



Summative Evaluation Report

Submitted by

Rockman et al

Research & Evaluation

Scientastic! Summative Evaluation Report

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By
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Executive Summary

Planet Earth Television (PET) created *Scientastic!*, a television series that focuses on a young girl named Leah's scientific investigations of the world around her. The pilot episode of the program, entitled *Sticks and Stones*, explores human bones and how they heal. A website (www.scientasticshow.com) was created to supplement the show, and an iPad app, *Powers of Minus Ten – Bone*, was created to allow users to examine differences at the microscopic level between a broken and intact bone.

Rockman et al (REA), a research and evaluation company based in San Francisco, CA, conducted a summative evaluation of the pilot episode of the *Scientastic!* television program, the accompanying website, and iPad application. The evaluation focused on the impact of these materials on youth's knowledge about and interest in science and specific topics related to bone health and healing. A secondary goal of the evaluation was to gather feedback about the television program, website and app. Youth (grades 1-7) were asked to participate in the study either at home with their families or in a classroom with their teacher. Youth completed surveys before viewing the materials, after watching the pilot episode, and after visiting the website and using the app. Their parents and teachers were also asked to provide their opinions of the *Scientastic!* resources via telephone interviews and to document their use of the materials via a participant log.

Key Findings

Impacts of Scientastic! Resources on Youth

Participating children were already interested in science topics before engaging with the *Scientastic!* materials. Even so, the *Scientastic!* television program appeared to help them transform that initial interest into a deeper belief that science is a tool that can help them investigate phenomena in their everyday lives:

- After watching the program, participants' belief that science helps them understand some of the things that they see around them significantly increased (from 75% to 84%)
- Participants also felt significantly more confident in asking a scientific question after viewing the program. Since the premise of the show revolves around a girl named Leah, who has a question and does research to gather facts to answer her query, it appears that the pilot episode contributed substantially to participants' belief in their ability to conduct their own lines of inquiry.

- After viewing the program, youth were more likely to indicate that they would ask a content expert in order to find out information about a research topic. This is likely the result of having viewed Leah's interviews of various content experts in the pilot episode.

- The website and app did not lead to significant additional changes in participants' attitudes towards or confidence in science.

After watching the television program, young children also demonstrated that they were more knowledgeable about how bones heal, which was the main topic of the pilot episode:

- After watching the pilot episode, youth self-reported feeling significantly more knowledgeable about how human body works and significantly more familiar with science-related vocabulary. The Scientastic! website helped participants become acquainted with several of these terms even further.

- After viewing the program, participants also demonstrated significantly more understanding on a content knowledge assessment focused on bones and bone healing and provided more sophisticated explanations of the healing process than they had before viewing the program.

Opinions of Scientastic! Resources from Youth, Parents, and Teachers

Young children and participating parents and teachers found the television program to be fun and engaging. They liked that the pilot episode provided clear content explanations and focused on the investigation of real world problems. They also liked the relatable characters and scenarios, including themes of bullying in the context of playing soccer.

Participants were less enthusiastic about the website. While some liked that the site contained interviews with experts and additional information about the topic of the program, many wanted more compelling activities and access to games directly on the site. Those who were able to try the iPad app appreciated the visuals and premise of the interactive, and wanted future iterations of the app to include more than one type of bone.

In thinking about the viability of the suite of Scientastic! resources, the television program emerged as the clear favorite, with most youth (90%) at least somewhat interested in watching similar programs in the future. The website (75%) and app (73%) also had moderate interest. Based on youth and adult participants' responses, a few targeted improvements to the website and app would help to transform these materials from supplemental resources to core tools for learning.

Introduction

Planet Earth Television (PET) created *Scientastic!*, a television series that focuses on a young girl named Leah's scientific investigations of the world around her. The pilot episode of the program, entitled *Sticks and Stones*, explores human bones and how they heal via a narrative in which Leah helps her friend Habiba heal faster in time for a big soccer game. A side story involves how Leah and Habiba deal with bullying. As part of her research, Leah interviews experts and reviews information in a segment called, "Stack the Facts." Leah is accompanied on her adventures by her brother, Axel, who often daydreams about information learned in this episode and translates it into song and dance sequences.

A website (www.scientasticshow.com) was created to supplement the show and provide additional information about the show and the topic of the pilot episode. The website contains Leah's notes, longer versions of the expert interviews, and several links to other websites and activities for youth. Lesson plans for teachers can also be found on the website. In addition, the *Scientastic!* creators commissioned an accompanying iPad app, *Powers of Minus Ten – Bone*, which allows users to zoom in at varying levels to both a healed and a broken bone and compare the two to one another.

Rockman et al (REA), a research and evaluation company based in San Francisco, CA, conducted a summative evaluation of the pilot episode of the *Scientastic!* television program, the accompanying website, and iPad application. The evaluation focused on the impact of these materials on youth's knowledge about and interest in science and specific topics related to bone health and healing. Youth were also asked to share what they liked and disliked about the episode, website and app. Youth either participated in the study at home with their families or in a classroom with their teacher. Parents and teachers were also asked to provide their opinions of the *Scientastic!* resources and to document their use of the materials with participating children. Findings are discussed in detail below.

Demographics of Study Participants

Six teachers (N=126 students) and 19 families (N=24 children) participated in the *Scientastic!* evaluation for a total of 160 youth participants. Slightly more girls (51%) participated in the study than boys (49%; N=151). Most were in 5th grade (see Table 1). Over half of the participants were Caucasian (see Table 2). Additional information about participants can be found in Appendix A.

Table 1: Grade Makeup of Study Participants (N=129)

	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7
Percentage of Participants	1%	0%	10%	19%	68%	1%	1%

Table 2: Ethnicity of Study Participants (N=153)

	Caucasian	African-American	Asian	Hispanic	Other
Percentage of Participants	58%	22%	1%	18%	1%

Methodology

Both the family and classroom studies took place from January 2013-May 2013. Families were initially recruited via posted flyers or through email and Facebook messages to interested parents in REA's participant database. Additional families signed on to the study based on word of mouth from past participants. Teachers were identified from REA's participant database and personal contacts.

Once a family or teacher agreed to participate, they were asked to provide some demographic information and the participating children/students were asked to take a pre-survey online or on paper (see Appendix B for survey protocols). The pre-survey consisted of questions about the child's general science attitudes and knowledge, and a series of content questions related to bones and healing. After participants completed the pre-survey, they were mailed a packet containing the remaining study materials. The packet included a consent form, paper version of the post-surveys (if applicable), a participant log, a DVD of the *Scientastic!* pilot episode, and a self-addressed, stamped envelope.

Participants were given two weeks to complete the study, although several took over two months to return the materials. First, participants were asked to watch the *Scientastic!* DVD with their family or in class. An adult then filled out the Participant Log, stating when they watched the program and in what setting (see Appendix C). Next, the child(ren) filled out a post-DVD survey (see Appendix B). This survey contained similar questions to the pre-survey, but also included specific questions regarding what participants liked or disliked about the pilot episode.

After completing the post-survey, participants were asked to visit the *Scientastic!* website for at least 20 minutes, and to test out the iPad app, if they had access to a device. Then, the children in the group completed a post-website survey (see Appendix B). The post-website survey contained some general science attitudes

and knowledge questions, and content questions specific to bone health, as well as questions around what participants liked or disliked about the website. In addition, the website survey included some questions about the iPad app. Adult participants were again asked to fill out a Participant Log, and to mail the signed consent forms and completed Participant Logs back to the Rockman office using the envelope provided.

Finally, participating parents and teachers were asked to take part in a short telephone interview about their and their children's/students' experiences with the Scientastic! resources (see Appendix D for interview protocols).

Findings

Changes in Science Attitudes

Overall, how youth felt about science did not significantly change after watching the program; 70% liked science before and 73% liked it after viewing the program¹. There were also no significant differences in their feelings towards visiting scientists in their labs or in their interest in learning about how the human body works after viewing the program or going on the website; most were already interested (88% and 77%, respectively). However, after watching the program, participants' belief that science helps them understand some of the things that they see around them significantly increased from 75% to 84%. There were no significant additional changes in this belief after participants went on the website. Thus, young children seem primed by an interest in science, and Scientastic! appears to help them transform that interest into a deeper belief that science can help them investigate phenomena in their everyday lives.

Participants' overall level of confidence in their ability to carry out different science-related activities did not significantly increase after watching the television program (see Table 3). Yet youth did feel significantly more confident in asking a scientific question after viewing the program. Since the premise of the pilot episode revolves around a girl named Leah, who has a question and does research to gather facts to answer her question, it appears that the program contributed to young children's confidence in being able to ask their own scientific questions in the future.

¹ All youth data collected from families and classrooms has been combined for the purposes of analysis.

Table 3: Young Children’s Level of Confidence in Science-Related Activities

Scientific Action	Mean Before Viewing Program	Mean After Viewing Program	Significance Level	Total N
Asking a Scientific Question	1.57	1.80	.013*	114
Forming a Hypothesis	1.62	1.71	.343	113
Planning Experiment Methods	1.55	1.69	.148	111
Collecting Data	1.68	1.72	.566	112
Drawing Graphs	1.94	1.79	.107	114
Talking About Experiment Results	1.89	1.81	.363	112
Total Confidence	10.32	10.69	.209	109

* Indicates a significant difference at the .05 level.

In terms of careers, there were no significant differences in participants’ level of interest in either science or health-related careers. Before viewing the program, several youth (32%) were already interested in a science career and some (43%) were already interested in a health career.

Changes in Science Knowledge

The majority of changes in youth’s science knowledge were around how the human body works, including concepts related to bones and bone healing. Participants’ self-reported general science knowledge did not change significantly after watching the program; the average ranking before and after watching the pilot episode was 6.4 on a 10 point scale². However, youth did self-report a significant increase in their knowledge about how the human body works. After watching the program, their rankings went from an average of 5.2 to an average knowledge ranking of 5.9. There were no significant additional changes in general science knowledge or knowledge about how the human body works after youth viewed the Scientastic! website.

Youth also felt that their knowledge of episode-related vocabulary had significantly increased both overall and in terms of individual concepts (see Table 4). They were asked to identify their familiarity with seven different concepts covered in the television program before viewing and after viewing the pilot episode. A ranking of “0” indicated that they had never heard the term, a “1” meant that they had heard the term, but did not know what it meant, and a “2” indicated that they knew what the term meant.

² Youth were asked to rank their knowledge on a scale from 1 to 10, with 1 being “I know nothing” and 10 being “I’m an expert.”

