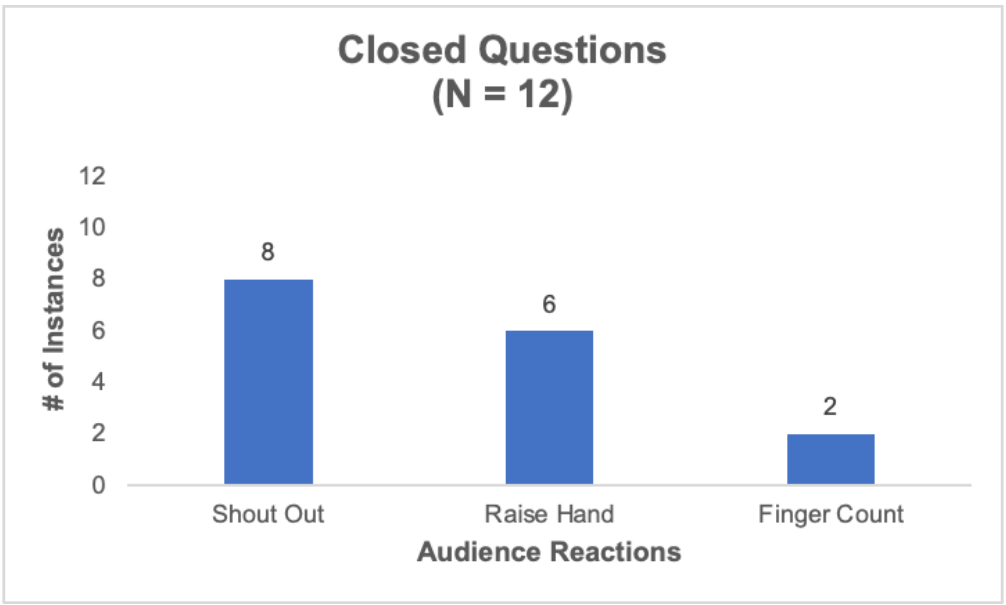

Figure 5. Audience reactions based on closed questions asked by the presenter. N = 12.

Open questions that required more detailed answers from the audience resulted in less shouting out compared to yes/no and closed questions (See Figure 3 above). Audience members reacted by raising hands in 13 instances out of the total of 21 reactions recorded in response to open-ended questions (Figure 6).

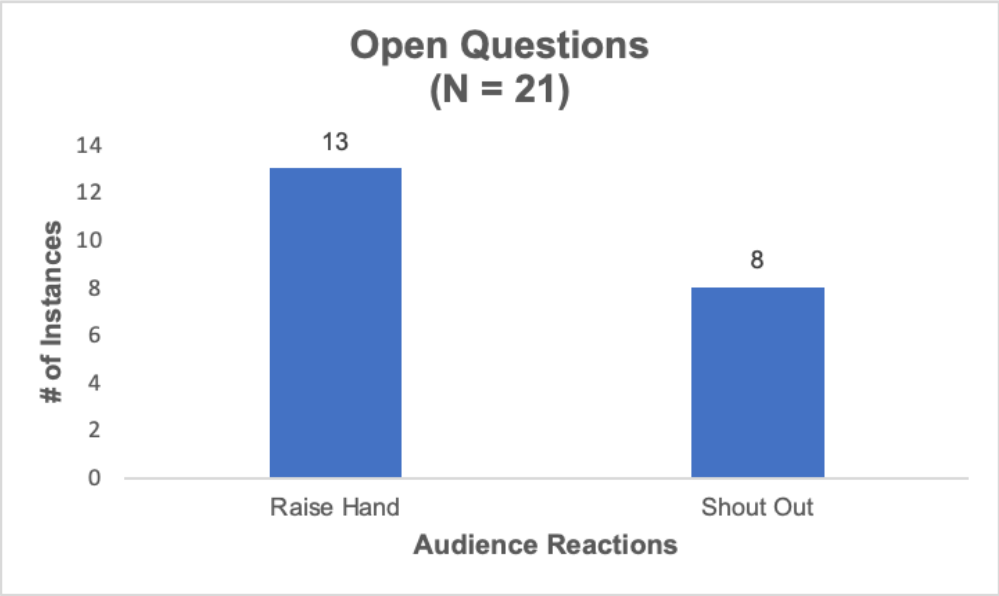

Figure 6. Audience reactions based on open questions asked by the presenter.

When presenters asked closed questions, audience members were sometimes asked to respond with claps or finger counts. This reduced some of the shouting out that often occurred with audience members. Examples of each of the types of questions and the reactions recorded by the audience are shown below.

Key: SO- shouting out; RH- raising hand

Yes/No Questions	**Reactions**
Could you spend 6 months underwater?	SO: "no"

Closed Questions	**Reactions**
"Which of these two is a snake?"	RH, put up fingers, SO: One! Two!

Open Questions	**Reactions**
"Where does the turtle go in the winter?"	Audience responses: Under the ground, in a warm place, underwater

Statements

Other statements shared by the presenter during the show were grouped into four categories: "Fun facts" or personal facts about the animal that was being presented (n = 11), general facts about animals (n =3), revelation or surprises (n = 13), and jokes (n = 2). Fun facts that were shared resulted in laughing (n = 7 instances) and shouting out (n = 8 instances). Overall, shouting out occurred most frequently after a presenter shared something surprising or revealed the animal (n = 10; Figure 7). Other than two jokes that were recorded, fun facts were the only things shared by presenters that resulted in laughing from the audience members. This was recorded a total of 7 instances (Figure 7). In one instance, when the presenter shared that a turtle was 40-50 years old, some children tried to stand up in their chairs to see, and one exclaimed "that's older than..!" A graph showing all of the reaction types across the three types of statements can be seen below in Figure 7.

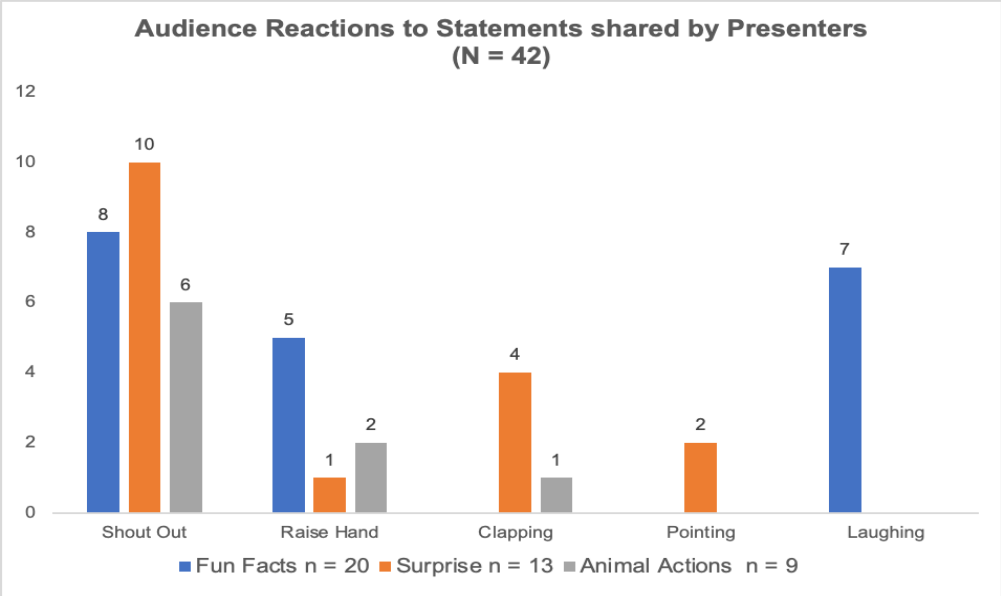

Figure 7. Audience reactions to statements shared by the presenters.