Participants appeared to have some knowledge about fractures and calcium before viewing the program, but did not know as much about specific terms related to bones and bone healing. Regardless, participants' average vocabulary knowledge around both familiar and unfamiliar terms significantly increased after watching the program. In addition, after viewing the website, youth felt significantly more knowledgeable about the ulna (M=1.62) and stem cells (M=1.41) than they had after watching the program.

Table 4: Changes in Participants' Vocabulary Knowledge

Term	Mean Before Viewing Program	Mean After Viewing Program	Significance Level	Total N
Fracture	1.48	1.67	.005*	113
Ulna	0.46	1.59	.000*	110
Calcium	1.38	1.60	.006*	111
Bone Marrow	0.71	1.26	.000*	110
Osteoclast	0.28	1.55	.000*	110
Osteoblast	0.50	1.63	.000*	107
Stem Cell	0.69	1.12	.000*	114
Total Vocabulary	5.72	10.52	.000*	101

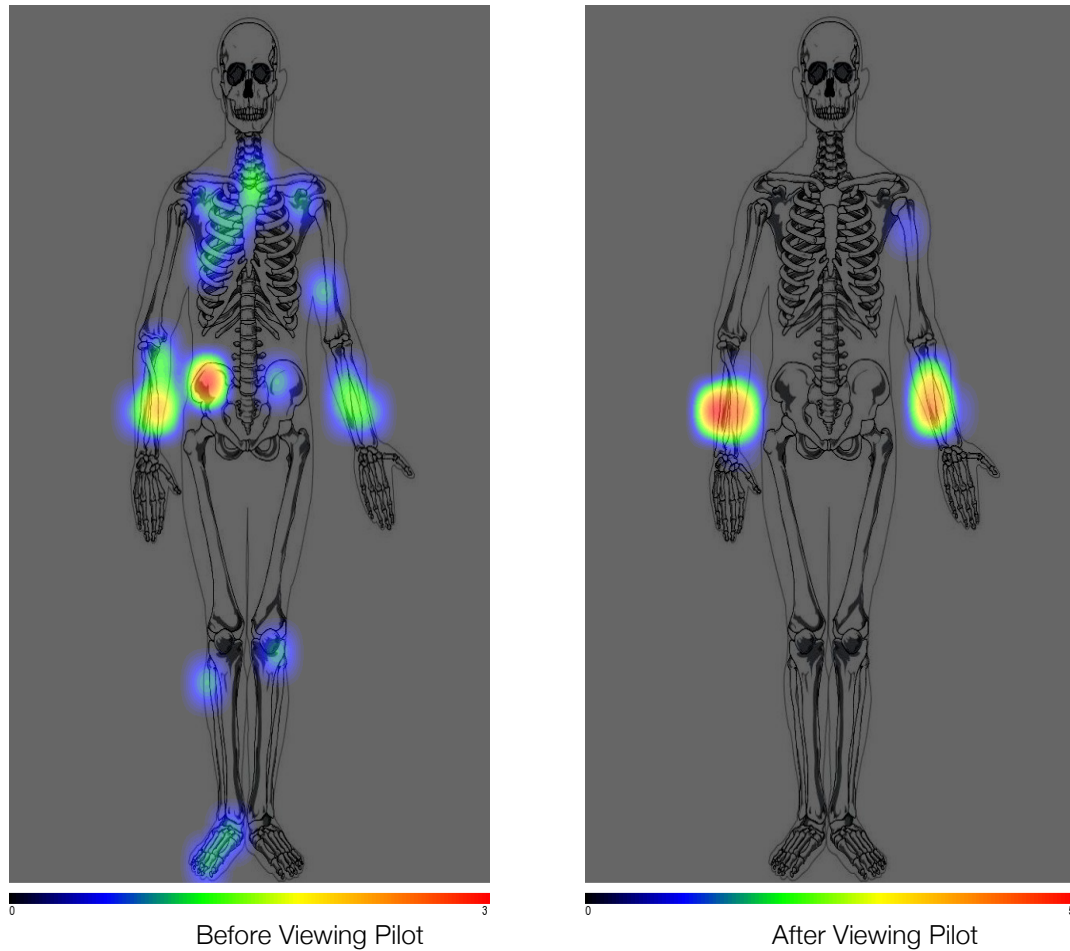
* Indicates a significant difference at the .05 level from before to after viewing the program.

To assess their content knowledge, participants were asked 7 multiple choice and 5 true/false questions (see Appendix B) about topics covered in the pilot episode. For each question, participants could receive either a "0" for an incorrect response or a "1" for a correct response. Their responses were added together to determine their Overall Content Knowledge, which could range from 0 to 12. Before viewing the program, participants were able to get an average of 5.38 questions correct. After viewing the program, participants were able to answer 9.21 questions correctly, which was a statistically significant increase in Overall Content Knowledge.

Participants were also asked to identify the location of the ulna on a skeleton. Before viewing the program, only 17% (N=110) of youth were able to select the location. After viewing the program, significantly more participants (84%) could correctly identify the location of the ulna. Figure 1 shows a heat map of family participants' answers (N=23) and contrasts their selections before and after viewing the program³. Note that before viewing the program, many participants selected areas of the pelvis, shoulder, ribs, and foot, whereas after viewing the program participants tended to stay in the arm region.

³ Heat mapping was only available via online versions of the survey, which were primarily taken by family participants. Students tended to take paper versions of the survey in their classrooms.

Figure 1: Participants' Selection of Ulna Locations Before & After Viewing the Pilot Episode (N=23 Pre; N=20 Post)



Youth were also asked a series of open-ended questions to better understand their knowledge of bones and bone healing. Before viewing the Scientastic! pilot episode, participants tended to use more general terms such as eating healthy foods, calcium, and milk to describe ways to help bones heal faster (see Table 5). After viewing the program, they still talked about healthy foods and calcium, but they also started talking more about vitamins, osteoclasts and osteoblasts.

Table 5: Participants' Ideas For Making Bones Grow Faster

Choice	Percentage of Participants Before Viewing Program (N=110)	Percentage of Participants After Viewing Program (N=142)
Healthy Foods	24%	41%
Calcium	24%	29%
Milk	24%	8%
Don't Know	16%	6%
Cast	10%	10%
Other	7%	8%
Vitamin D	6%	11%
Vitamins (General)	5%	11%
Antibiotics/Medicine	4%	0%
Stem Cells	3%	9%
Exercise	3%	0%
Cells (General)	3%	8%
Sleep/Rest	3%	2%
Osteoclast	1%	14%
Osteoblast	0%	10%

* Some participants listed more than one choice.

In addition, participants' knowledge of how bones heal became much more sophisticated after viewing the program. Before watching the pilot episode, almost half of the participants (47%) couldn't provide an answer to this question (see Table 6). The rest tended to talk about healing or growing new bones, in general. After viewing the episode, youth provided much more detailed explanations that included the use of cells and tissue, osteoclasts and osteoblasts, stem cells, and blood clots in addition to their more general descriptions. This difference is illustrated through one 5th grade girl's responses before and after viewing the program:

"The bone is trying to get better." (Before Viewing)

"The osteoblasts are getting rid of old bone. Osteoclasts are building new bones." (After Viewing)

Table 6: Participants' Knowledge of How Bones Heal

Mechanism	Percentage of Participants Before Viewing Program (N=96)	Percentage of Participants After Viewing Program (N=125)
Don't Know	47%	12%
Heal/Grow/Build More Bone (General)	42%	56%
Use Cells/Tissue (General)	10%	24%
Casts Keep Bones In Place	7%	4%
Osteoclasts	2%	26%
Use Stem Cells	2%	17%
Osteoblasts	0%	22%
Blood Clots	0%	14%

* Some participants listed more than one healing mechanism.

Participants also appeared to incorporate knowledge they gained specifically through the pilot episode when listing things that have vertebrae. After watching the program, participants were more likely to mention that birds and dinosaurs have vertebrae – two creatures that are focused on heavily within the episode itself (see Table 7).

Youth were then asked to share their strategies for where they would go if they had a scientific question. Since Leah does things like look up information online, read books on relevant topics, and ask content experts, we hypothesized that participants would mention these behaviors more often after viewing the program. Although looking online and in a book were the most popular strategies both before and after viewing the program, a greater percentage of participants indicated that they would engage in these behaviors after viewing the program than they had before (see Table 8). In addition, a greater percentage of participants indicated that they would ask a content expert to find out information about a research topic.

Table 7: Participants' Knowledge of Things With Vertebrae

Type of Animal	Percentage of Participants Before Viewing Program (N=101)	Percentage of Participants After Viewing Program (N=132)
Mammal	41%	39%
Human	36%	35%
Don't Know	31%	27%
Reptile	15%	19%
Bird	14%	25%
Provided Definition of Term	13%	7%
Fish	12%	12%
Amphibian	3%	2%
Dinosaur	0%	27%

* Some participants listed more than one type of animal.

Table 8: Participants' Strategies To Gather More Information*

Strategy	Percentage of Participants Before Viewing Program (N=106)	Percentage of Participants After Viewing Program (N=113)
Search Computer/Internet	52%	62%
Read a Book/Go to Library	37%	51%
Ask a Teacher	24%	19%
Ask Adult/Family Member/Friends	18%	22%
Ask a Content Expert	17%	28%
Do an Experiment	14%	4%
Other	11%	3%
Ask Questions/Do Research (General)	10%	11%
Watch a Television Show	5%	4%

* Some participants listed more than one type of strategy.

Reactions to the Scientastic! Pilot Episode

Participants' Overall Opinions of the Pilot Episode

Over half of the youth participants liked the pilot episode overall and were highly interested in the program content (see Table 9). Several participants thought that the episode “looked cool” and that the topics covered in the program mattered in their own lives. However, viewers tended not to find the music as appealing and some did not find the characters to be relatable.

Table 9: Participants' Opinions of the Pilot Episode

Opinion	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Liked Program Overall	1%	7%	34%	58%	148
Interested in Program Content	3%	6%	39%	52%	147
Thought Program Looked Cool	3%	11%	37%	49%	146
Found Music Appealing	16%	24%	25%	35%	146
Felt Characters Were Relatable	11%	20%	36%	33%	148
Felt Topics Covered in Program Matter in Own Lives	9%	8%	39%	44%	146

Most participants (79%; N=145) thought that the pace of program was just right. The rest either thought the pacing had been too fast (15%) or too slow (6%).

Scientastic! Pilot Episode Specific Likes & Dislikes

Youth liked that the program provided clear explanations of content and investigations of real world problems, and helped them learn science in a fun and engaging way (see Table 10):

“I liked how the video used real life situations and connected it to science.”

“I liked that it explains everything. I liked how it showed where she goes and how she gets her research and what she does to do it, like go to the library to get books and asks questions.”

“It showed me that science might be kind of easy and it was fun and funny to watch because I learned something important and interesting.”

Table 10: What Youth Liked Most About the Program (N=143)*

Aspects of Program	Percentage of Participants
Information/Facts/Explanations/Learning	31%
Storyline	14%
Humor/Fun	14%
Songs	11%
Asking Questions/Process of Doing Research	10%
Dancing	6%
Don't Know/Nothing	6%
Soccer	6%
Museum/Location Visits	5%
Everything	3%
Axel	2%
Length of Program	1%

* Some participants listed more than one aspect of the program.

Several youth also appreciated the bullying storyline and the focus on overcoming obstacles:

"I liked how Leah stood up to Maggie and Malinda because it encourages kids to stand up for bullied kids."

"I liked when the girl who broke her ulna scored a goal because the other kids were wrong about her."

However, many youth got so into the story that they actively disliked the bullies (see Table 11):

"[I did not like] when the mean girls were telling Habiba her arm was never going to heal because they were lying."

Youth viewers had mixed feelings about the singing and dancing in the episode. While a few appeared to like the interludes, most participants found the amount of musical numbers in the show to be too frequent:

"I would change the boy's imagination. He imagines too many dancers. It got old."

"The random dancing is really weird. Maybe take out some or just get rid of it."

"All the dancing because it got on my nerves."

Table 11: What Youth Liked Least About the Program (N=144)*

Aspects of Program	Percentage of Participants
Don't Know/Nothing	26%
Dancing	23%
Mean Girls/Bullies	16%
Songs	13%
That Habiba Broke A Bone	4%
Everything/Boring/Cheesy	3%
Episode Topic of Bone Health/Healing	3%
Axel	3%
Museum/Location Visits	2%
Axel Ate Mealworm	2%
Difficult to Explain What Learned	2%
Amount of Time Spent on Stack The Facts	1%
Soccer	1%

* Some participants listed more than one aspect of the program.

It should be noted that several participants (26%) could not find anything that they disliked about the program overall.

Participants' Interest in Program Topic and Format

Most participants (90%) were at least somewhat interested in watching similar programs and somewhat likely to recommend the Scientastic! program to others (81%) (see Table 12). Many youth (79%) were also somewhat interested in learning more about topics of bone health and healing.

Youth overall were more likely to want to watch the program at school than at home. However, youth who had watched the program at home with their families were significantly more likely to want to watch more Scientastic! episodes at home than students who had watched the pilot episode in the classroom ($t(143)=-2.915$, $p=.004$). There were no differences between the two groups regarding whether they would want to watch future episodes at school.

Table 12: Participants' Future Interest in Program Topics & Episodes

	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Wanted To Learn More About Program Topics	7%	14%	40%	39%	147
Wanted to See Similar Programs	5%	5%	40%	50%	146
Would Recommend Program To Others	6%	13%	42%	39%	145
Would Watch More Episodes At Home	9%	20%	28%	43%	145
Would Watch More Episodes At School	9%	7%	31%	53%	145

Figure 2: Screen Capture from Pilot Episode Introductory Sequence



Parents' Opinions of the Pilot Episode

Most parents were pleased with the pilot episode. Many parents found the information in the program to be informative and relevant:

"I liked that it was conveying knowledge and science in a playful way."

"Absolutely yes, it was appropriate. It's science. It's based in reality. Everybody has bones, right? Everything with bones kind of goes through the same process, if they break a bone or something like that. Relatable content. Realistic, fact-based science."

Several mentioned the relatability of the characters as the show's greatest strength. The inclusion of soccer players seemed to immediately attract their children's attention:

"It felt very relevant the way they did it in the context of the story. I really like how they incorporated into the plot, what happened with this girl and how her arm was feeling. I think they really enjoyed it because my younger daughter broke her arm in August...They related to the broken bone concept and it answered questions that they had had...Made me wish I had known about this earlier! They really enjoyed it a lot. They kept asking if there were more episodes."

"She is interested in sciences and she was totally interested in learning the names of the bones and the fun little facts about the density of bones, but she is also a 5th grade girl and identified with the characters after going through some trying times in 5th grade, she could really draw some parallels between the girls."

"My daughter, I thought it was perfect for her. We talked about it because you know there are some mean girls in there so we talked about that and we talked about how the girl was afraid. She made a comment about that too because she's in indoor soccer right now. She said, 'if you break a bone you can't be afraid because it's going to heal.' She had made little comments here and there and they've all been about the DVD."

A few parents were also pleased to find that the show dealt with issues like bullying and addressed ways to confront this problem:

"It was really entertaining. It wasn't dull at all, but it dealt with some potentially difficult issues in a really nice way. The bullying, how people can stand up for each other, self confidence, making yourself understood when your friends don't understand! I thought all of that was handled really well."

Parents were comfortable with their children viewing the program without their supervision. No one felt that the material was confusing or too difficult for their children, although two parents stated that their children had grown tired of new facts by the end of the show. Regardless, all parents felt that the material was all very easy to understand and presented well:

"It was pretty well-presented, didn't go too fast. It seemed to present info logically and in a structure that was easy to comprehend, seemed to build on a structure that would take it further and then tie it back in. We talked about this, 'what would be the next question?' That type of thing."

“Both of my children liked the experts, and that [Leah] was interviewing them rather than looking it up in books. Both of them really like science and liked the technical vocabulary - not dumbed down.”

The biggest criticism voiced by parents was directed at the dancing and singing sections of the show, which they found distracting, unnecessary, or more for younger audiences:

“The dancers with the facts. Maybe that makes it stick for the kids, but for me it was just odd.”

However, a few parents saw the musical moments as learning tools:

“When you use music it’s a little easier to remember, like when things rhyme.”

“When it asked later in the questionnaire how many bones, she repeated the little song, ‘205 plus 1.’”

Regardless of their opinions of the musical sections, parents felt that the overall program had held their children’s interest:

“She showed a lot more interest in that material than I would have expected. It seems like a very boy topic, but she really bought into it with all the girls and it was fun learning all those things with her.”

“If you had asked me before, I would not have said she’s interested in science...but she really likes this!”

“Her big brother (15 years old) watched it with us, so we all watched together and discussed the science of the bones as we were watching, so it was really interesting. It kept everyone’s attention as we were going.”

Furthermore, several parents indicated that they had had quality discussions with their children around program topics and that the program had contributed to their children’s learning:

“There was a part that talks about how many bones you’re born with as opposed to a different age. She was relating it to her own situation. Then, it made her wonder, ‘How have I lost some of my bones and where?’ Then it answered her question. I could tell it caught her attention.”

“We talked about when you break your bone, how it rebuilds in seven years...She really loves animals, so we talked a lot about that part, talking about the differences between humans and animals’ bones.”

“She was talking about how you could just watch it and get the ‘important facts.’ They talk about that in school, looking out for those to get ready for the test.”

“That the giraffe and her had the same amount of bones. She remembers that.”

“She was excited to learn how many bones you have and the fact that they fuse together.”

Teachers’ Opinions of the Pilot Episode

Teachers’ opinions of the Scientastic! program were in many ways similar to parents’ feedback. Teachers really seemed to enjoy the pilot episode and its presentation of the material. Teachers explained that they liked the characters, found the information to be accurate and accessible, and enjoyed contemporary aspects like the characters using a webcast. Several teachers mentioned that they found the main characters’ approach to interviewing and reviewing knowledge she had learned to be quite beneficial in showing students how to conduct research.

“I thought it was really well done, well produced. My students seemed to be really engaged in it, more than a lot of videos I’ve shown. I’ve shown Bill Nye videos and others like that and this one definitely had them more engaged. I liked how it had the question that the person was asking themselves and how can I find out the answer, and going to different people to find what she was looking for. I also liked the music and dancing as well.”

Teachers most often cited the inclusion of soccer as the main point of interest for students that helped them relate to the characters. One teacher explained that his class, which is predominately Hispanic, did not relate as well to the program due to the inclusion of only Caucasian and African-American characters.

Most of the teachers felt that their students were engaged during the episode, particularly in the content-related portions:

“When the video was going on, I noticed the students pointing out the different types of bones being discussed on their arms. Usually I have to prompt them to do those types of things, but the fact that they were doing it on their own showed me that they were really paying attention and interested in what was going on.”

“They did enjoy it and the content and learned about their bones. During the dancing pieces and songs they were not as engaged; they were busy talking. When Leah went to the experts and with the soccer, they were very engaged in

those bits...They didn't seem to be as engaged with the verbal stuff with the bullying in the hallway; they were too busy talking to each other about how they felt about that. I liked it, but they didn't like when Leah stacked the facts...They think, 'why should I re-say what I already said?' I think that's really important though."

Teachers' Use of the Pilot Episode in Their Classrooms

Teachers thought that the pilot episode could be used either as a stand-alone lesson or for review purposes. In fact, several teachers used the episode to compensate for a lack of other resource materials on the skeletal system:

"I had done body systems toward the beginning of the year, so I kind of used it as a review. They have a state test coming up, so it was real useful in terms of reviewing the skeletal system."

"Beforehand, we talked about how it was going to be about bones and afterwards they were excited, talking about some of the words they had learned and we discussed it, talked about the kids on the show and how if they would break a bone, this is the process they would go through."

Fifth grade teachers felt that the episode's material fit well within the science curriculum, while lower grade teachers explained that anatomy was not typically taught at the 3rd/4th grade level and would need to be used at a later time. Several teachers went further to state that it would be relatively easy to pair the program's content with the class textbook. One teacher commented that while the topic was review for her 5th grade class, her lower level classes responded very positively to the program, which has convinced her to modify her 5th grade skeletal system lesson to incorporate the program in future years. Interestingly, all participating teachers were unaware of the lesson plans that are available online that correspond with the pilot episode content.

Suggestions for Improvement of the *Scientastic!* Television Program

Many youth participants liked the program as is and did not have any suggestions for improvement (35%; N=128). Several wanted less singing (15%) and dancing (20%). A few wanted the girls on the other team to be slightly less mean. Other potential changes that youth participants mentioned included presenting additional topics, adding more boy characters, reducing or eliminating the dream sequences, shortening the length of the program, and to provide a summary at the end of the program as a review. One child wanted the words on the screen to be said aloud to make it easier for him to remember.