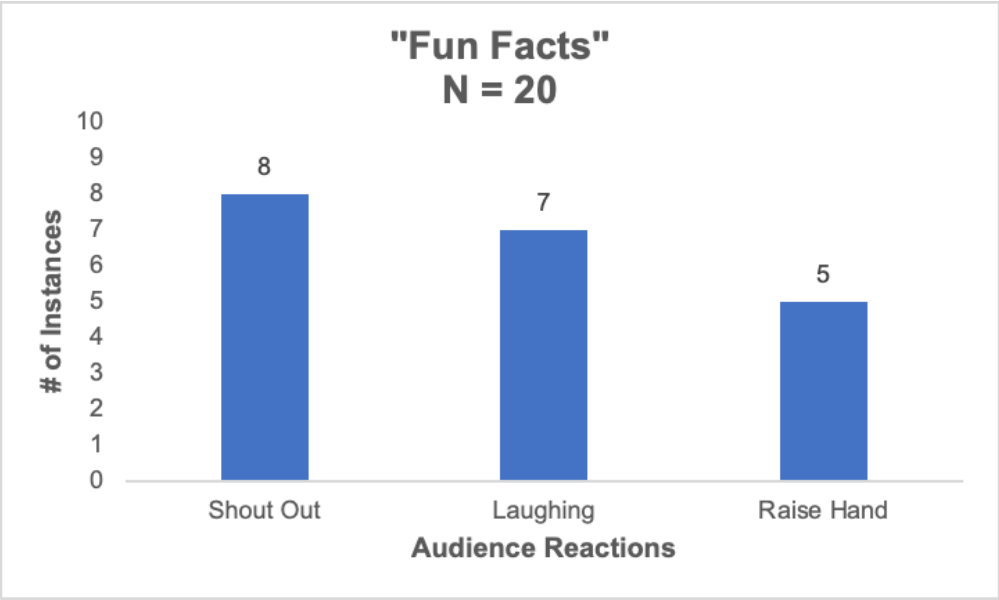

Figure 8. Audience reactions based on fun facts shared about the animals in the presentation.

After the presentations, many children also asked about the animal's name, what it ate and how old it was. Some examples of fun facts shared and the reactions from the audience are below:

Key: SO- shouting out; RH- raising hand

"Fun Facts"	**Reactions**
"His favorite food at the museum is cat food."	"Cat food!", Laughing
"..Age is 40-50"	"Ooh", lots of reactions, kids stand up to see, "That's older than…"
Reveals that skinks eat poop	SO, "Ewww", laughs

Another type of statement shared by presenters that produced many reactions from the audience were moments when an answer to a question was revealed, an animal was revealed, or the audience was surprised. These types of statements were grouped together as Reveal/Surprise moments. The audience reacted to these moments by clapping, pointing, raising hands or shouting out. The most common reaction by the audience members to moments of surprise was shouting out or talking. This was recorded in a total of 10 instances (Figure 8).

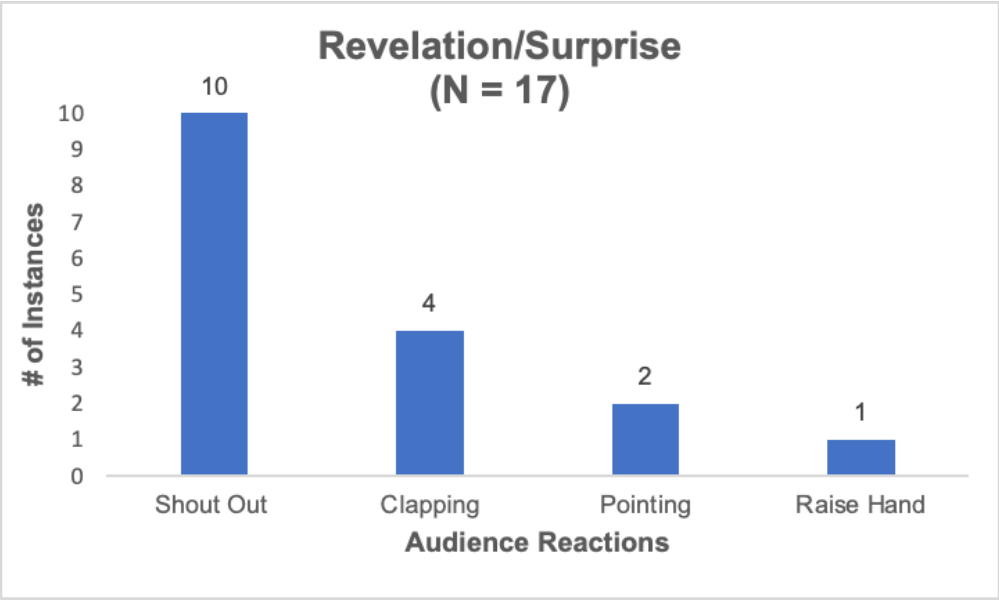

Figure 9. Audience reactions to moments of surprise or revelation as initiated by presenters during live animal shows.

At each point during the live animal presentations, the educators revealed the live animal that they had brought with them to the stage. They also revealed answers to questions they asked or surprising information about the animals. Examples of some statements and reactions that fell into this reveal/surprise category are shown below:

Key: SO- shouting out; RH- raising hand

Reveal/Surprise	**Reactions**
"We have a gameshow."	"Ooh"
(Audience finds out which one is a snake)	"Ooh", claps
"Let's go ahead and meet our contestants"	"Ooh", pointing, talking, SO, claps

Along with the moment the animals were revealed, another high point of engagement for the audience was observing the animal actions during the presentation. Shouting out or talking occurred most frequently and was recorded as occurring a total of 6 times (Figure 9).

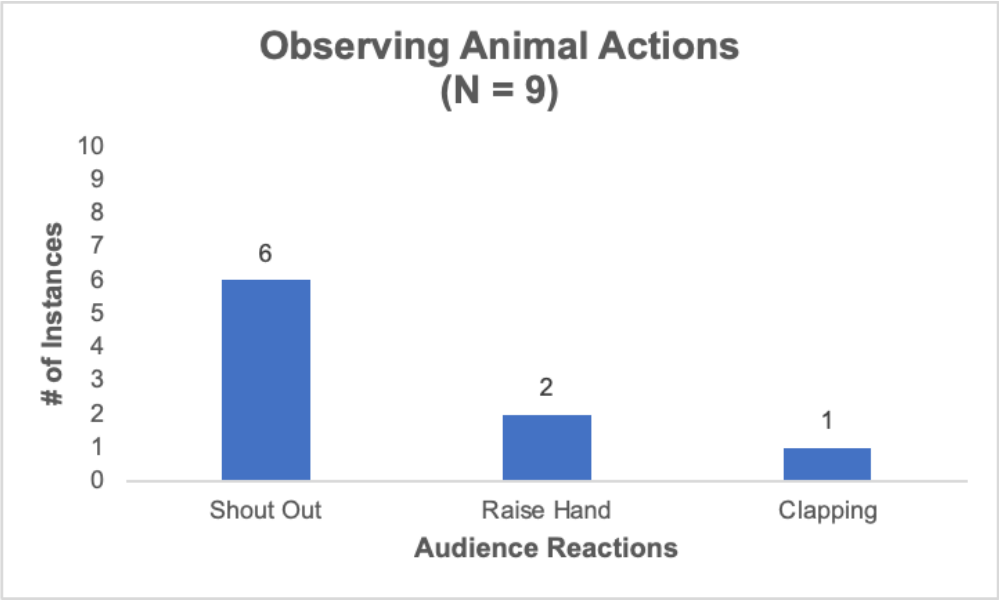

Figure 10. Audience reactions to animal actions during the live animal shows.

Questions from the Audience

To record questions asked from the audience members after the show, researchers approached the educators after the presentation and asked them to share the questions that they were asked. It is therefore necessary to note that the questions asked from the audience were not heard first-hand, but rather were recorded based on second-hand reports from the educators who most likely did not remember every single question they were asked.

The questions that audience members asked after the presentation were grouped into 5 categories. These categories were: Questions about facts based on the presentation, questions based on animal observations, personal facts about the animal, touch/feel questions, and an 'other' category of questions that did not fit into any of the other categories. A total of 32 questions were recorded:

➢ **Questions about facts based on the presentation** (n = 5)**.**
● *"What is the fastest snake in the world?"*
➢ **Questions based on animal observations** (n = 5).
● *"Why are his legs so long?"*
➢ **Personal facts about the animal** (n = 16).
● *"Does the possum like to play?"*
➢ **Touch/Feel Questions** (n = 2).
● *"Can I touch him?"*

➢ **"Other" Questions** (n = 4).
• *"What is the biggest type of turtle?"*

Table 1. Questions asked by participants after the live animal show. N = 32 questions.

Half of the 32 questions recorded were questions coded as pertaining to personal facts about the animal. Four questions coded within this category were about the animal's name, three questions were about what the animal eats and three participants asked about what the animal likes to do. Three questions also were about how old the animal was or how long it lived. Some of the questions asked by children after the presentation had to do with things they were observing about the animal in real-time. For example, children asked about why the turtle's legs were so long, or why the snake was sticking its tongue out. Two of the questions were coded as touch/feel questions, because the children asked if they could touch the animal, or how the skin of the snake felt like and if it was slimy.