Parents also wanted more diverse characters and more realism:

“Science is really interesting and kids love it! They have such a natural curiosity about the world around them that you don’t really have to drag them kicking and screaming to it and pretend it’s some kind of hip hop thing.”

“It would be nice to add some boy characters and get scientists from a cross section of humanity, scientists of color who work in these fields. The doctor was the only person of color at all on there. The dialogue could be a little more realistic too! All of it was really stilted and very junior high school play kind of thing.”

Teachers’ suggestions tended to center around how they would use the program in the classroom. For example, one teacher mentioned the accessibility of lesson plans, while another encouraged the show’s producers to tie each show’s content very explicitly to the curriculum:

“It’s easier for me if I would get a printout [of the lesson plans] or something with the DVD, since if it’s on the website I have to print it myself and it’s an additional step to find and download! When you’re making something for teachers, to make them use it, make it as easy as possible! Where all they have to do is plug it in, pass it out! Make it easy because our jobs are busy and hard enough as it is!”

“If they continue and make future episodes, maybe they could get some of those standards for other grade levels. Third grade has simple machines, motion sciences, stuff like that - Lights, sound, how those energy pieces change and move. Fifth grade has a lot of chemistry standards, mass and volume, matter - those would be nice to have some interactive videos about. I don’t know if Leah could ever go back in time, but there are also fossils, land forms, how things were formed and how they changed. I would encourage going through the standards and really aligning with those because with all our focus on standardized testing, we can’t just play a video because it’s cute! It really has to go with the standards so we can justify using it during the class time.”

Reactions to Scientastic! Website

Participants’ Overall Opinions of the Website

Many participants liked the website overall and found its appearance appealing, but users were less enthusiastic about the website compared to their earlier opinions of the television program (see Table 13). Several participants thought that the content and web activities were interesting, that the characters were relatable and that the

topics covered mattered in their own lives. Most participants (62%; N=136) thought that the website contained the right amount of material. The rest were split between whether the website had too much content (18%) or not enough information (20%).

Figure 3: Screen Capture from Website

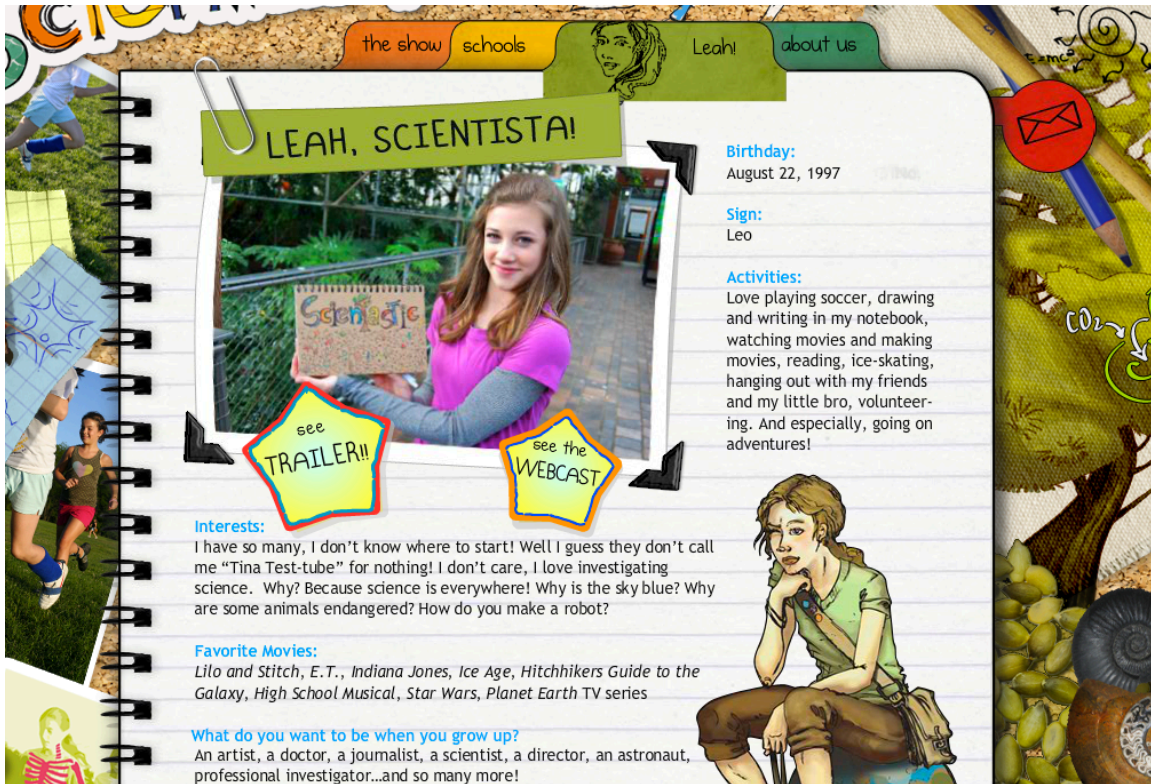


Table 13: Participants' Opinions of the Website

	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Liked Website Overall	10%	15%	31%	44%	135
Interested in Website Content	12%	19%	39%	30%	138
Interested in Website Activities	18%	20%	29%	33%	138
Found Website Appearance Appealing	9%	25%	25%	41%	138
Felt Characters Were Relatable	20%	18%	30%	32%	138
Felt Topics Covered on Website Matter in Own Lives	9%	17%	38%	36%	137

Many participants (75%) were at least somewhat interested in visiting similar websites, although again, these percentages were less than those who wanted to view similar television programs (see Table 14). Some youth (62%) were also at least somewhat interested in learning more about topics of bone health and healing.

Table 14: Participants' Future Interest in Website Topics & Activities

	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Wanted To Learn More About Website Topics	11%	27%	28%	34%	137
Wanted to See Similar Websites	11%	14%	36%	39%	136
Would Explore Website At Home	17%	27%	32%	24%	137
Would Explore Website At School	11%	21%	29%	39%	136

Overall, users were more likely to want to visit the Scientastic! website at school than at home. There were no significant differences between youth who visited the website at home with their families or at school with their teacher, regarding whether they would want to visit the website again at home or at school.

Website Use

Youth reported that they most often watched the pilot episode's trailer on the website, viewed the webcast, and/or read Leah's Notes (see Table 15). They were less likely to play the games on the site, use the app, or go on the Scientastic! Fan Club's Facebook page. This is likely because these resources were not embedded within the website itself and took them to other web pages.

Table 15: Participants' Use of the Scientastic! Website (N=143)*

Website Section	Percentage of Participants
Watched the Scientastic! pilot episode trailer	71%
Watched the webcast	70%
Read more about Leah	64%
Read Leah's notes to learn more about bones	55%
Watched expert video interviews	44%
Found out more about the places Leah and Axel visited	37%
Went to another website link in "More Stuff" section	27%
Played Dr. Allievable's Lab games	19%
Played the POMT – Bone activity	17%
Looked at Scientastic! Fan Club on Facebook	8%

* Website visitors could identify more than one activity.

Website Likes & Dislikes

Youth liked learning from the website, in general, and the additional interviews that Leah conducted (see Table 16). Several mentioned specific aspects of the website that they enjoyed such as Leah’s Notes, the skeleton chart, videos, and interacting with the cast:

“I liked the notes because they were short and specific.”

“I liked how you could see what was happening inside the bone in the “My Notes” section.”

“[I liked] the skeleton chart because you could click on a bone and it would tell you what it is.”

“[I liked] the webcasts because it helps me learn better than reading.”

“[I liked] how you can send an email because you can talk to them.”

Table 16: What Youth Liked Most About the Website (N=128)*

Aspects of Website	Percentage of Participants
Learning	20%
Don’t Know/Nothing	13%
Leah’s Research/Interviews	12%
Games	7%
Singing/Dancing	7%
Fun/Humor	5%
Skeleton Chart	5%
Everything	5%
Actors’ Information	5%
Storyline	4%
Leah’s Notes	3%
Bone Topic	2%
Send Messages/Email	2%
Powers of Minus Ten -Bone	2%
Look & Feel	2%
Visuals	2%
Trailer	2%
Webcast	2%
Location Suggestions & Web Links	2%
Leah’s Bio	1%
Axel	1%

* Some participants listed more than one aspect of the website.

However, several youth did not like the website and said they found the content boring. For many users, the website did not hold their interest and did not have activities that immediately stood out. Several participants did not like that the website games had to be downloaded in order to play them and had difficulty running a few of the games on a Mac; One classroom participant indicated that they are “not allowed” to download games at school. They also did not like the amount of reading on the website, and a few found the website itself hard to navigate. One participant thought that the website images and text were too small. Youth who watched the webcast or episode trailer on the website also routinely commented on the dancing and “annoying” theme song.

Table 17: What Youth Liked Least About the Website (N=122)*

Aspects of Website	Percentage of Participants
Don't Know/Nothing	23%
Dancing/Singing	17%
Lack of Games/Interactives	14%
Ability to Access/Download Games	13%
Mean Girls	7%
Redundant Videos	5%
Boring	5%
Amount of Reading	4%
Everything	2%
Theme Song	2%
Topic of Bone Health	2%
Website Navigation	1%

* Some participants listed more than one aspect of the program.

Parents' Opinions of the Website

A few parents liked the content of the website, especially the videos and the scientist interview portions that provided more in-depth information:

“The website [had] good content for her age level, put together well and here were lots of options...We saved it, so she can get on there again. We can let her get on there and know it’s safe.”

Several parents indicated that they had let their children explore the website on their own, with periodic parental check-ins. A few children were observed linking the television program to the website material or referencing the web materials in their conversations:

“I kind of left her alone on that. She was working pretty independently on it. We talked a little bit about the DVD when using the website. She mentioned that now things made more sense after watching the DVD.”

“She tells people about it, ‘Do you know what an ulna is? You can go to this website.’”

“All of our discussion was more about, ‘How can I find it? Can I do what she did? Can I go find something about this material?’”

However, many parents noted that the website had been difficult for their child to navigate, and that the amount of reading was, at times, overwhelming. One parent reported that some of the font or the contrast between the font color and boxes on the screen were difficult for her daughter to read:

“I don’t think the links were easy for her to find. There was lots of easy clickable information at the bottom of the responses on the front of the website, but finding the learning stuff like the labs and games, that really interested her, but she had trouble finding them...There was a ton of text. I think for a fourth grader, it’s too much.”

“[My son] clicked on a few things, but they didn’t take him anywhere. There were some jumping off points on the ‘More’ page...but it didn’t allow him to do what he wanted, so he got frustrated and quit.”

Many parents also felt that there wasn’t much in the way of new or supplemental information to complement the show. Rather, the information on the website contained images and material that had already been addressed on the DVD:

“It was the same exact information in a different way. For bright kids, this is a little repetitive and boring. My son wanted to find out more about what he just learned.”

“I didn’t like the website at all. It was flat, I kept wondering if my machine was really using it. I just went from a screen to screen, but there was no inquiry or in-depth. As my daughter said, ‘This info is just pictures from the movie.’ It didn’t look new or different to her. She didn’t want to look at the website at all.”

“My expectation was that the site would be very engaging and interactive because the DVD held my interest and the app was awesome, but the website didn’t really let me expand on that, put out these questions, there wasn’t a little quiz I could take. I didn’t see anything of that happening that would have engaged my daughter. ‘Did you see the film? If so, go do this. If you haven’t, go do this.’ They just seemed like flat fact sheets and my daughter said “well I already know this from the video”, there wasn’t really anything new from her perspective.”

“The website was okay, there just wasn’t a whole lot on there. He looked at the mobile thing on my phone and tried to play the game and got bored with it in a couple minutes. He didn’t want to learn a whole lot more about Leah or watch the videos again. There wasn’t anything that compelling about it, I had to kind of force him to sit there and try it out. He tried the links, it just didn’t really grab him.”

A few parents stated that they were hopeful that more content or episodes would be added to the website and that it would be frequently updated to ensure that they would come back to the website again. Parents were very vocal in their frustration to find extra material that was not just a rehashing of content they had already viewed in the television program. They also wanted more online interactives. To compound this issue, several parents had issues trying to access website games which was the main draw for their children, who ended up being disappointed that they couldn’t play any games:

“She wanted to know if there was a game that she could go to that would show her the bone healing process, the osteoblasts and osteoclasts...but then when we found the lab, she honestly wasn’t interested in it...She really wanted something more hands-on that she could do.”

“I didn’t personally explore it but sat by while my kids looked at it and the one thing that I heard from almost all of them was that there wasn’t that much to do on it. We didn’t do any downloading, we don’t have an iPad...They thought there should be more activities, more interactive. There were previews of videos they already saw so they were saying there wasn’t really any reason to watch those...I think more interactive things would draw them in a little more.”

“The website content was also age appropriate, but it could be kicked up a notch! There could be cool animations, more researching into that without making it boring, of course, but I think there can be more interactive or cool things going on.”

Teachers’ Opinions of the Website

Most teachers used the website to supplement the pilot episode’s content and several encouraged their students to explore the website and app further at home:

“[My class] mostly talked about how you can go to places to find more information, finding and researching more for science. We also talked about bone anatomy, bone attrition and healing, talking a lot about the bones and how they heal. We also talked about them going back to the website at home and

using the iPad at home because a lot of them have those at home, so a lot of them were saying they would do that.”

Teachers often reported having trouble getting the website to load completely. Two teachers commented that their school’s firewall blocked many of the aspects of the website that the kids were most interested in exploring, such as the games. Several also had difficulties helping their students navigate the website:

“The website was a tiny bit more confusing, but possibly because they had a hard time getting logged on and trying to find everything and we weren’t exactly sure what we were supposed to be doing. They spent time exploring. Once they got the hang of it, they enjoyed it a lot. I liked that they reiterated what they had learned on the DVD. They got more exposure. I spent so much time trying to make sure they were logged on, and didn’t get to do much exploration.”

“We didn’t get to explore the website very much. The initial page was cute and draws your attention, but we have a lot of things blocked at our school so we couldn’t play the game. I tried it at home, so my kids could do it at home and they liked it. The website did draw their attention and had the webcasts, which were pretty succinct little versions of the whole show and I could see that drawing their attention to watching another in the future.”

“The website I thought looked like it was well put together but my students seemed to have a lot harder time accessing that, in terms of accessing the information and being able to get what they should have out of it. I think they have a hard time understanding how to access different things on the website, I think the video was a lot more straightforward.”

Many teachers felt that the web content was recycled in a way that did not elicit more excitement or engagement from their students, and was more of a review of the television program, rather than a provider of additional information and hands-on activities:

“With the website, just the links they were slightly more engaged, but since they couldn’t play the games and were bored by the repetition of the videos they had already seen, there wasn’t a whole lot of engagement with all the technical difficulties we had with the website.”

Suggestions for Improvement of the Website

Many youth participants liked the website as is and did not have any suggestions for improvement (21%; N=119). Several wanted more information on the website (19%) or more games and interactives (18%). A few wanted more accessibility to games and better website navigation overall (13%); these youth specified that they wanted games they could play directly on the website, rather than having to download them. Other potential changes that youth participants mentioned included the presence of more videos, less reading and more music, clearer presentation of facts, the ability to ask questions of the cast, placing less information on the home page itself, and introducing new characters on the website. One youth felt that the video interviews were too much like lectures and repeated what had already been shown in the television show. Another youth wanted more realism and believed that Leah's favorite movie would not be High School Musical. Finally, one participant was looking for more descriptions of hands-on science experiments that she could do at home.

Parents echoed many of their children's suggestions, and called for more content, games, interactives, and downloadable hands-on activities on the website, additional web links, and having the games and app embedded within the website rather than having links to a 3rd party website. For example, one parent simply wanted more information on the site that follows lines of inquiry that children naturally have:

"Give them rabbit holes to go down. Have one thing that talks about stem cells and how they're made in the bone and what do they do and why do people have transplants and why do people have bone marrow transplants? What's the difference? Why does it matter where it breaks? Why is it some bones have you in a cast for 6 weeks whereas others don't really matter, you're still running around. The questions kids actually ask."

Parents also requested worksheets/quizzes/teaching materials to supplement the television program, a method for searching the website by topics, making the website easier to navigate for younger users, and regularly updating the website content. One parent wanted more tie-ins with the show's characters and narrative structure:

"In terms of content, I think more opportunities for the kids to make something or do something, I think the computer games and websites that they're into are all character driven and it's all about making something you decorate or having these online avatars and dressing them and making their house, meeting other kids that have their avatars. I think the reason she moved through it so quickly was it wasn't like any of the websites she uses."

Reactions to iPad App: Powers of Minus Ten - Bone

Participants' Overall Opinions of the App

Youth seemed to conflate the app with the website, indicating that they were less interested in the app overall and its appearance (see Table 18). However, the number of respondents to these questions did not all play the app. Many of those who did play the app appeared to be at least somewhat interested in its content and activities:

"I liked how you could look inside the bone of a healed bone or a broken bone."

Table 18: Participants' Opinions of the POMT – Bone Activity

	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Liked POMT – Bone Overall	10%	16%	53%	21%	106
Interested in POMT – Bone Content	22%	15%	22%	42%	41
Interested in POMT - Activities	19%	19%	5%	57%	37
Found POMT – Bone Appearance Appealing	20%	20%	16%	44%	138

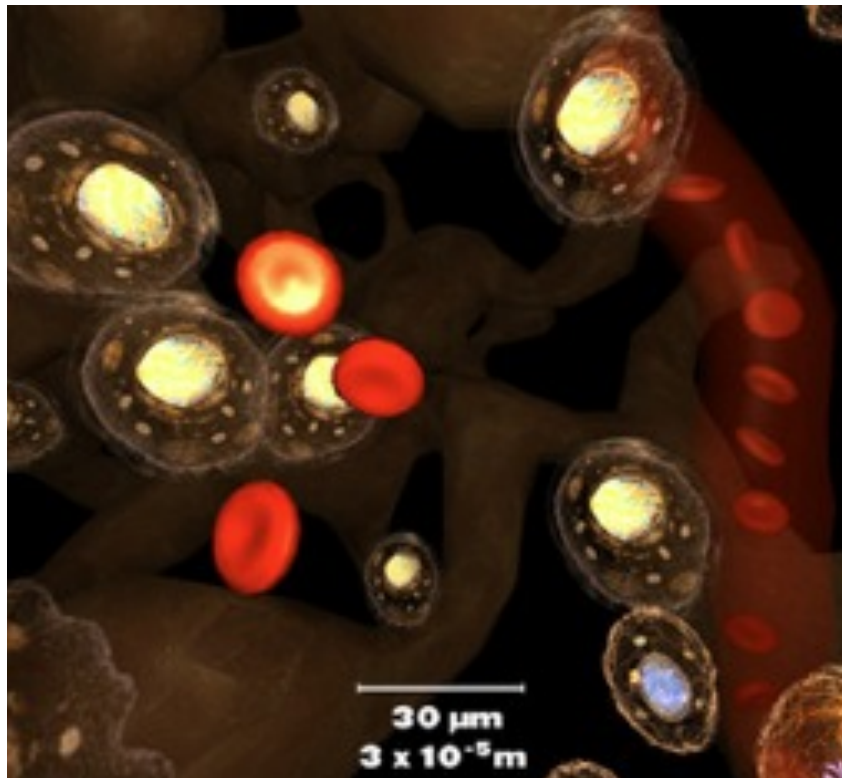
Most participants (61%; N=38) thought that the POMT – Bone activity contained the right amount of material. The rest either thought POMT - Bone did not have enough information (26%) or that it had too much information (13%). Some youth indicated that they wanted to engage in similar activities in the future, although several did not want further exposure to the content (see Table 19).

Students who played the app at school were significantly more likely to want to play the app at school again compared to youth who played the app at home with their families ($t(30)=-2.304$, $p=.028$). There were no significant differences between the two groups regarding whether they would want to play the app again at home.

Table 19: Participants' Future Interest in POMT - Bone Topics & Activities

	Not At All	Not Much	Somewhat	Yes, Totally	Total Number of Respondents
Wanted To Learn More About POMT - Bone Topics	32%	7%	17%	44%	41
Wanted to See Similar Activities	15%	12%	28%	45%	40
Would Explore POMT - Bone At Home	17%	26%	14%	43%	35
Would Explore POMT - Bone At School	20%	20%	20%	40%	35

Figure 4: Screen Capture of Powers of Minus Ten – Bone App



Parents' Opinions of the App

Several parents were unable to use the app due to technical problems or an inability to download the app successfully. The four families who did download the app said that it was easy to use and that their children did not need assistance. In fact, some children even taught their parents how to use the app later:

"I thought it was cool. My daughter installed it on her own, which shows she was very interested in it straight from the video. She immediately started showing me all these things."

"The app wasn't confusing for her. She could do it all on her own. She was fine with it. She showed me where she could go over a bone and then blow the picture up on the screen and show me what's inside the bone...She liked drilling down into it. That's what kept her hooked."