Five of the 32 questions recorded were questions that related directly to information that was shared in the presentations. During one of the presentations about snakes, the educator shared that one way you can tell a snake from a lizard is by looking to see where the tail starts. She shared that the hognose snake had a much longer tail than the glass lizard. Someone asked after the show how she could tell where the body ends and the tail starts, because both the snake and the glass lizard had no legs. During a different presentation, the presenter talked about an adaptation that box turtles have where they have the ability to close their shells completely. The presenter shared a video to show an example of this behavior. After the presentation, one of the questions someone asked was if they could see the turtle inside of its shell.

Surveys

The 63 caregivers who took the survey represented the data of 112 children, some caregivers attended with multiple children. However, that exact number of children represented cannot be determined as no identifiable information was recorded. Any surveys taken by people outside our target audience, or otherwise with severe data quality issues, was marked in orange in the raw data and excluded in the analysis. The findings from the survey are divided by evaluation objective, and for objectives two and three, they are divided by results from close-ended questions and open-ended questions.

Evaluation Objective 1: Motivation for coming to the show

The two corresponding questions in the survey to evaluation objective # 1 asked how the attendees heard about the live animal show and what motivated them to attend (*responses in Figure 1a and 1b below*). Both these questions were asked in a checklist format where respondents could select multiple choices.

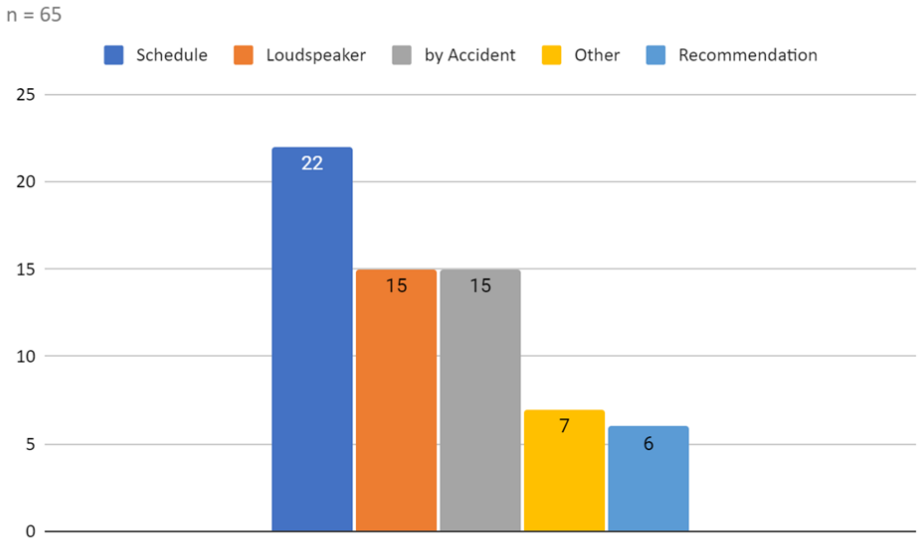

Figure 11: Responses to "How did you hear about the live animal show today?" N = 65.

Most responses to this question - a little over 30% - reported finding out about the live animal shows from the daily live show schedule. Almost 25% of attendees heard about the live animal show from an announcement on the loudspeaker and another quarter came across it by accident. In "Other", a number of people mentioned the front desk or cashier, and one wrote about seeing the sign on the door which may be interpreted as coming across the show by accident. Under 10% reported being recommended by a friend or museum guide. Note that it is possible that there were multiple interpretations of who or what makes a "museum guide" so in a future iteration of the survey, recommendation by a friend or museum guide could be divided up into two different options. One response mentioned that their motivation for coming to the show was "We are a homeschooling family learning about animals." Another response for a different question also noted they were a homeschooling family who would continue the learning at home.

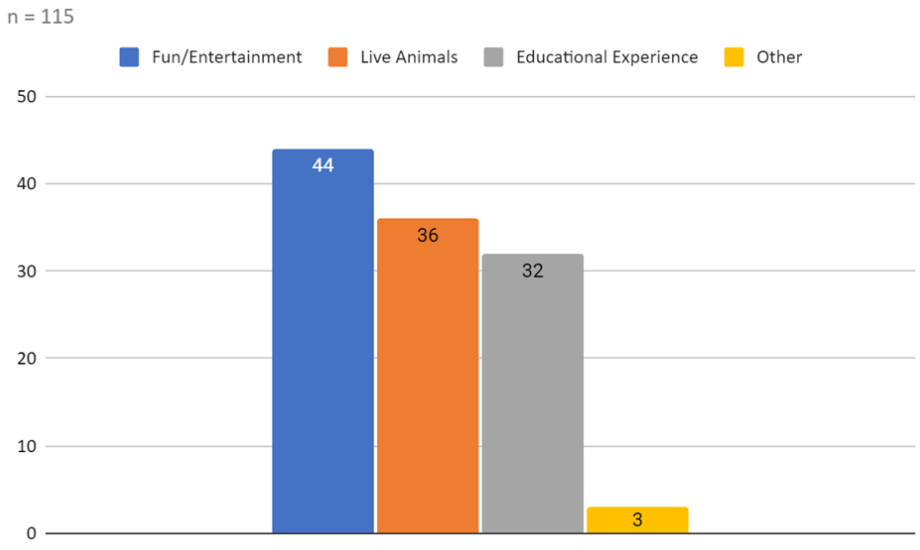

Figure 12: Responses to "What motivated you to attend a live animal show today?" N = 115.

In terms of motivation to actually attend the show after being informed of it, most people reported option b: Fun or entertainment. Fun/entertainment was the leading option both in the number of responses that exclusively report any one reason (just a, n = 7 or just b, n = 16 or just c, n = 10) as well as the number of responses that mention the fun/entertainment option (i.e. in conjunction with or without other options) as shown in the bar graph. Seeing live animals was reported the second most number of times. Educational experience was reported the least amount of times among the three close ended options. However, one open response noted "We are a homeschooling family learning about animals". Another notable distinction, of the seven responses that solely cited educational experience as motivation, two of the caregivers were nannies. No other nannies are represented in the survey.

Evaluation Objectives 2 and 3: aspects that are interesting and engaging, and new learning or inspiration for future learning.

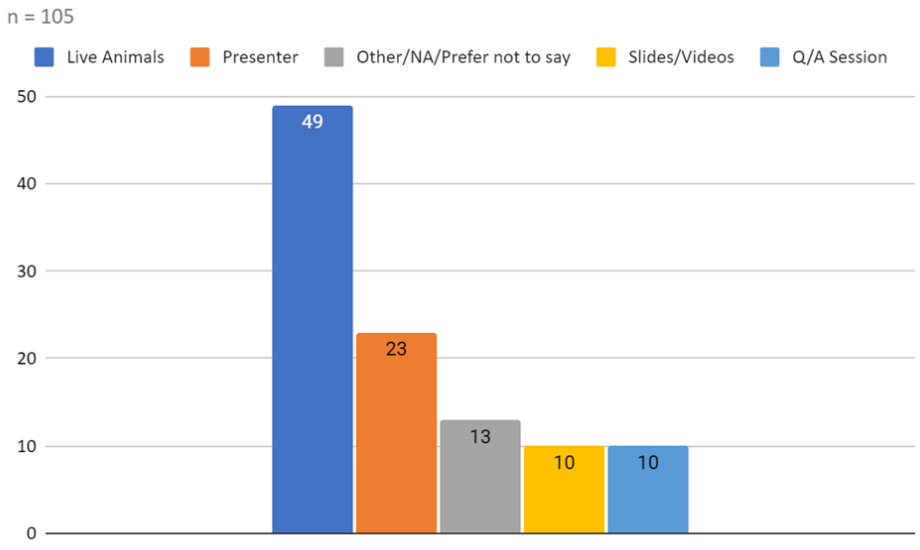

Figure 13: Responses to "If you attended the show with children, which aspects of the presentation was most engaging for the child(ren)?" N = 105.

The close-ended question relevant to these evaluation objectives, asked about which aspects of the presentation was most engaging or interesting to the attendees. Almost half of the responses to this question included mention of the live animals. The presenter was mentioned 23 times, and slides/videos and Q and A sessions were each chosen in 10 responses. In Other, "questions during the show" was mentioned - which could be a potential addition to the close-ended options provided in a future iteration of the survey. There was also mention of the use of animated visuals.