Parents liked that you "could click and expand down into the bone and see the cells." One parent indicated that her daughter had even used information that she had learned from the app in another educational setting:

"It's a springboard for her to continue learning. Incidentally, we went to this thing this morning and they were showing how they use a scaffold to build bones and she was able to talk about that based on what she had learned from the video. So it seemed like she was really applying what she learned. She liked being able to zoom in, see the bones and marrow, it was her favorite part, being able to go in really deep and seeing the different parts of the bone that you don't normally think about."

The largest complaint from parents about the app was its lack of choices. All the parents who tried it out indicated that their children had expressed a desire to look at objects within the app on a more detailed level. Once their children had explored the mechanics of zooming in on specific body parts, they were done with the experience fairly quickly and wanted to move on to other bones or ways of interacting with the app:

"She liked it, but wished there was more than just the hand...It's good that she was engaging with it and it left her wanting more!"

"She never went back and looked at it and I think that was because it was geared just towards that one bone and the healing of it and with the cell stuff. You could get some parts of it, but some parts were floating around and that was very interesting to us but there wasn't anything we could click on there. There would have been potential for a game there, something we could click on and chase or something, but there wasn't anything like that. We were playing around with it, 'Is there a name? Can we chase it? Can we destroy it? That's naturally what kids her age think, so I think she would have liked something more interactive."

Teachers did not discuss the use of the app in detail because so many had difficulty launching the Scientastic! website and focused their classes' attention there.

Online Reviews of the App

Eight-two app users posted a rating on the iTunes App Store page through April 2013. Of these, 55% ranked POMT - Bone at least a four out of five stars (see Figure 5). Forty-three percent of users also provided a written justification for their ratings. Users' opinions were about evenly split between positive (38%), negative (31%), and neutral responses (31%).

Online adult users raved about the app's visuals and ease of use:

"This app is a great way to visualize microscopic anatomy. It is simple, intuitive and well made. Get it, whether you're an adult (like me) or a child!"

"Epic. This is a really cool app. U can zoom and steer through a bone and it goes as far as the DNA. U can explore red blood cells, chromosomes, blood clots, cytoplasm and more."

Figure 5: Online Customer Ratings of Powers of Minus Ten – Bone App



Several wanted more content, such as additional bones. A few had difficulties with the zoom functionality and personal settings:

"Idea could be good. Execution not so good. Complaints: Music is annoying, but turning it off with the control supposed to turn music off didn't actually work; controls of magnification are unresponsive most of the time; no explanation for what you're seeing; scene sort of rotates by in a way that made my head swim. Also, it should be negative powers of ten, not powers of minus ten. Big difference. Free though."

"Meh! It's cool, except looking at one bone that is broken and seeing its healing stages gets boring after awhile, especially if it's only the middle finger. I want to

see some more bones and see how they heal, grow, and work internally and externally.”

Suggestions for Improvement of the App

Most youth participants (73%; N=26) thought that the POMT app was fine the way that it is. The rest mentioned things like adding more bones, increasing the length of time, changing the colors in the interface, and being able to look even deeper in more detail as things that they would like to see in future Scientastic! apps.

Online users, who were from an older audience, tended to want more sophisticated explanations of what they were viewing on-screen:

“It could be more complete. There should be depictions of: Endothelial cells of blood vessels, Biphospholipidic cell and nuclear layer, internal mitochondrial view with its circular DNA, nucleolus and its internal fibrillar DNA, ribosomes with both subunits 60s and 40s and translation occurring, tRNA, peptides, a whole mitosis occurring like, also a molecular view of chondroitin and hydroxyapatite, internal view of the cytoskeleton of an RBC.”

However, such detail would likely not be appropriate for a youth audience.

Conclusions and Recommendations

Overall, the suite of Scientastic! resources was shown to significantly increase young children's knowledge about and interest in science topics and the inquiry process. In particular, the pilot episode of the television program had the greatest impact. The website and iPad application may have had less of an effect because they were viewed by participants as knowledge reinforcement and review materials, rather than as rich resources to engage in more in-depth topic exploration. Regardless, both youth and adults indicated that they were at least somewhat interested in additional television episodes, website content and activities, and iPad applications. Subsequent materials would benefit from the incorporation of the most successful aspects of Scientastic!, as well as from participants' suggestions. These features include:

A Strong Narrative Structure With Relatable Characters & Scenarios

Participants liked the topic of the pilot episode because it focused on a real-world problem (i.e. trying to help a friend heal a broken bone faster) and dealt with issues of bullying in a competitive soccer context. Dream sequences and song and dance numbers were viewed as less crucial to the overall show because viewers were captivated by the storyline and saw the main character's investigative techniques as a natural advancement of the plot and engaging in and of themselves.

Clear Explanations of Scientific Phenomena & Processes

Adults and children seemed to like the "Stack the Facts" portion of the program, where Leah summarized what she had learned thus far. Such summaries are important mechanisms for helping learners synthesize what they have seen and heard. Future Scientastic! online and broadcast materials might include more short audio or visually-based descriptions of difficult terms and concepts and use real-world analogies to help learners better remember the ideas being covered.

Modeling of Research Practices & Opportunities to Engage in Lines of Inquiry

Young children were fascinated by the process that Leah went through to seek out answers to her questions. Having a character, or set of characters, model effective research practices may encourage youth to engage in such practices themselves. For example, both children and adults liked the interviews with experts and saw the value in this strategy. Future materials should continue to include such interviews in the program and on the website, and might provide opportunities for youth to submit their own questions for Leah to use to interview experts on a particular topic. Pop-up expert videos might even be incorporated into the iPad app to help explain what users are seeing as they delve deeper into the cells of a bone or other portion of the body. In addition, the website could house descriptions of hands-on inquiry activities so that learners can engage in their own research. The site might

even include a venue for learners to share their real-world investigations in a format that mirrors Leah's scientific process.

Involvement of Engaged Adults To Facilitate Learning Conversations

Parents feel comfortable allowing their children to explore the Scientastic! materials unsupervised. Yet when parents watched the show or used the online materials together with their children, they reported having compelling conversations around the show's content and the nature of the inquiry process. Teachers also had rich discussions about bones and bone health with their students. Thus, future iterations of the television program and online materials might allow for collaborative feedback or activity (for example, encouraging youth to engage in scientific investigations with an adult, come up with a good research question, or seek out additional resources on a topic together).

Plethora of Activity Choices

For the most part, participants liked the website and iPad application, but they wanted a larger quantity and greater diversity of activities and interactives. To keep learners coming back, Scientastic! will need to keep its online content updated and offer a variety of games and resources that are embedded within the site itself, both to keep participants engaged with targeted topics, but also to ensure that users are not constantly being led away from the site via outside links. Future Scientastic! resources should be a mix of external resources and on-site, just-in-time information.

Commitment To Multiple Media

The crucial feature of the Scientastic! project is that it is a multimedia approach to introducing youth to scientific processes and keeping them engaged with science-related content. While the Scientastic! television program alone is likely to continue to elicit increases in knowledge and changes in viewers' attitudes towards science, the additional support provided by the website and iPad application cannot be undervalued. Young children seem to be looking for ways to extend their experiences with science content on television beyond the role of passive viewer to take a more active role in investigations of scientific processes and phenomena. These youth are already fluent and engaged with online and mobile technologies. Thus, these locations seem like natural places in which to leverage the interest generated through a broadcast and extend and sustain learning over time. The fact that participants wanted more activities online and sought deeper levels of engagement with the app is a testament to the draw of these media as tools for learning. Scientastic! will be successful if it continues to tell stories about real science via compelling characters and utilizes multiple media to extend engagement with science content and activities beyond the broadcast.

Appendix A: Additional Demographics

Youth Participant Profile

- 88% of participants (N=122) like doing science experiments.
- 60% of participants (N=122) like watching television programs about science.
- 48% (N=121) like to explore science websites.
- 61% (N=122) would like to listen to scientists talk about their jobs.
- 65% (N=122) think that science magazines and stories are interesting.
- 37% (N=120) like to talk to their friends about science.
- 76% (N=120) like the science that they do in school.
- 52% (N=120) like to ask questions about the human body.
- 32% (N=122) think that is boring to learn new science words.
- 86% (N=121) like to do science experiments for fun.
- 88% (N=122) like to use tools to build things.
- 77% (N=120) like to take things apart to see how they work.
- 41% (N=122) use science to solve problems in their own lives.
- 54% (N=120) can use science to figure out what's wrong when something breaks.
- 50% (N=120) talk about science at home.
- 51% (N=121) indicated that science was their favorite school subject.
- 22% (N=121) of participants want to be a scientist when they grow up.
- 41% (N=120) of participants want to be a doctor when they grow up.

Appendix B: Survey Protocols

Youth Pre-Survey

Please answer the questions below BEFORE you watch the DVD of the Scientastic! pilot episode.

While they can't give you the answers, ask a parent or teacher for help if you are having trouble reading the survey.

Please provide us with the following information about yourself:

First Name: _____ Last Name: _____

Gender: Male Female

Race: Caucasian African American Asian
 Hispanic Other, please specify _____

Name of your school: _____

Grade in school (Circle one): 1st 2nd 3rd 4th 5th 6th 7th 8th

Year you were born: _____

Science Attitudes & Knowledge Questions

1.) Overall, how do you feel about science? [Check one]

I don't like it at all.

I like it a little.

I like it.

I like it a lot.

2.) In general, how do you feel about doing science experiments?

I don't like doing them at all.

I like doing them a little.

I like doing them.

I like doing them a lot.

3.) On a scale from 1 to 10, with 1 being “I know nothing” and 10 being “I’m an expert”, how knowledgeable do you think you are about science? [Check one]

1	2	3	4	5	6	7	8	9	10

4.) On a scale from 1 to 10, with 1 being “I know nothing” and 10 being “I’m an expert”, how knowledgeable do you think you are about how the human body works? [Check one]

1	2	3	4	5	6	7	8	9	10

5a.) Please indicate your level of agreement with the following questions by placing an X in the appropriate box:

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. I like to watch television programs about science.				
b. I like to explore science websites.				
c. It is boring to visit with scientists in their labs.				
d. I would like to listen to scientists talk about their jobs.				
e. Science magazines and stories are interesting.				
f. I want to learn more about how the human body works.				
g. I like to talk about science with my friends.				
h. I like the science we do at school.				
i. I like to ask questions about the human body.				
j. It is boring to learn new science words.				
k. I like to do science experiments for fun.				
l. I like to use tools to build things.				
m. I like to take things apart to see how they work.				
n. I use science to solve problems in my life.				
o. When something breaks, I can use science to figure out what’s wrong.				
p. I talk about science at home.				
q. Science is one of my favorite subjects in school.				
r. I want to be a scientist when I grow up.				
s. I want to be a doctor when I grow up.				
t. Science helps me understand some of the things I see around me.				

5b.) How interested are you in learning more about science careers?

- Not at all interested
- Somewhat interested
- Interested
- Very Interested

6.) How interested are you in learning more about health careers?

- Not at all interested
- Somewhat interested
- Interested
- Very Interested

7.) How confident do you feel doing the following?

	Not at all confident	Somewhat Confident	Confident	Very Confident
a. Asking a scientific question				
b. Forming a hypothesis				
c. Planning experiment methods				
d. Collecting data				
e. Drawing graphs				
f. Talking about experiment results				

8.) If you have a science question, what are some ways that you can find out information about it?

9.) What is your experience with the following concepts? [Check one column per term]

	Never heard of it	Heard of it, but don't know what it is	Know what it is
Fracture			
Ulna			
Calcium			
Bone Marrow			
Osteoclast			
Osteoblast			
Stem Cell			

Content Questions

10.) Bird bones are

- a.) solid
- b.) hollow

11.) How many bones are in the adult human body?

- a.) 300
- b.) 208
- c.) 275
- d.) 206

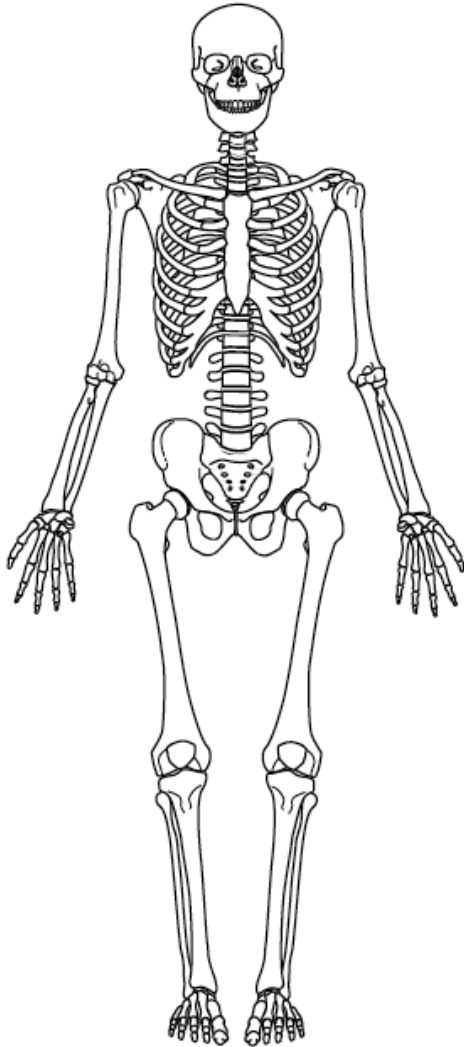
- 12.) Giraffes have
- a.) More neck bones than humans
 - b.) Less neck bones than humans
 - c.) The same amount of neck bones as humans
- 13.) What animal heals the quickest after an injury?
- a.) birds
 - b.) mammals
 - c.) reptiles
 - d.) fish
- 14.) What percentage of your body weight is bone?
- a.) 14%
 - b.) 25%
 - c.) 67%
 - d.) 8%
- 15.) How often does your body replace each bone?
- a.) Never
 - b.) Every 3 years
 - c.) Every 7 years
 - d.) Every 12 years
- 16.) Which takes longer to heal?
- a.) A displaced fracture
 - b.) A non-displaced fracture
- 17.) Bones are living organs like your heart or skin.
- a.) True
 - b.) False
- 18.) Osteoclasts build up bone.
- a.) True
 - b.) False
- 19.) Stem cells can turn themselves into bone cells to speed up healing.
- a.) True
 - b.) False
- 20.) Doctors put casts on broken bones to keep the fracture from moving.
- True
- False

21.) Blood clots are the last thing that the body does to heal a broken bone.

True

False

22.) Circle the location of the ulna on the skeleton.



23.) What kinds of things help bones grow faster?

24.) What are some things that have vertebrae?

25.) A 5th grader named Ian broke his ankle skateboarding.

a.) Describe what is happening inside his body while the bone is healing.

b.) Is there anything that Ian can do to speed up the healing process?

- 26.) If you had a question, would you seek out a doctor or scientist to get answers?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all
27. If you had a question, would you go to a library to get answers?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all
- 28.) If you had a question, would you go on the internet to get answers?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all

Thanks for answering the survey!

Youth Post-Television Program Survey

Please answer the questions below AFTER you watch the DVD of the Scientastic! pilot episode in class.

While they can't give you the answers, ask a parent or teacher for help if you are having trouble reading the survey.

Science Attitudes & Knowledge Questions

1.) Overall, how do you feel about science? [Check one]

- I don't like it at all.
- I like it a little.
- I like it.
- I like it a lot.

2.) On a scale from 1 to 10, with 1 being "I know nothing" and 10 being "I'm an expert", how knowledgeable do you think you are about science? [Check one]

1	2	3	4	5	6	7	8	9	10

3.) On a scale from 1 to 10, with 1 being “I know nothing” and 10 being “I’m an expert”, how knowledgeable do you think you are about how the human body works? [Check one]

1	2	3	4	5	6	7	8	9	10

5a.) Please indicate your level of agreement with the following questions by placing an X in the appropriate box:

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. It is boring to visit with scientists in their labs.				
b. I want to learn more about how the human body works.				
c. Science helps me understand some of the things I see around me.				

5b.) How interested are you in learning more about science careers?

- Not at all interested
- Somewhat interested
- Interested
- Very Interested

6.) How interested are you in learning more about health careers?

- Not at all interested
- Somewhat interested
- Interested
- Very Interested

7.) How confident do you feel doing the following?

	Not at all confident	Somewhat Confident	Confident	Very Confident
a. Asking a scientific question				
b. Forming a hypothesis				
c. Planning experiment methods				
d. Collecting data				
e. Drawing graphs				
f. Talking about experiment results				

8.) If you have a science question, what are some ways that you can find out information about it?

9.) What is your experience with the following concepts? [Check one column per term]

	Never heard of it	Heard of it, but don't know what it is	Know what it is
Fracture			
Ulna			
Calcium			
Bone Marrow			
Osteoclast			
Osteoblast			
Stem Cell			

Content Questions

Please answer the following questions as best you can. It's okay if you don't know the answers. Just use your best guess.

10.) Bird bones are

- a.) solid
- b.) hollow

11.) How many bones are in the adult human body?

- a.) 300
- b.) 208
- c.) 275
- d.) 206

12.) Giraffes have

- a.) More neck bones than humans
- b.) Less neck bones than humans
- c.) The same amount of neck bones as humans

13.) What animal heals the quickest after an injury?

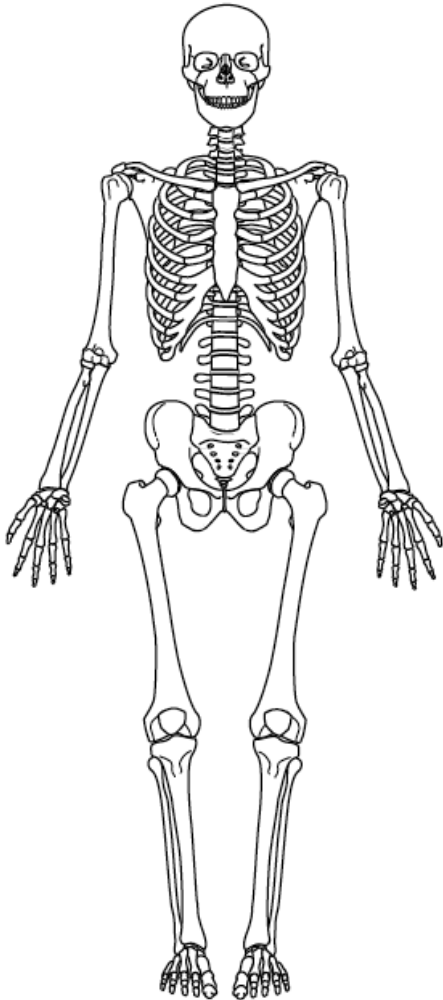
- a.) birds
- b.) mammals
- c.) reptiles
- d.) fish

14.) What percentage of your body weight is bone?

- a.) 14%
- b.) 25%
- c.) 67%
- d.) 8%

- 15.) How often does your body replace each bone?
- a.) Never
 - b.) Every 3 years
 - c.) Every 7 years
 - d.) Every 12 years
- 16.) Which takes longer to heal?
- a.) A displaced fracture
 - b.) A non-displaced fracture
- 17.) Bones are living organs like your heart or skin.
- a.) True
 - b.) False
- 18.) Osteoclasts build up bone.
- a.) True
 - b.) False
- 19.) Stem cells can turn themselves into bone cells to speed up healing.
- a.) True
 - b.) False
- 20.) Doctors put casts on broken bones to keep the fracture from moving.
- True
- False
- 21.) Blood clots are the last thing that the body does to heal a broken bone.
- True
- False

22.) Circle the location of the ulna on the skeleton.



23.) What kinds of things help bones grow faster?

24.) What are some things that have vertebrae?

25.) A 5th grader named Ian broke his ankle skateboarding.

a.) Describe what is happening inside his body while the bone is healing.

b.) Is there anything that Ian can do to speed up the healing process?

Now I'd like to ask you some questions about the Scientastic! video that you saw.

26a. Did you like the Scientastic! video overall?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

26b. What did you like most about it and why?

26c. What did you like least about it and why?

27. Was the content of the program interesting to you?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

28. Did you think the program looked cool?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

29. Was the music appealing?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

30. Do you feel like the characters in the Scientastic! video were kids you could relate to?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

31. Do you feel the topics covered in the program matter in your life?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

32. Did you like the pace of the program?

- a. It was perfect
- b. It went too fast
- c. It was too slow

33. Do you want to know more about the topics you learned about in the program?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

34. Would you want to see more programs like this one?

- a. Yes, totally!
- b. Maybe
- c. Not really
- d. No way!

35. If you had a question, would you seek out a doctor or scientist to get answers?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

36. If you had a question, would you go to a library to get answers?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

37.) If you had a question, would you go on the internet to get answers?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

38.) Would you recommend the Scientastic! television program to another person your age?

- a. Yes, totally!
- b. Probably
- c. Not really
- d. Not at all

39.) I would like to watch more Scientastic! episodes at home.

- a. Yes, totally!
- b. Probably
- c. Not really
- d. Not at all

- 40.) I would like to watch more Scientastic! episodes at school.
- a. Yes, totally!
 - b. Probably
 - c. Not really
 - d. Not at all

41.) If you could change anything about the Scientastic! television program what would it be? Please be specific.

Youth Post-Website & App Survey

Please answer the questions below AFTER you explore the Scientastic! website in class.

While they can't give you the answers, ask a parent or teacher for help if you are having trouble reading the survey.

Science Attitudes & Knowledge

1.) On a scale from 1 to 10, with 1 being "I know nothing" and 10 being "I'm an expert", how knowledgeable do you think you are about science? [Check one]

1	2	3	4	5	6	7	8	9	10

2.) On a scale from 1 to 10, with 1 being "I know nothing" and 10 being "I'm an expert", how knowledgeable do you think you are about how the human body works? [Check one]

1	2	3	4	5	6	7	8	9	10

3.) Please indicate your level of agreement with the following questions by placing an X in the appropriate box:

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. It is boring to visit with scientists in their labs.				
b. I want to learn more about how the human body works.				
c. Science helps me understand some of the things I see around me.				

4.) If you have a science question, what are some ways that you can find out information about it?

5.) What is your experience with the following concepts? [Check one column per term]

	Never heard of it	Heard of it, but don't know what it is	Know what it is
Fracture			
Ulna			
Calcium			
Bone Marrow			
Osteoclast			
Osteoblast			
Stem Cell			

Content Questions

Please answer the following questions as best you can. It's okay if you don't know the answers. Just use your best guess.

6.) What kinds of things help bones grow faster?

7.) A 5th grader named Ian broke his ankle skateboarding.

- a.) Describe what is happening inside his body while the bone is healing.
- b.) Is there anything that Ian can do to speed up the healing process?

Now I'd like to ask you some questions about the Scientastic! website that you visited.

8. Did you like the Scientastic! website overall?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

8a.) What did you like most about it and why?

8b.) What did you like least about it and why?

9. Was the content on the website interesting to you?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

10. Were the activities on the website interesting to you?
- Yes, totally!
 - Some of the time
 - Not much
 - Not at all
11. Did you do any of the following on the website: [check all that apply]
- watched the trailer
 - watched the webcast
 - read more about Leah
 - checked out the Scientastic! fan club on Facebook
 - watched some of the expert video interviews
 - read Leah's notes to learn more about bones
 - found out more about the places Leah and Axel visited in the episode
 - played the Powers of Minus Ten – Bone activity
 - played Dr. Allevable's Lab games
 - went to other website links in "more stuff"
12. Did you think the website looked cool?
- Yes, totally!
 - Some of the time
 - Not much
 - Not at all
13. Do you feel like the characters in the Scientastic! website were kids you could relate to?
- Yes, totally!
 - Some of the time
 - Not much
 - Not at all
14. Do you feel the topics covered on the website matter in your life?
- Yes, totally!
 - Some of the time
 - Not much
 - Not at all
15. Did you like the amount of material on the website?
- It was the right amount of information
 - It was too much information
 - It was too little information

16. Do you want to know more about the topics you learned about on the website?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all
17. Would you want to see more websites like this one?
- a. Yes, totally!
 - b. Maybe
 - c. Not really
 - d. No way!
18. If you had a question, would you go on the internet to get answers?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all
19. I would like to explore the Scientastic! website more at home.
- a. Yes, totally!
 - b. Probably
 - c. Not really
 - d. Not at all
- 20.) I would like my science teacher to let us use the Scientastic! website at school.
- a. Yes, totally!
 - b. Probably
 - c. Not really
 - d. Not at all
- 21.) If you could change anything about the Scientastic! website what would it be? Please be specific.

Please answer the questions below ONLY IF you played the Powers of Minus Ten – Bone Activity in class. Ask your teacher if you are unsure.

- 22.) Did you like the Powers of Minus Ten – Bone activity overall?
- a. Yes, totally!
 - b. Some of the time
 - c. Not much
 - d. Not at all

23.) Was the content in the Powers of Minus Ten – Bone activity interesting to you?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

24.) Were the activities in the Powers of Minus Ten – Bone activity interesting to you?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

25.) Did you think the Powers of Minus Ten – Bone activity looked cool?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

26.) Did you like the amount of material in the Powers of Minus Ten – Bone activity ?

- a. It was the right amount of information
- b. It was too much information
- c. It was too little information

27.) Do you want to know more about the topics you learned about in the Powers of Minus Ten – Bone activity?

- a. Yes, totally!
- b. Some of the time
- c. Not much
- d. Not at all

28.) Would you want to see more activities like the Powers of Minus Ten – Bone activity on the website?

- a. Yes, totally!
- b. Maybe
- c. Not really
- d. No way!

29.) I would like to explore the Powers of Minus Ten – Bone activity more at home.

- a. Yes, totally!
- b. Probably
- c. Not really
- d. Not at all

30.) I would like my science teacher to let us use the Powers of Minus Ten – Bone activity at school.

- a. Yes, totally!
- b. Probably
- c. Not really
- d. Not at all

31.) If you could change anything about the Powers of Minus Ten – Bone activity what would it be? Please be specific.

Thanks for answering the website survey. You're Scientastic!

Appendix C: Participant Log

Please share with us when and how you used the Scientastic! resources:

Date	Time of day	Time (in minutes) spent	Indicate which resource you used:			What was the setting? Were there any special conditions?	What kinds of conversations did you engage in about the program/web site?	Did these conversations happen before, During or after your use of the materials?
			Video	Web	Mobile App			

- Which sections of the website did your child explore? Check all that apply.
- Watched the trailer
 - Watched the webcast
 - Read more about Leah
 - Checked out the Scientastic! fan club on Facebook
 - Watched some of the expert video interviews
 - Read Leah's notes to learn more about bones
 - Found out more about the places Leah and Axel visited in the episode.
 - Played the Powers of Minus Ten – Bone activity
 - Played Dr. Allevable's Lab games
 - Went to other website links in "more stuff"

Appendix D: Interview Protocols

Parent Interview

Hi _____, I'm _____ and I'd like to talk to you about your use of Scientastic! at home.

Do you mind if I record our conversation? It's only for my use, so I don't need to take detailed notes, and it will not be shared with anyone outside of the research team.

1. What's your name and how old is your child(ren)?
2. Did you have a chance to watch the Scentastic! Video and visit the website with your child(ren)?
3. What did you think of the program? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your child(ren)?
4. What did you think of the website? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your child(ren)?
5. Did you use the iPad app? What did you think about it? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your child(ren)?
6. How did you use the Scientastic! materials with your child(ren)?
7. Who did you watch the program with? Did you talk about the program? If yes: What kinds of things did you talk about?
8. How long did you wait after viewing the program to use the web materials? Who did you use the web materials with? How many times did you use the web materials? Did you talk about the web materials? What kinds of things did you talk about? Did you reference the program at all while looking at the web materials? What kinds of things did you say about it?
9. How long did you wait after viewing the program to use the iPad app? How many times did you use the app? Did you talk about the app? What kinds of things did you talk about? Did you reference the program or the website at all while looking at the app? What kinds of things did you say about it?
10. Did you feel the television program content was appropriate for your child/family?
11. Did you feel the website content was appropriate for your child/family? Why or why not?
12. Did you feel that the app content was appropriate for your child/family? Why or why not?
13. Was Scientastic! interesting to your child(ren)? Did they seem engaged?

14. Can you give me an example? Were there particular portions of the television program where they were more engaged than others?
15. Were there particular points in their exploration of the web materials where they seemed more engaged than others?
16. Did your child(ren) relate to the characters? Were there particular characters that you think stood out more than others?
17. Do you think you would watch other episodes of this program with your child(ren) in the future? Why or why not?
18. Do you think you would use the Scientastic! web resources and/or app with your child(ren) in the future? Why or why not?
19. How could the program/website/app be made more useful to you? Do you have any suggestions?
20. Is there anything else you would like to add?

Thanks for your time. We really appreciate it.

Teacher Interview

Hi _____, I'm _____ and I'd like to talk to you about your use of Scientastic! in the classroom.

Do you mind if I record our conversation? It's only for my use, so I don't need to take detailed notes, and it will not be shared with anyone outside of the research team.

1. What is your name and what grade did you teach with the Scientastic! materials?
2. Did you have a chance to watch the Scientastic! Video and visit the website with your students?
3. What did you think of the program? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your students?
4. What did you think of the website? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your students?
5. Did you have a chance to play the Powers of Minus Ten – Bone activity with your class? If yes, what did you think of the Powers of Minus Ten – Bone activity? What did you like about it? Was there anything you didn't like as much or thought might be confusing for your students?
6. How did you use the Scientastic! materials with your students?

7. Was it a stand alone activity or did you pair Scientastic! with other curriculum?
8. Did you use any of the lesson plans or activities provided on the Scientastic! website? If yes, which ones? Tell me about how you think they went. What would you change for next time?
9. Did you talk about the program episode with your students beforehand? During? Afterwards? What kinds of things did you talk about?
10. How long did you wait after viewing the program to use the web materials? How did you use the website? How many times did you use the web materials? Did you talk about the web materials beforehand? During? Afterwards? What kinds of things did you talk about? Did you reference the program at all while looking at the web materials? What kinds of things did you say about it?
11. How long did you wait after viewing the program to use the iPad app? How many times did you use the app? Did you talk about the app beforehand? During? Afterwards? What kinds of things did you talk about? Did you reference the program or the website at all while looking at the app? What kinds of things did you say about it?
12. Did you feel the program content was appropriate for your students? Why or why not?
13. Did you feel that the website content was appropriate for your students? Why or why not?
14. Did you feel that the app content was appropriate for your students? Why or why not?
15. Did the program and website content fit with your curriculum?
16. If you were to use the materials again would you pair them with other classroom resources or curriculum? Which ones?
17. Was Scientastic! interesting to your students? Did they seem engaged?
18. Can you give me an example? Were there particular portions of the television program where they were more engaged than others? Were there particular points in their exploration of the web materials where they seemed more engaged than others?
19. Did your students relate to the characters? Were there particular characters that you think stood out more than others?
20. Is this a resource you would like to use? Why or why not?
21. How could the program/website/Powers of Minus Ten –Bone app be made more useful to you? Do you have any suggestions?
22. Is there anything else you would like to add?

Thanks for you time. We really appreciate it.