There were two open ended questions in the survey.

Q. 1. What information (if any) did you find most interesting or surprising about this program?

Q. 2. Was there anything that you (or your child/ren) heard or saw that made you curious to learn more at home? Please elaborate.

22 respondents skipped Q1 and 36 respondents skipped Q2. The responses did not strictly adhere to what the question was asking and were sometimes a duplicate of each other, so the broader themes gleaned from them have been collated together. However, the n for each example is delineated by open-ended Q1 and Q2.

Broadly, there were five themes that emerged from the open-ended questions in the surveys. First was a theme of *connections with life.* The audience appreciated connections to the presentation and their own lives. Similar to the first, there was a theme of seeking *connections with the home environment* as the audience wondered about similar animals in their immediate environment. The third theme was *demonstration of learning,* which could be seen in a few

specific ways. Connected to the third theme was the fourth, where we learned ways the children may be gathering *inspiration for learning* in the future. Finally, although the survey questions did not explicitly ask for *suggestions for improvement*, some attendees made note of their suggestions. The animals represented in the shows that were evaluated were a possum, skink, boa, turtle and snake. Note that when quotes are noted with the number of times they are mentioned, the data is based on each show (versus survey wide).

Connections with life

Curiosity was piqued when the presentation explicitly called out personal connections to the audience, including caregivers.

Adults in the audience, in particular, were very excited to learn that this mother reptile gives live birth (Q1 n=5; Q2 n =2). Examples include

- Q1: "I never knew there are reptiles that give live birth!"
- Q2: "What other reptiles give live birth"

The audience appreciated the connection to April Fool's Day (Q1 n = 2).

- "There was a relevant theme to the day (April fools), that was thoughtful"
- "I like how they connected the animals to April Fool's day"

For context to the above responses by the caregivers: the caregivers in attendance were mostly in the 35-44 age bracket. They were primarily parents but there were several family friends or aunt/uncles (and one or two chaperones for school trips or grandparents). Please see appendix for further demographic data.

Connections with the home environment

In response to both the questions about what information was most interesting or what would be something that they are curious to learn more about at home, there was a consistent theme of making connections with their home environment. Some qualitative examples below:

- "What to do if you see the animal not to spook it but get a better look"
- "If you learn more about turtles, you can help them more"
- "...Will keep eyes out at our nearby creek for wood turtles. Thanks."
- "Want to find out what snakes live near us"

Demonstration of learning

Live animals allowed for and encouraged deeper observations of the physical characteristics of animals.

In the morning show on March 26, all text responses referring to the question about surprising or interesting facts mentioned physical characteristics of snakes (Q1 n=6; Q2 n =3). Examples below:

- "As an adult I learned characteristics of snakes that I didn't know about."
- "Lizards may not have feet"
- "That snake A was a lizard"
- "Snakes have tails"/ "Snakes don't have ear holes or eyelids"

Q&A sessions created opportunities for further learning

Below are two examples that demonstrate that the Q&A sessions appear to be enhancing learning.

- Parent wrote on their child's behalf: "I learned about the use of its tongue because I got to ask questions at the end"
- In response to the question about what made you curious to learn more about, another parent wrote "My children had the opportunity to ask their own questions about animals"

Content shared with humor or funny facts made the content more salient.

Learning about the fact of coprophagy or animals eating their own feces was mentioned several times for the skink show (Q1 n =4, Q2 n=1). Examples include:

- "The fact and behavior of coprophagy will have my children looking further in depth"
- Skinks eat poop!

Learning that turtles can breathe through their butt was presented in a funny way, and four out of five text responses in that show about the most surprising or interesting part include that fact (Q1 n=4).

- "Wood turtles breathe through their butts. Wood turtles can live to be 100 years old."
- "My daughter repeats that she knew they breathe out of their butts"

Inspiration for learning

Caregivers considered a memorable live animal show to be impactful on the child's interests at least in the near term.

Below are two responses to Q2 that illustrate this.

- "Animal facts in general spur them to focus on animals for the afternoon - perhaps even decides what tv they may consume this afternoon - aka wild kratts or PBS. They're more likely to play with animal toys at home."

- "We may not do a presentation on snakes, but my child is homeschooled and throughout the day we will find something to do a poster board presentation on"

Suggestions for improvement

These notes were jotted down in the paper survey by the adults, even though there was no question asking for suggested changes. This points to a potential future improvement in the online surveys to make space for "any additional comments".

One suggestion was to enable a better look at the animal. (*see in conjunction with child interview data about more physical engagement*).

- "How to tell when [the] body ends and tail starts?...The key features of this show (eyelids, tail/bodyline) are very hard for the audience to see even with the close-up camera)"

Even when content and presentation was enjoyed, benchmarking the content level for young kids was suggested by one attendee.

- "Skinks are interesting! A little above my kids level" - Adult with kids aged 3, 4, and 5

Child Interview

11 interviews were conducted with participants ranging in age from 5-11. Interviews were conducted following the live animal presentation and were only conducted with children whose caregivers gave consent and the children gave assent.

Engagement

Relevant Evaluation Objective: What aspects of the live presentations, if any, do visitors find interesting and engaging and why?

Can you tell me what the show you watched was about? (n=11)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Animal name/type	Participants shared the animal the show was focused on	4	"Turtle" "Lizard"

Animal Fact	Participants shared an a fact associated with the animal	5	"about the slowest snake in the world" "turtle was red, it ate leaves, plants, and fruit"
Personal Story	Participant shared a personal story on a similar topic of the show	1	"before I liked snakes but now I don't because one bit me"
Other	Participant shared another answer connecting to the topic of the show	1	"Let the snake slither, I would like to hold the snake"

Did you learn anything new today? If so, can you tell me about it? (n=11)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
New Facts	Participants shared interesting facts they learned	10	"They eat poop to get good bacteria" "about camouflage. They have drawings on their bellies to help animals not see them"
General information	Participant shared general animal information they learned	1	"Not all animals are snakes"

What was your favorite part of the show? Can you tell me why? (n=11)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Seeing the animal		7	"seeing the animals

			because I like seeing live animals and new animals”
Fun facts	Participants shared that learning an interesting fact was their favorite part	2	“The poop part” “The birth part”
Unique show elements	Participant shared that their favorite part was a unique element in the show	1	“the animal race [on the screen in the desert rosy boa show]”
Not a specific part	Participant shared that they did not have a favorite moment	1	

How did you feel when they brought out the live animal (n=10)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Excited		3	“excited”
Shared other information	Participants shared other information about the animal	3	“Wish we could touch the snake” “Wish someone could keep the snake” “I knew they were endangered”
Not surprised		1	“I wasn’t surprised. I guessed it was a turtle”
Surprised		1	“Yes - surprised it was a snake “
Other	Participant shared other information about animals	1	“I've seen animals before” (then started sharing about seeing other animals)

What did you think about the video/powerpoint (n=4)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Helpful	Participants mentioned that it was helpful	2	"Helpful with the camera to see the animal up close" "Helpful to see the colors and patterns of the snake"
Okay	Participant mentioned that it was okay	1	
Unique moment	Participant mentioned a unique moment on the screen they enjoyed	1	mentioned they loved the race on the screen

What, if any, changes would you make to the show? (n=9)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Touch the animal	Participant said they wanted to touch the animal	1	
No Changes	Participants said they would not change anything	3	
Specific ideas	Participants shared specific changes they would make to the show	3	"I would make two turtles chase each other, watch a turtle to see if it likes going in water – put it in a pool" "I'd bring a snake too" "show some other

			animals that are not snakes. I would have liked to see more animals"
Scared	Participants mentioned parts of the show that were scary	2	"Showing children the skeleton [of the turtle] was so scary and will give me nightmares. You should not show it at all" "Predators were scary to see"

Inspiration for Future Learning

Relevant Evaluation Objective: What are audience members (children 0-10 and caregivers) gaining after engaging in the presentation?

a. In what ways, if any, are audiences inspired to learn something new?
b. What, if anything, do visitors find surprising or interesting about the information presented?

What would you tell a friend who would want to see the show? (n=5)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Would recommend		3	"Yes I would definitely recommend and will come to the 1:30 show"
Mentioned animals	Participants specifically mentioned animals in their response	2	"I would ask them if they like reptiles" "it's fun, you'll learn a lot about animals"

What, if any questions do you have about the show? (n=2)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**

None		1	
Life expectancy		1	"I asked how long they live up to"

What did you think about the video/powerpoint (n=4)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Helpful	Participants mentioned that it was helpful	2	"Helpful with the camera to see the animal up close" "Helpful to see the colors and patterns of the snake"
Okay	Participant mentioned that it was okay	1	
Unique moment	Participant mentioned a unique moment on the screen they enjoyed	1	mentioned they loved the race on the screen

Caregiver Interviews

We carried out a total of 7 caregiver interviews with participants whose accompanying children were all between the ages of 4 and 12 (median: 7, mode: 4 & 6). 6 out of the 7 caregivers were the accompanying children's parents, whereas the 1 remaining caregiver was the children's grandparent.

Motivation for Attendance

Relevant Evaluation Objective: Gain a broader understanding of what drives the museum visitors' motivation to attend a live animal presentation.

Interview Question: What brought you into the live show today?
Total Number of Respondents: 7
Themes: LA / FO / SB / INT
LA – Drawn to live animal
FO – Found out through an announcement / sign a the MOS
SB – Seen animal show before

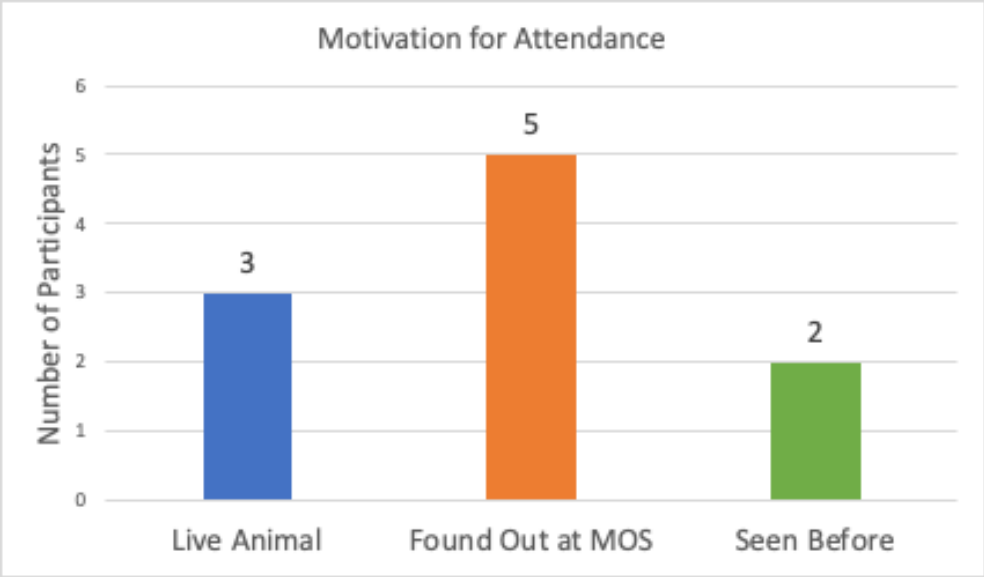

Figure 14. Motivation for audience attendance based on interview data. N = 7

What brought you into the live show today? (n=7)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Drawn to Animal		3	
Found out through an announcement / sign a the MOS		5	"[We heard it on the loudspeaker and it] sounded cool."
Seen animal show before		2	

Vehicles for Engagement

Relevant Evaluation Objective: Identify which aspects of the show are the most engaging in the audience's families' co-learning experience.
Interview Question: What aspects of the show were the most engaging to you?
Total Number of Respondents: 7
Themes: SFT / PRS / FF
SFT – See for Themselves
PRS – Presenter
FF – Fun Fact

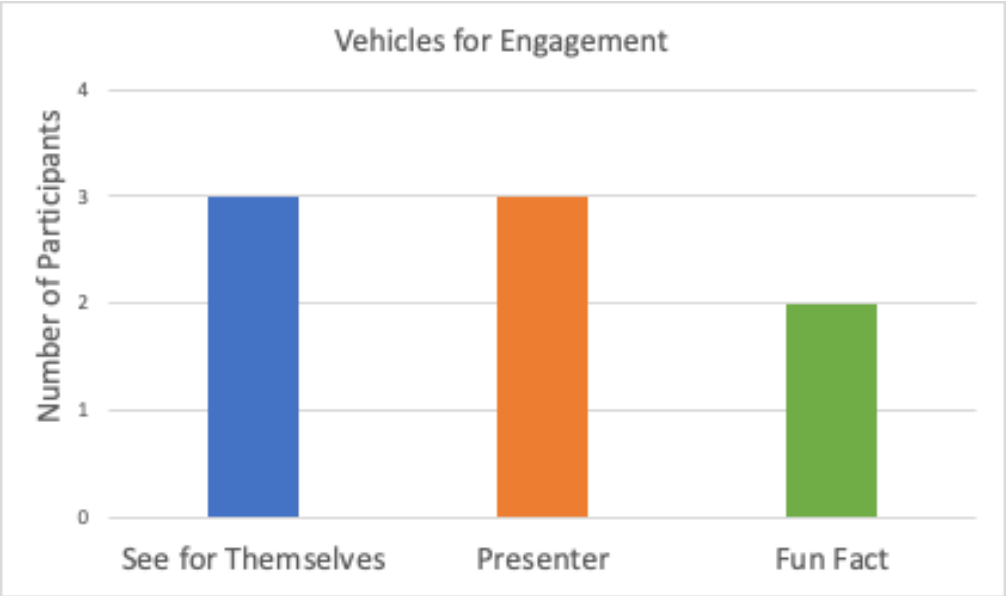

Figure 15. Vehicles for engagement based on caregiver interview data. N = 7.

What aspects of the show were the most engaging to you? (n=7)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
See for Themselves	Found seeing the live animal for themselves to be engaging	3	
Presenter	Found the presenters to be engaging	3	"The presenter did a great job!" "The presenter, she was great."
Fun Fact	Found the fun facts shared throughout the live presentation to be engaging	2	

Representations of Learning

Relevant Evaluation Objective: Identify which aspects of the show are the most engaging in the audience's families' co-learning experience.
Interview Question: What learning are you taking away from this live show?
Total Number of Respondents: 7
Themes: SF / GL

SF – Specific Facts
GK – General Learning

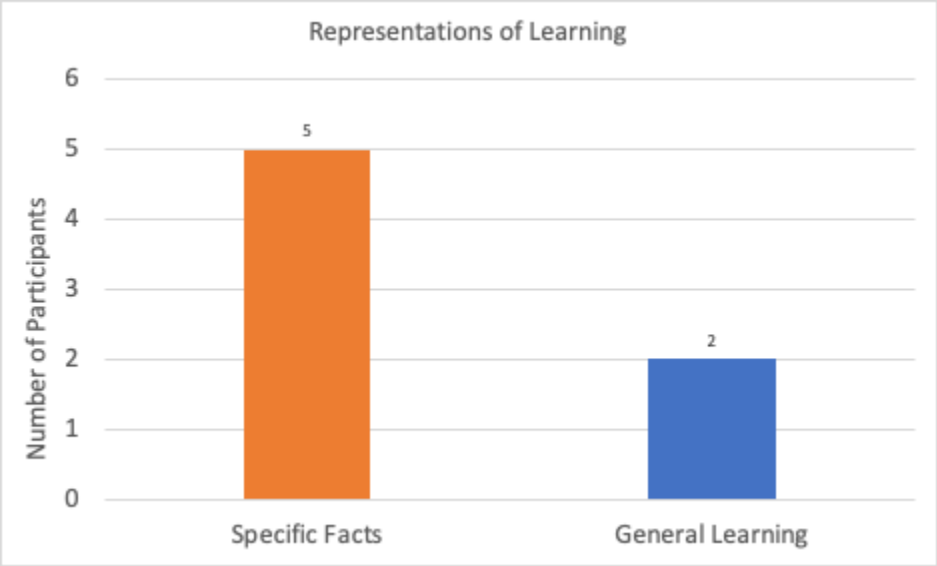

Figure 16. Representations of learning based on caregiver interview data. N = 7.

What learning are you taking away from this live show? (n=7)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Specific Facts	Shared a specific fact to represent the learning they took away from the live presentation	5	"Snakes smell through their tongue." "Opossums are not endangered." "The box turtle closes its shell"
General Learning	Expressed that their take away from the live was general learning	2	"About skinks, everything, I knew nothing about them!"

Further Interests

Relevant Evaluation Objective: Obtain feedback surrounding what learning the audience members are taking away after the show
Interview Question: If you were to visit us again/attend another live animal presentation, what would you like to see done differently/more of?
Total Number of Respondents: 7

Themes: UC / NO
UC – Interaction up-close with the animal
NO – Nothing to be changed

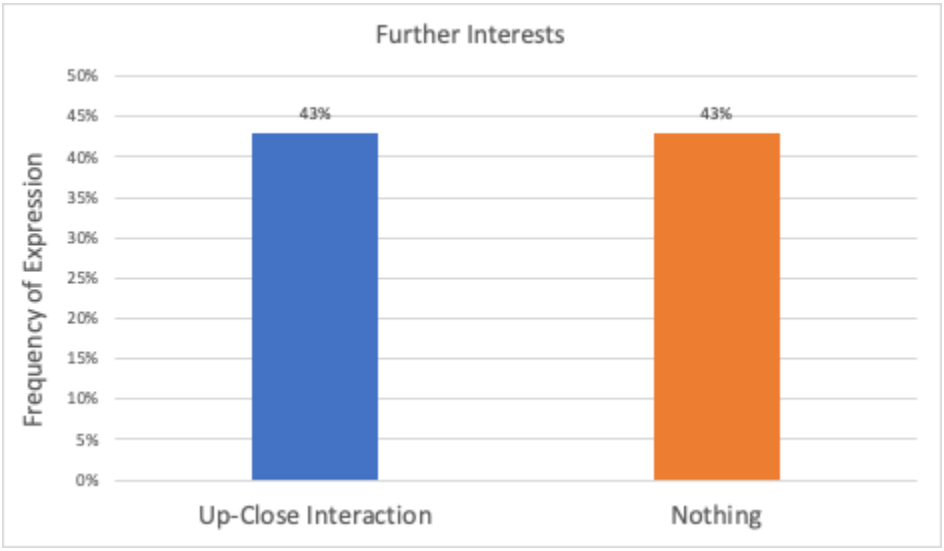

Figure 17. Further interests of audience members after watching live animal shows. N = 7.

3 out of 7 participants expressed that they would like to have a more close-up interaction with the live animal.

"It would be nice to touch the animals, but we understand why we can't."

3 out of 7 participants expressed that they did not have anything in particular that they would like to see done differently.

"Nothing, it was pretty great. The length seemed great [be]cause kids get fidgety."

"Absolutely nothing, it was great!"

If you were to visit us again/attend another live animal presentation, what would you like to see done differently/more of? (n=7)			
Theme	**Explanation**	**# of Participants**	**Example (Quotes from data)**
Interaction up-close with the animal	Expressed that they would like to have a more close-up interaction with the live animal	3	"It would be nice to touch the animals, but we understand why we can't."
Nothing to be changed	Expressed that they did not have anything in particular that they would like to see done differently	3	"Nothing, it was pretty great. The length seemed great [be]cause kids get fidgety."

			“Absolutely nothing, it was great!”

Discussion

Motivation for Attending Show

The caregiver interviews and survey data provided insight about the target audience's motivation for attending the live animal shows. Audience members shared information, through surveys and interviews, about how they learned about the show and their motivation for attending. 22 out of 65 (around 30%) of adults shared they discovered live animal shows through the daily schedule, 15 out of 65 (25%) respondents selected the loudspeaker announcement, and 15 more responses selected by accident. Other audience members learned about the show from recommendations by a museum guide, admission desk staff, or recommendations from friends/family. One response from the survey mentioned the motivation for coming to the show was "We are a homeschooling family learning about animals." 44 out of 115 audience members shared through survey responses they attended the show for fun/entertainment. 36 out of 115 survey responses and 3 out of 7 caregiver interview responses shared that the live animal was the main motivation for attending the live animal show. Educational experience accounted for 32 out of 115 survey responses about motivation for attending the show. Caregivers discovered the show somewhat equally between daily schedules, loudspeaker announcements, and completely by accident, while motivation for attending after hearing about the show was most commonly for fun/entertainment, closely followed by seeing the live animal and educational purposes.

The data collected around this question highlights both moments of success and opportunities for marketing and outreach of the live animal presentations. When information is shared upon arrival or throughout time at the museum, patrons become aware of the shows and gain motivation to attend. When patrons have specific information shared about the show, that can increase participation as well because they better understand what the experience will be (ex. Seeing an animal in real life, it is interactive and engaging, there is some educational material as well, etc). This information can help the museum education team and staff understand how to connect with the audience before the show begins and encourage museum visitors to attend the shows.

Points of Interest and Engagement

Through data collection, there are clear themes around features of the show that audiences found the most engaging. When asked what their favorite part of the show was, many children shared that they enjoyed seeing the animals in person. 4 out of 10 children shared they were excited or surprised when the animal was revealed and 3 out of 10 shared more detailed questions or information about the animal. This was echoed through observations and clear physical/vocal reactions in response to the moment the animal was revealed during the show. When an animal was revealed during the presentation, the audience reacted by shouting out or saying "ooh" 10 out of the 13 times. Audience members self-reported that they were engaged when fun facts were shared during the presentation, which were some of the most memorable moments of the show. These fun facts include any personal facts about the animal that was being presented, such as its age, its name or what it eats. In total, 11 of the presenter's statements were coded as "fun facts" during observations. Out of the total of 11 times these fun facts were shared, people reacted by laughing 7 times. Other than observation data, this finding is also supported by

the responses that participants gave during interviews and also by the information people wrote about in the surveys.

Another highly engaging moment during the show were interactions between the presenters/educators and the audience. Audience members were highly engaged when asked questions and responded by shouting out and using physical gestures such as a thumbs up/down. Audience members participated regardless of if the questions were closed or open-ended, but open-ended questions prompted them to make connections and consider their own observations. This is shown in the data by examining that the number of instances the audience raised their hands to answer open ended questions was higher compared to the number of instances hands were raised for closed or yes/no questions. Members of the audience were observed raising their hands in 13 instances for open ended questions, compared to 6 and 4 instances for closed and yes/no questions. For example, when one educator asked, "Where do turtles go in winter?" three audience members raised their hands and were prompted to consider their own prior knowledge and make educated guesses based on what they already knew about turtles. They responded by saying, "under the ground", "in a warm place" and "underwater". Additionally, audience members had the opportunity to ask questions and get a closer look at the animal at the completion of the show, and many children were observed doing this. Questions from the audience ranged from personal information about the animal (name, age) to more specific questions about the animal's habitat.

Children and caregivers also shared that the assistive technology and digital presentations were a nice addition to the show and made it easier to see the animal. In surveys, slides and videos were grouped together in one category. 10 survey respondents indicated that the slides/videos were an engaging aspect of the presentations. The videos and animations in particular appeared to be memorable. In questions asked by the audience after the show, 3 out of the 5 of the questions that related to facts shared during the presentation were based off of video clips that audience members saw. In contrast, no one asked questions about images or slides that they had seen. This information suggests that audience members may have found video or animation footage more engaging than slideshows, because they followed up about the information with questions after the show.

Audience members had higher engagement with the show when they were able to make meaningful connections between material/content and their life/home environment. It is clear from the themes that emerged in the survey, as well as other data instruments, that the audience valued connection to their life or home environment. Given the demographic data available on the people who are attending live animal shows, further effort could be put into making such connections for the audience. Audience members, particularly children, appeared to be more engaged learning about animal facts if the facts were directly related to the animal they saw in front of them. For example, if an educator started a presentation talking about reptiles in general, and talked about some facts that described what defines a reptile, some of the audience members (especially younger children) did not react with any behaviors that indicated engagement (no shouting out, raising hands or pointing). However, once the educator revealed the animal and began sharing information about the specific animal in front of them, engagement appeared to be high. When the animal was revealed, children and adults pointed in 2 instances, people took pictures in 1 instance when the possum came out of its carrier, and in 7 instances people shouted

out (See Figure 7 and 8). This difference could possibly be characterized by information that is shared generally or abstractly, versus information that can be concretely attached to the animal on the stage, and is directly related to first-hand observations. This was also evident after the show, where the majority of questions asked were questions related to personal information about the animal in the show, or questions based on participant's observations.

While participants had clear moments of engagement, they also shared some suggestions for change or moments that were not as engaging. During interviews, some children specifically mentioned that there were scary moments, such as seeing skeletons and videos in which predators are attacking animals, and suggested not sharing those, especially without warning. Both children and adults shared their interest in physical interaction with the animals and wanting to touch them. While some members of the audience had some specific changes they would make, there were also others (3 out of 7 adults and 3 out of 9 children) who had no suggestions for changes and said they would keep the show exactly the same.

Most of the data collected shared insight into the engagement of audiences during the live animal shows. The information and analyzed data can support the museum educators in crafting the most engaging and impactful experience for audience members. An engaging experience can support long term goals such as retaining information, spark curiosity, and future learning/engagement with the museum and beyond. The information gathered can be used to inform future shows by incorporating the audience voice and feedback into the design stages of creating an interactive learning opportunity.

Inspiration for Learning

Survey and interview responses highlighted insights about key takeaways audience members had at the end of the show and curiosities they had about the experience that can serve as inspirations for future learning. Attendees were curious to learn more about other animals and how animals interact with each other. In interviews, one child mentioned wanting to see how animals interact with each other, while another child asked more questions about life expectancy. Similarly, 3 out of 7 caregivers expressed interest in more up-close interactions with the animals. Audience members had the opportunity to ask questions of the presenters following the show which was documented in the observation data as curiosities audiences had following the show. As represented in the observations, children shared many questions with the presenters (n = 32) including learning more about the animal in different environments and unique characteristics of the specific animals. Information shared in the presentations prompted audience members to think more about animals in their home environment and inspired them to keep an eye out for them, as noted in some survey responses. For example, in response to the open-ended survey question about which information was most interesting or what would be something the participants would like to learn more about at home, one respondent wrote, "Want to find out what snakes live near us". And another wrote, "…Will keep eyes out at our nearby creek for wood turtles."(see survey findings: connections with home environment). Among all kinds of information presented, fun or catchy animal facts were most salient to the children. 10 out of 11 shared fun facts as pieces of information they remembered from the show, while 5 out of 7 caregivers shared specific facts as memorable learning from the presentation. Half of the questions asked after the shows (16 out of 32) were about personal facts about the animals presented. This included questions about the animal's name, its age and what kinds of things it

likes to do. Some of the other questions asked were about information they had learned in the presentation, observations they had about the animal, and asking if the animal could be touched. Similar curiosities were shared in the survey responses such as “does the possum love trash?” Few survey respondents answered the question about curiosities to explore at home, however one response said “the habitat where these snakes are found - we will learn about other animals that will be prey and predator to this species.” This response is similar to some of the children’s curiosities around animal habitat and interactions with one another.

Some of the audience members left the show with new insights, and some left with clear inspirations for future learning on the topic or related themes. Understanding the main takeaways from audiences can help the education team explore if their learning goals and long-term engagement goals are being met. There seems to be more engagement during the show rather than immediate motivation to continue learning about the topic. Since the research was collected immediately following the show, there is an opportunity to do some additional testing and further explore the long-term impacts of the experience and further education/engagement with the topic. There is also an opportunity to consider any follow-up or clear takeaways messages that the educators can emphasize for the audience members at the completion of the show.

Conclusion

The formative evaluation of the stage presentations at the Museum of Science - Boston utilized observations, surveys, children interviews and caregiver interviews to explore the motivation, engagement, and learning surrounding the educational experience of live animal shows. Through strategic analysis of the data and a careful synthesis of the findings, we were able to fulfill our three evaluation objectives. First, we were able to get a broader understanding of the museum visitors' motivation to attend the live shows, which primarily stemmed from their interest in seeing a live animal up close. Second, we identified the aspects of the show that were the most engaging in the audience's co-learning experience, which once again highlighted the value of the live animals' presence, especially in observing its actions and behaviors. We also found that the presenters played a significant role in driving the audience's engagement, particularly in their sharing of fun facts or asking the audience direct questions, prompting the audience to participate by either gesturing, shouting out, or raising their hands. Third, we gathered feedback on what learning the visitors are taking away after engaging in live animal shows, during which visitors tended to remember animal facts they learned throughout the presentation, and they expressed curiosity for learning about other animals. Visitors also expressed a popular desire to engage more personally with the live animals, primarily by touching them.

Limitations

We acknowledge that there were certain limitations to our study, which led to us modifying our initial evaluation plan in order to accommodate the population we interacted with. For example, the initial target audience for our child interviews was children between the ages of 6-10; after gathering our data, we expanded that range to children between the ages of 5-11. This shift was due to our sampling protocol which made it challenging to distinguish the exact age of the children we interviewed when approaching them. Similarly, the initial target audience for our caregiver interviews was caregivers of children between the ages of 0-5. After conducting interviews, we realized that many of the caregivers were accompanying multiple children, meaning that, while they did have children that fit within our pre-established age range, they also had children who were older.

We also acknowledge that our evaluation instruments and original evaluation plan were, in some areas, not adequately responsive to the demographic diversity of the visitors of the Museum of Science, meaning that, at times, we encountered language barriers that did not enable us from interviewing specific visitors and impacted our sampling. Some of the terms and wording on our survey could also have been misinterpreted or required a definition (for example, the term "museum guide" could have referenced several roles of MOS staff). This may have allowed for an inaccurate representation of the answers provided in our surveys.

Lastly, all of our data collection took place within the span of two weeks in late March and early April, and exclusively from Friday to Sunday. Gathering data on weekdays would have given us access to a broader pool of museum visitors and potentially have given us different insights than those we were able to interact with on the days that we were there.

Recommendations

Based on our findings, we would recommend the following ideas to maximize the motivation, engagement, and learning of visitors who attend or could potentially attend a live animal show:

- Provide multiple means for museum visitors to find out about the scheduling of the live animal shows.
- Prompt for the audience to interact with the animal and presenter in different ways, including multiple means of engagement that could include: verbal contributions, physical movement, moments to ask questions, and share ideas.
- Presenting the educational content of the show in a narrative focused on the specific animal with occasional connections to the audience's own lives as a way of sustaining engagement.
- Consider how learning can continue after the show has concluded. This could include a suggestion to visit another exhibit, materials for continued learning, digital or physical resources, etc.
- Maximize the use of visual resources to enhance the audience's experience of seeing the animal "in action" and "close up".

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Appendices

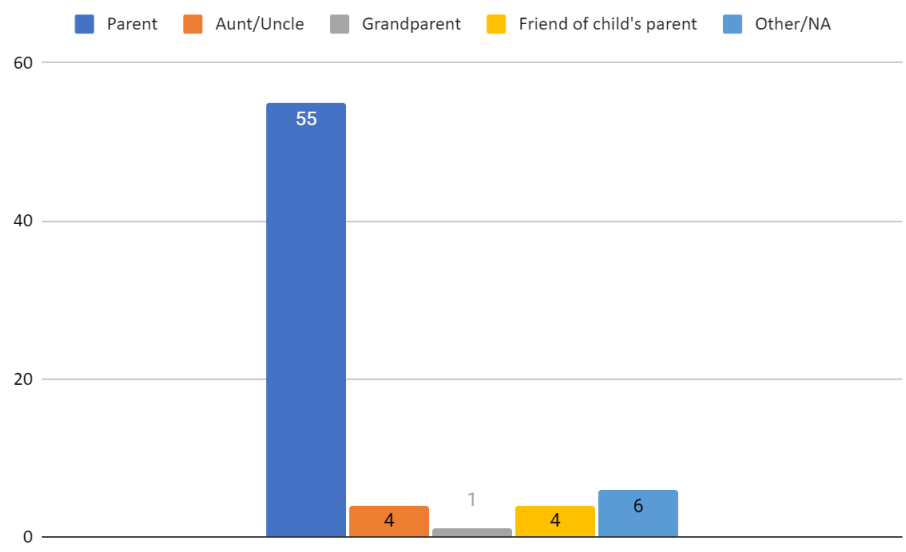
Script (when speaking with the educator)
Hello, our names are ___ and we are conducting some research for a grad school project in partnership with the museum about children and their caregiver's experiences with the live animal shows. The evaluation is in no way an evaluation of your teaching abilities, but rather will be focused on the reasons why people are coming to see the show, which aspects of the show are most engaging, and what they are most curious to learn more about after watching the presentation. We will be conducting observations of the audience during the show, and we would also like to ask museum visitors if they would consider participating in a survey and interview after the presentation. Could you please help us recruit participants by reading this script at the beginning of your presentation? Also, would you mind keeping track of what questions museum visitors ask you after the presentation, and reporting back to me? Thank you so much.

Suggested script (For educator to share at the start of the show):
We have some guests here collecting data today for a project being done in collaboration with the Museum of Science who will be observing the show. If you are willing and able, please complete the survey on your chairs or using the QR code, and you might be asked to answer a few interview questions at the completion of the presentation. All participation is optional and we thank you for your responses.

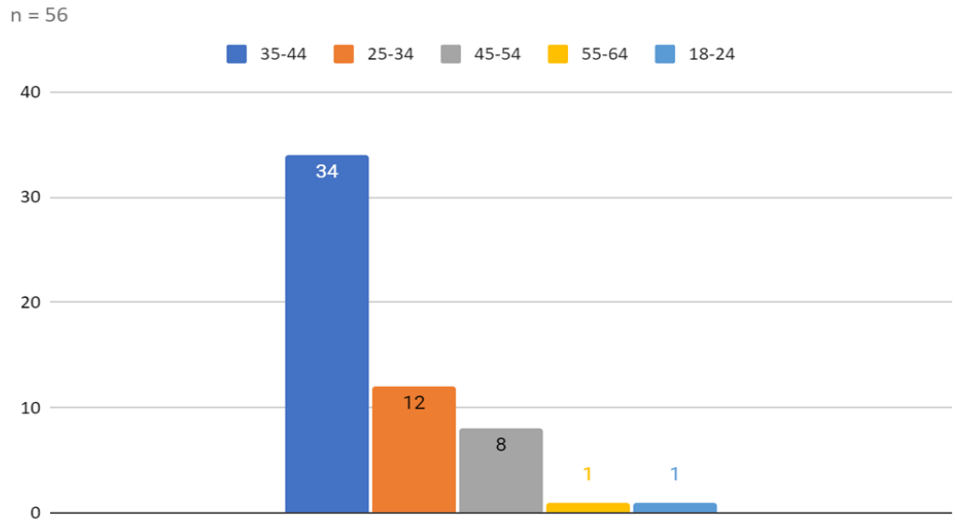
Surveys

QR code link.

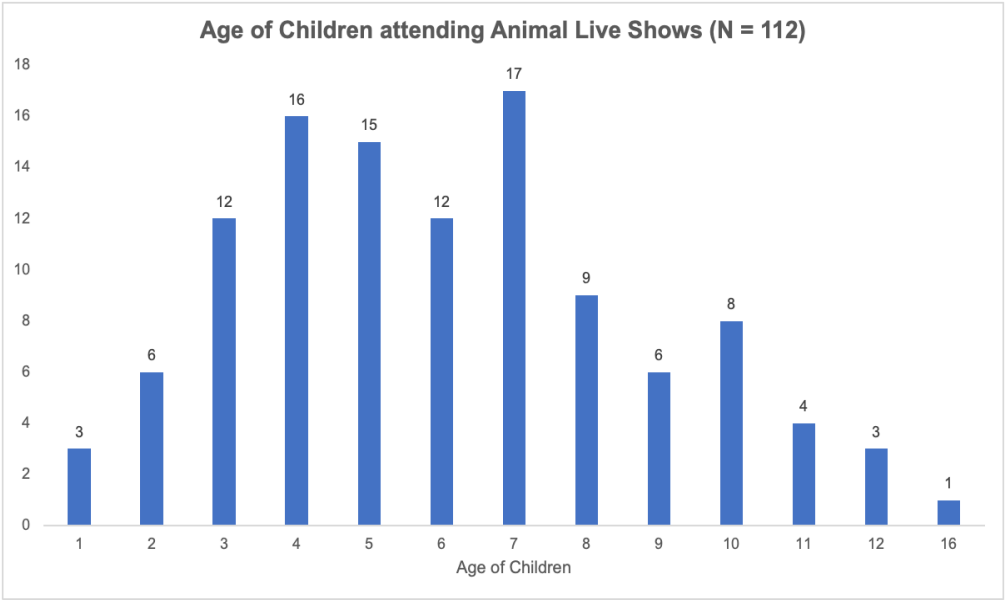
Want to help the MoS improve their programming?
Scan here to access a short online survey:



Demographic Figure 1: Responses to "If you are visiting with children, what is your relationship to them?"



Demographic Figure 2: Responses to “What is your age?”



Demographic Figure 3: Responses to “If you are visiting with children, what is their age(s)?”

Child Interviews

Script (For evaluator to use with target audience [children 6-10] and caregivers)

- To Caregiver: Hi. My name is [insert your name here] and I am collecting some research for a graduate school project I am conducting in partnership with the museum. I am hoping to learn more about children's experience during the show, and what they are leaving with. Would it be alright if I ask your child(ren) if they are comfortable and willing to answer a few questions? It should only take about 5 minutes. No identifying information will be shared, including name, only responses to the questions.
- If the caregiver says 'no': Thank you for your consideration. Have a great day!
- If the caregiver says 'yes': Hi. My name is [insert your name here]. What's your name? (Let them answer) Nice to meet you! Your parent(s)caregiver said it was okay if I asked you a few questions about the show. Is it alright to ask you some questions about what you just saw? I will not share your name, you can stop at any time and there are no 'right' or 'wrong' answers. I just want to hear more about the show you just saw and your thoughts.
    - If the child(ren) says 'no': Okay no problem. Have a good day! (Give the children a sticker)
    - If the child(ren) says 'yes': Great! (Ask the questions from the *instrument section below)*
- After completing the questions (or as many as the child(ren) has chosen to answer): Thank you so much for chatting with me! It was so cool to hear more about the show and all your awesome interests. Since you were so helpful I want to give you one of the super cool museum stickers. Would you like one?
- To parents/caregiver: Thank you again for allowing us time to chat. Thank you for answering our questions and visiting the museum today!
- To everyone: Have a great day!

Evaluator: Date: Time: Animal: Presenter Name: Child Age:
Initial questions: 1. I don't remember everything about the show - can you tell me what it was about? 2. Did you learn anything new today? If so, can you tell me more about it?

3. What was your favorite part of the show?
    a. Can you tell me more about why that was your favorite part?

4. How did you feel when they brought the live animal out?

5. What, if any, changes would you make to the show?

Additional questions/follow-up (if time permits/the child(ren) is engaged and excited to share more)

1. If you were talking to a friend who has never seen the show and they asked if they should see it, what would you tell them?

2. What, if any, questions do you have about the show?

3. What did you think about the video/powerpoint?

Caregiver Interviews

Script

Unless a participant voluntarily walks up and expresses interest in participating in an interview, approach participants at random and ask if they are willing to participate. When the caregiver expresses interest in participating in a post-attendance interview and proceed with the following:
"Hi. My name is [insert your name here] and I am collecting some research for a grad school project I am conducting in partnership with the museum. I am hoping to learn more about your experience during the show, and what you are walking away with. Would it be alright if I ask you a few questions? The interview will last no more than five minutes and can be stopped at any time. No identifying information will be shared, only your responses to the questions."
If the caregiver says 'no':
"Thank you for your consideration. There's a lot of data collection happening today, so if you wear this sticker we'll know that we've already asked you and we'll let you go on about your day! Have a great visit!"
If the caregiver says 'yes':
"Wonderful, thank you!" (Ask the questions from the *instrument section* below and record their answers).
After completing the questions:
"Thank you so much for your time! We would love to give you and your child a museum sticker. Would you like one?"
Closure:
"Thanks again! Have a great day!"

Instrument

Semi-Structured Interview

Evaluator:	**Date:**	**Time:**
Presenter:	**Animal:**	
What brought you into the live animal show today?		
What aspects of the show were the most engaging to you?		

What did you learn from the live animal show today?
If you were to visit us again/attend another live animal presentation, what would you like to see done differently/more of?
Age of accompanying child/children: **Caregiver's relationship to child/children:**

Observation Guide

Data Collector:	Date:	Time:	Name of Presenter:	Animal:

Group Composition

Estimated # of people total (at show start): Estimated # of children age 10 or younger:

# of people who leave during the show:

Technology used (select all that apply):

- ☐ Slideshow
- ☐ Video
- ☐ Visuals (non-digital)

Codes:

RH: Raises Hand
SO: Shouts out
Q: Asks question

Presentation Notes

Write presenter actions and audience reactions in the corresponding areas below:

Action: Reaction:
Action: Reaction:
Action: Reaction:
Action: Reaction: