



MULTIMEDIA RESEARCH

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Formative Evaluation of  
*SciGirls Video: Puppets*



Report for  
Twin Cities Public Television

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**EXECUTIVE SUMMARY**  
**FORMATIVE EVALUATION OF *SCIGIRLS* VIDEO: PUPPETS**  
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With support from the National Science Foundation, Twin Cities Public Television is producing a new PBS series about tween girls for a tween audience. Each live action half-hour episode follows a group of two to four “SciGirls” as they investigate their own science questions or take on an engineering challenge. Whereas the on-screen *real* SciGirls change with each episode, the series is unified by the animated world of Izzie and her BFF Jake. Izzie and Jake have their own story in every episode and look to the real SciGirls for help. To guide further development of the series, Multimedia Research implemented a formative evaluation of a rough cut video with 63 girls just entering fifth grade.

Appeal

The main story of the video is the engineering of a parade-size pig puppet with moving parts, and viewers pointed to this aspect of the video as what they liked the most. The fifth grade viewers liked the making or engineering of the pig puppet (38%); seeing the process of the girls’ teamwork (29%); having the real and animated stories intertwined (13%); seeing real girls do a believable project (10%); learning something interesting (10%); and seeing all the puppets (5%). Less appealing aspects pointed out by many fewer viewers concerned the girls’ disagreeing with each other (17%); the animated story (16%); the puppet story (11%); and the web clips about the girls’ interests and home life (10%).

Quantitative appeal ratings revealed that eight out of ten girls liked the *SciGirls: Puppets* video and would watch another show in the series. A majority rated the story as interesting (68%) and the video as visually interesting (56%). On average, viewers felt that the story pace moved neither too fast nor too slow.

Viewers also rated quantitatively how much they liked or did not like various production features of the video:

- Viewers really liked that the girls worked together as a team (94%) and that the girls did a real-life project (89%). These results reflect *SciGirls*’ front-end findings in the STEM research literature that “girls prefer to experience science in group settings” and that “girls look for compelling real-life contexts for science.”
- Viewers enjoyed that the girls talked a lot about their ideas (75%) and that they worked with adult helpers (76%). One-third (37%) liked that the girls sometimes disagreed with each other, but on average, the viewers felt this behavior was only “okay.”
- Interstitials in the video showed website presentations of the SciGirls’ other interests and their lives at home. Two-thirds of the fifth grade viewers liked these segments and liked hearing about the backgrounds of the SciGirls. Minority viewers in particular enjoyed learning about the lives of the onscreen girls who represented a diversity of ethnic groups.

Animated Characters

Three-quarters (75%) of the fifth graders liked the animated character Izzie, noting that she was funny or fun (38%), had a confident attitude (16%), was nice or cheerful (16%), and was helped by the SciGirls (14%). A majority of viewers (63%) felt that Izzie's story made them more interested in watching the show.

Those who liked Jake (43%) thought he was funny; another 13% thought Jake was funny but had reservations about his actions with respect to Izzie; 13% described Jake simply as okay; and 32% did not like the way he treated Izzie in this particular story.

### Impact

A majority thought the video was clear (83%) and felt that they learned from it (60%). Viewers reported learning about how to make a puppet (30%), learning some of the details of the pig puppet's mechanicals (29%), and learning something about teamwork (21%).

Three-quarters of the viewers (76%) agreed that they could build a project like the girls in the show did. The viewers identified with the onscreen girls, recognized that construction of the pig puppet was "doable," and as a result felt interested, comfortable and confident in their own ability to implement the same sort of project.

In conclusion, the rough cut video overall is competitive with other popular PBS shows, as eight of ten girl viewers expressed interest in seeing more shows. The research-based strategies for attracting 'tween girls to science and engineering topics were successfully implemented in the video, and the audience responded positively to them as planned.

## INTRODUCTION

With support from the National Science Foundation, Twin Cities Public Television is producing a new PBS series about tween girls for a tween audience. Each live action half-hour episode follows a group of two to four “SciGirls” as they investigate their own science questions or take on an engineering challenge. Whereas the on-screen *real* SciGirls change with each episode, the series is unified by the animated world of Izzie and her BFF Jake. Izzie and Jake have their own story in every episode and look to the real SciGirls for help. To guide further development of the series, Multimedia Research implemented a formative evaluation of a rough cut video with 63 girls just entering fifth grade.

Videos. The *Puppets* rough cut video opens with an animatic<sup>1</sup> presentation of Izzie and Jake’s story of Izzie running for class president (see top thumbnail). Jake tells Izzie that the tallest candidate usually wins, which prompts the short Izzie to go to her *SciGirls* website for ideas. She scans the many SciGirls’ projects posted there until she finds one that might solve her problem and then jumps into the real SciGirls’ story.

The live action SciGirls’ story follows four tween girls who, with a little adult guidance, engineer a May Day Parade pig puppet that blinks its eyes, wiggles its tail and blows smoke (see title page photos and middle thumbnails). During the engineering process, an animated Izzie pops into the screen occasionally to observe and comment (see bottom left photo). Learning from the SciGirls’ experience, Izzie builds her own puppet to make herself appear taller in her bid for class president (see bottom right photo).



<sup>1</sup> “Animatic” refers to unfinished non-animated still frames that represent the animated characters and their actions in the video. Voices of the Izzie and Jake characters were included in the rough cut.

## METHOD

**Procedure.** Focus groups of small groups of 3-4 girls met in Sacramento, CA, Austin, TX, Milwaukee, WI, Miami, FL, and Harvard, MA. The following was told to the girls prior to viewing the 26 minute video described above:

Today you will be watching a show from a series called *SciGirls*. *SciGirls* is meant for girls your age. Each half-hour episode follows a group of girls who take on an engineering challenge or investigate their own science question. The girls change with each episode, but an animated character, Izzie, is in all episodes. Izzie runs the *SciGirls* website, and you'll learn more about her as you watch this show.

The version of the show we are going to see today is not quite finished. The character Izzie is not yet fully animated in the way that she will be in the final version. You will see how the artists have drawn Izzie, and you'll hear Izzie's voice. You'll also hear her friend, Jake. Here is a picture of how Izzie and Jake will look in the final show. In the show you will see today, Izzie and Jake are not completely drawn and are not animated. You'll have to imagine the animation.

We will watch the show for a half-hour. Then you will answer some written survey questions. Then we'll talk about the show for a bit.

After viewing, the participants completed an individual written survey and participated in a group discussion. The survey and discussion questions explored appeal of the video and specific features of the show; appeal of Izzie and Jake and their story; and impact on learning.

**Sample.** A total of 63 girls entering fifth grade participated. The majority of the sample (83%) were 10 years old; the remainder were 9. The ethnicity/race distribution included 63% white, 21% Hispanic, 5% African-American, 2% Asian-American, and 9% mixed.

Almost two-thirds (63%) of the participants reported watching TV science programming on any channel "sometimes," as shown in Figure 1. Three-quarters (74%) of the participants reported watching PBS programming of any kind "sometimes" or more frequently, as shown in Figure 2.

A majority (62%) of participants had previously completed a science fair project. Of these girls, half had produced one science fair project, and the remainder reported completing from 2 to 5 projects. Those who had completed a science fair project reported viewing PBS programming significantly less frequently than those who had not completed a project.

Figure 1. Frequency of Viewing TV Science Programming

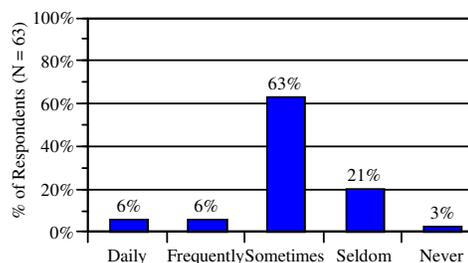
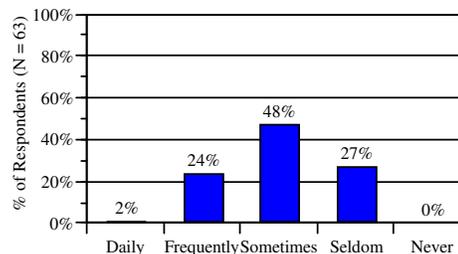


Figure 2. Frequency of Viewing PBS Programming of Any Kind



## RESULTS: VIDEO APPEAL

### What was liked about the video

After viewing the video, respondents wrote what they liked about the video. **The appealing aspects noted by the fifth grade viewers included the making or engineering of the pig puppet (38%); seeing the process of the girls' teamwork (29%); having the real and animated stories intertwined (13%); seeing real girls do a believable project (10%); learning something interesting (10%); and seeing all the puppets (5%).** Quotes below illustrate what was liked about the video:

- 38% enjoyed the making or engineering of the pig puppet; e.g.,  
*I liked how they showed the process of going through ideas, architecture, mechanical stuff.*  
*What I liked about the video is that there's engineering involved and I liked the giant pig they made.*  
*It taught you about engineering and structure. I'm sure the show isn't all about puppets, and I liked how it showed conflict in the project as well as success.*  
*I liked how they made lot's of plans for the pig and that they were very creative because it made the show more interesting.*  
*I liked when they would show the girls making the different parts of the pig because it was very interesting what materials they used to put together the parts.*  
*I liked the video because you really do need lots of steps to make a pig that big.*  
*I liked it because it was cool that they made the pig and how it worked was interesting to me.*  
*I liked how they showed how to make the big pig, because it was cool.*  
*How they made the pig. It was interesting.*  
*I liked watching them build the pig thing. And I liked watching them put it in the parade*
- 29% commented on the teamwork of the girls; e.g.,  
*I liked it because I feel like that video was about teamwork.*  
*I liked the way you showed teamwork because everything gets done faster.*  
*I liked it because I thought that it was good that they worked together and had fun.*  
*Because I think they did a good job working together even though they fought a little bit.*  
*I liked that they all worked together because you can always have different opinion and you may find a better idea.*  
*I liked that if they had a problem they solved it and that they used the supplies around them and that they used team work.*  
*How they solved when they started to fight about the eyes. It shows how to solve things*  
*I like that they work as a team to do projects.*  
*I like that the girls came together and made the float. Because doing stuff like that is difficult and I like that they made it. It seemed so easy because they made it seem easy.*  
*I loved how the team worked together because they split into 2 teams and finished it perfectly.*  
*I liked how they all worked together as a team.*  
*I like how they worked out their friendship. I also liked how the four girls had fun.*
- 13% liked Izzie's story inserted into the live action story; e.g.,  
*I liked how it showed a whole different show in the show.*  
*I liked 2 stories in the episode.*  
*That it's both cartoon and reality, so if I'm not sure which I want to watch, they are both in there.*  
*I liked how it had both cartoon and not cartoon because in other shows they don't have that,*  
*I liked the animated character, Izzy. I think she made the show a lot more exciting.*

*I thought the parts when Izzie came in and she tried some of the things that they were building because it infused her into the story more. To add on to that I thought the little parts where she came in and out were funny.*

*Like how Izzie popped up in the screen while the girls were working and how Izzie used what the girls were doing to help her situation.*

- 10% appreciated seeing real girls doing a real project; e.g.,

*I liked how they were real girls doing real things.*

*I like how they showed real girls.*

*I liked it because you can see real girls not cartoons. It was nice because you can have fun watching these episodes.*

*I liked that it was believable because usually shows seem like it wouldn't be possible.*

*I like that it was real situations instead of being kind of fake.*

*I liked the part when they showed stuff about the girls, because the girls had regular life and were fun to watch.*

- 10% noted learning more generally; e.g.,

*I liked it because maybe someday we will have to do that and that could give us an idea of what we could do.*

*I liked it because it was interesting.*

*It gave me lots of interesting facts.*

*I liked the video because it was interesting and I learned a little bit more about puppets.*

- 5% liked seeing all the puppets; e.g.,

*I liked all the interesting puppets in the video because they are all different.*

*I liked the puppets and different kinds of puppets and colors because it was interesting.*

## **What was not liked about the video**

Viewers also were asked what they did not like about the video. **More than one-third (37%) wrote that they liked everything about the video. The less appealing aspects noted by the fifth grade viewers concerned the girls' disagreeing with each other (17%); the animated story (16%); the puppet story (11%); and the web clips about the girls' interests and home life (10%).** Quotes below illustrate what was not liked about the video:

- 17% wrote that they did not enjoy the girls' disagreements; e.g.,

*I just didn't like how the girls treated each other. It seemed there were a lot of parts like that. They weren't nice sometimes or helpful to one another.*

*They kind of were fighting a lot in the video.*

*I thought that some of the bickering they showed was unnecessary, but some was fine.*

*I did not like how they argue. It was a waste of time.*

*The girls fought about things that weren't important.*

*How the girls were sometimes too dramatic. The arguing got annoying.*

*Also the girls argued quite a bit too much.*

*I didn't like that they fought sometimes because they're a team.*

*I did not like how they were fighting and they were yelling at one of the girls to fill up the bellows.*

- 16% commented on the animated story; e.g.,

*They should not have someone animated in a non animated show.*

*I didn't like that Izzie is a character because I think it would be better if she was real.*

*I didn't really care for when Izzie kept popping up. Because while I was watching she kind of interrupted.*

*I did not like the video because it would be better if the SciGirls talked to Izzie.*

*I didn't like that Izzie had to be tall to win, because that shouldn't matter.*

*I didn't like the beginning with Izzie and Jake because it was boring and not fun to watch.*

*How the boy was acting with Izzy. There was something there that was not great.*

*I did not like how the end ended because I thought the ending was confusing in different ways.*

*I did not like how there was so much not cartoon because you never learned much about Izzie*

*I didn't like that there wasn't much of the cartoon parts because they were funny.*

- 11% commented on the puppet story; e.g.,

*I didn't like how when they were talking about the eyes because I didn't understand it.*

*It would have helped more if they explained what the different things were in the blueprint.*

*One thing I didn't like about the video was that I didn't really understand the concept of the story. I also thought you could have learned more. They should make it more interesting and more exciting.*

*I did not like when they were going to put smoke out of its ears because it would of made it look mad.*

*I did not like the video because in the middle of the show they stopped because the Pig did not blow.*

*I didn't like the part when part of the puppet needed to be fixed at the parade because it shouldn't have broke on parade day*

- 10% did not like the webclips about the girls' interests and home life; e.g.,

*I didn't like when they showed the "card" about each girl because it took away from the show.*

*I did not like all the information about the kids because you should not tell the world about your social life.*

*When it showed stuff about the girls and they were like "this is my dog" or "I'm going to play the piano".*

*I did not like how when they showed videos of the girls. They each did something odd to me.*

*I did not like that they had clips from all people because they were very crazy. They should have answered specific questions.*

## Quantitative appeal ratings

After viewing the video, participants rated appeal of the video, as indicated in Table 1 below. **Eight out of ten girls liked the video and would watch another show in the series. A majority rated the story as interesting (68%) and the video as visually interesting (56%). On average, viewers felt that the story pace moved neither too fast nor too slow.**

Table 1. Mean Ratings of Video Qualities [ % choosing 4 or 5 on 1 to 5 scale]

	1	2	3	4	5	
Disliked the video				4.2 [81%]		Liked the video
Would <u>not</u> watch another show in <i>SciGirls</i> series				4.2 [81%]		Would watch another show in <i>SciGirls</i> series
Boring story				3.9 [68%]		Interesting story
Visually boring				3.7 [56%]		Visually interesting
Story moved too slow			3.0 [17%]			Story moved too fast

To obtain a clearer picture of the weaknesses of the video, each girl who circled a “1” or “2” rating was asked specifically in the post-viewing discussion to explain why they chose that rating.

- Only one girl chose a “1” or “2” for appeal of the whole video and her focus was on the relationships of the girls: *I just didn't like how the girls treated each other. It seemed there were a lot of parts like that. They weren't nice sometimes or helpful to one another.*
- Only one girl chose a “1” or “2” for intention to watch again and her interest was learning more about Izzie: *I just think it's sort of boring, like how it didn't show animated characters as much. It didn't show Izzie as much. It just said Izzie's name, but I wanted to know more about Izzie.*
- The few who rated the story low in appeal expected more Izzie; for example: *Parts were boring because they talked about the same thing over and over. In the middle I thought it was boring the pace was too slow. Include more Izzy but not just popping up. I thought the show was going to be more about Izzie and they kinda just basically talked about the making of the pig and I thought that was kinda boring. It was just like she was going to make a puppet, and it's not going to work, but then it worked out.*
- Only one girl chose a “1” or “2” for visual appeal and her complaint was a lack of action: *There wasn't much action to watch. There wasn't much to keep me watching like holding on to my chair!*
- Several rated the pace too slow; for example: *They spent too much time saying one person thought this. It kind of made it really slower, when they would stop things and have a person talking. Pace too slow too much talking but it did get faster. I think that the show went way too slow, it just took forever it went on and on about the same thing. I thought it was too slow. I'm just the type of person who likes shows fast, and it's my opinion that this was a little too slow. In one of the scenes, I saw that they sped it up, they do that in MythBusters, and that made it a little bit more interesting. I just don't like seeing all the details, every single detail.*

Viewers also rated how much they liked or did not like each of the video features listed in Table 2. **Viewers really liked that the girls worked together as a team (94%) and that the girls did a real-life project (89%). Three-quarters of the viewers enjoyed that the girls talked a lot about their ideas (75%) and that they worked with adult helpers (76%). About two-thirds liked that the video showed the *SciGirls* website within the show (63%) and that the girls told about their other interests and their lives at home (67%). Minority or interracial viewers were significantly more interested in learning about the onscreen girls’ other interests and their lives at home, with 87% liking this feature ‘somewhat’ or ‘a lot’ compared with 55% of the white participants. One-third (37%) liked that the girls sometimes disagreed with each other, but on average, the viewers felt this behavior was only “okay.”**

Table 2. Mean Ratings of Video Features [% choosing 4 or 5]

How much did you like or not like...	1 Did not like at all	2 Did not like much	3 It was okay	4 Liked some- what	5 Liked a lot
that the girls worked together as a team					4.5 [94%]
that the video showed a real-life project					4.5 [89%]
that the girls talked a lot about their ideas					4.2 [75%]
that the girls worked with adult helpers					4.0 [76%]
that the video showed the <i>SciGirls</i> website within the show					3.9 [63%]
that the girls told us about their other interests and their lives at home					3.7 [67%]
that the girls sometimes disagreed with each other					3.1 [37%]

Again, each girl who circled a “1” or “2” rating on the above list of features was asked specifically in the post-viewing discussion to explain why they chose that rating.

- Only one girl chose a “1” or “2” for girls working together and her focus was on the disagreements of the girls: *I just didn't like the parts where they disagreed.*
- Only one girl chose a “1” or “2” for showing a real-life project. She felt that *puppets don't seem like science.*
- Two girls did not like that the girls talked a lot about their ideas: *They can talk about their ideas, I just think they should not talk about their ideas so much. Short, sweet, make the point. They talked but they argued more and that got annoying.*
- A few viewers suggested that the show would be better if the girls did not work with adult helpers; for example:

*I think it would have been really cool if they did it themselves. Like at least just tried. I think that would be cooler.*  
*I kinda like that they helped but I think it would be more interesting if they figured it out by themselves, and I think that would make the show a bit better.*  
*Because if they didn't [use adults], it would be a little more creative cause they would be using their own ideas.*

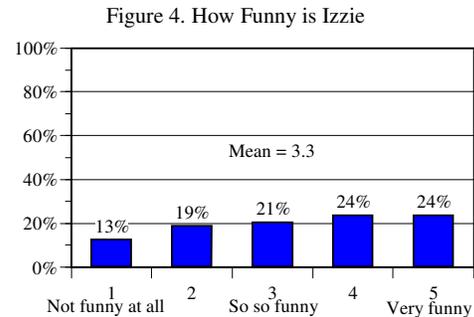
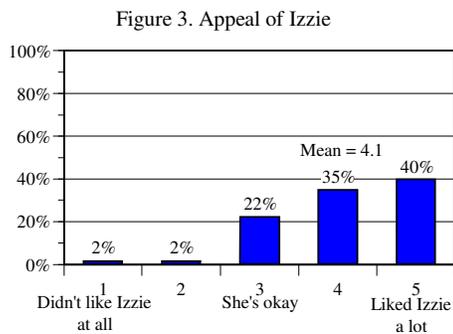
- Those few who did not like the SciGirls website within the show were not aware that the website was shown; for example:  
*I didn't really notice that, I don't think it would have made me want to go the way it was showed. It didn't do it like a commercial, to get you to want to go out and buy it you know!*  
*I didn't really see the website.*
- Almost one-quarter (22%) of the fifth grade viewers felt that presentation of the girls' other interests and their lives at home interrupted the show or was irrelevant to the main storyline; for example:  
*I think it was just like that took away from the story or the show; it just took away from it.*  
*It interrupted the program.*  
*I really didn't like that the girls talked about themselves so much, and it kind of interrupted the show.*  
*That drove me crazy. I didn't think that they needed to tell the world what they did. They could have just gone on with the show.*  
*It seemed like they just popped the home life stuff in, and it was sort of unrelated to the rest.*  
*I didn't really like when they told about their lives at home because it had nothing to do with the story. It did tell about what their lives were like and what they were doing, but it had nothing to do with the storyline. And it makes it go slower. [what should they change] They should make it shorter, just say like "I have a kitty" but not so much.*  
*I think they should change it and maybe they shouldn't talk about themselves but just about the project.*  
*It just seems like you shouldn't tell people about your personal stuff like when you're on email and stuff. Too much personal information when it was supposed to be about the project.*  
*Lives at home - I found it kind of boring. I don't think they should include it.*  
*I did not relate to the home life stuff.*
- One-quarter (25%) of the fifth grade viewers were either “annoyed” that the girls sometimes disagreed with each other or felt that the disagreements took up time in the show that could have been spent on other content; for example:  
*It got a little annoying listening to them, I don't think they had to argue so much, it wasn't necessary.*  
*That really annoyed me because it took forever and it didn't really do anything. It made me like the girl that was against the logical [Clara Sophia] less.*

*It was just kinda annoying they would be yelling at each other, and it was kinda confusing.*  
*I think that disagreeing is fine I just don't like it, it just bugs me basically.*  
*I just don't like the fighting they showed. It would be better without that.*  
*It's just when they disagreed that the process really seemed to slow down, and if they disagreed just a little, they could have showed more of the technical areas of the pig.*  
*That wasted time. It wasted like 3 whole minutes.*

## RESULTS: APPEAL OF IZZIE AND JAKE

### Izzie

Figure 3 below shows that **75% of the viewers liked the animated character Izzie**, and Figure 4 indicates that **48% thought Izzie was funny**. Ratings of liking Izzie were highly correlated with ratings about Izzie's humor ( $r = .61$ ); that is, those who thought Izzie was funny were more likely to rate her overall appeal higher.



**When describing what they liked about Izzie in response to an open-ended survey question, viewers wrote mostly about liking her personality, as follows:**

- 38% noted that Izzie was funny or fun.
- 16% liked Izzie's confident attitude; e.g.,  
*Very determined.*  
*Confident about herself.*  
*Never gave up although she was short.*  
*Tried winning even though her brother called her short.*  
*Very serious about being elected.*  
*Not afraid of asking questions.*
- 16% described Izzie as *nice* and/or *cheerful*.
- 14% liked that Izzie was helped by the SciGirls; e.g.,  
*She needed help from the Scigirls in the show.*  
*She copied them.*

*How she would watch the girls to get an idea.  
She went on scigirls.com to see if there was anything she could do.  
That she has problems and the SciGirls helped.*

- 6% described Izzie as *creative* and/or *smart*.

**More than half (56%) of the viewers could think of nothing that they did not like about Izzie. The weaknesses of the animated character were few and varied, as follows:**

- 10% commented on Izzie’s on-screen actions; e.g.,  
*I didn’t like how she interrupted while the girls were speaking. It kind of got me distracted.  
How she should be talking and the other girls would be talking too. It was confusing.  
That she popped up on the screen. They should have had full screen talks.  
That she’s small when the scigirls are on. It should be like she is actually there with them.  
That she pretended to talk to the girls.*
- 8% did not like that Izzie thought she had to be tall to win the class presidency.
- 6% disliked that Izzie was clumsy; e.g.,  
*I think that at the end when she fell they tried to make her look funny but it made her look dumb.  
She acted kinda out of place and clumsy.*
- 6% felt Izzie tried to be funny but was not funny; e.g.,  
*Her humor wasn't funny to me. It was like she tried too hard, and it wasn't natural. I think they could make her funny by having it be less forced, like she doesn't have to try so hard.  
Izzy was not very funny. She thought she was really really funny but she wasn't really that funny.*
- 6% did not like Izzie’s voice; e.g., *Talked too fast; She had a squeaky voice; She talked like she was younger.*

Figure 5 below shows that **most (70%) of the fifth grade viewers felt that Izzie is about their own age**. Figure 6 indicates that **almost half (48%) of the viewers wanted to see more of Izzie**.

Figure 5. How Old is Izzie

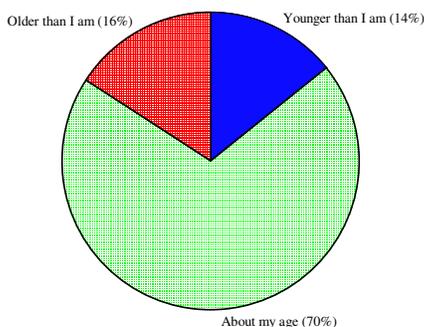
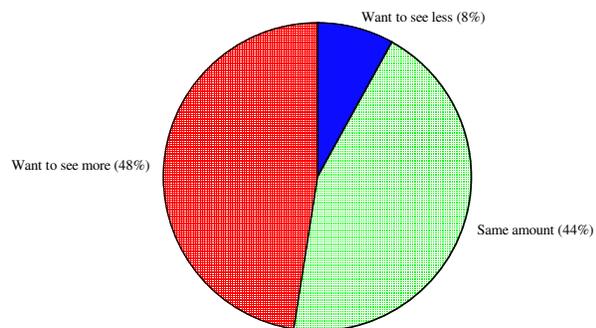


Figure 6. See More or Less of Izzie

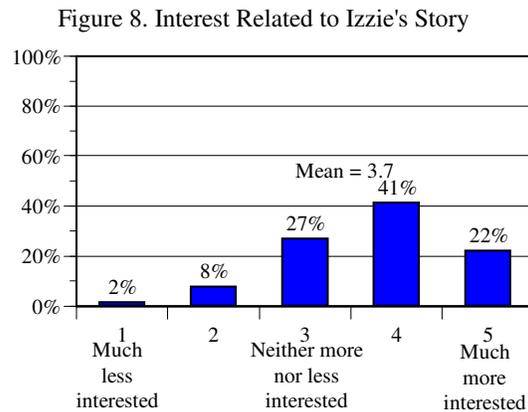
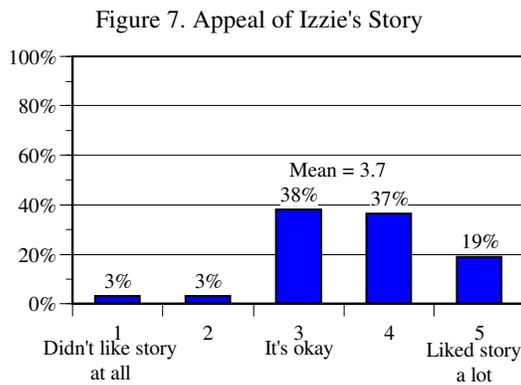


Viewers were also asked what Izzie learned from the SciGirls. **Most viewers said that what Izzie learned from the SciGirls was how to make a big puppet:**

- 57% said Izzie's learned how to make a big puppet; e.g.,  
*How to build a big puppet.*  
*She learned that she could build a puppet.*  
*How to make big puppets.*
- 11% took their answers one step further to suggest that Izzie learned how to make a puppet to make herself taller; e.g.,  
*How to make herself taller.*  
*How to engineer a puppet so she would appear taller.*  
*How to make herself taller by using a puppet.*
- 13% described various life lessons learned by Izzie; e.g.,  
*Izzie learned that it doesn't matter what anybody else thinks about what you do, it matters what you think.*  
*That if you work hard, you can make whatever you are doing great.*  
*Izzie learned that if she tries her hardest, she can achieve and learn a lot more.*  
*Izzie learned that she can do things by herself.*  
*Izzie learned that you can do some things to make a difference.*  
*Izzie learned that there are always different ideas out there.*
- 10% said they did not know what Izzie learned from the SciGirls.
- 8% noted that Izzie learned about teamwork, e.g.,  
*That it is hard to work as a team.*  
*That she can use teamwork.*
- 6% thought that Izzie learned that tallness doesn't matter, e.g.,  
*That it doesn't matter how tall you are.*  
*Being tall doesn't make you a winner.*

Figure 7 below indicates that **56% of the viewers liked Izzie’s story of running for class president**. The few (6%) who rated the appeal of Izzie’s story quite low (chose a “1” or “2”) felt confused about the lack of clear connection between Izzie’s story and the SciGirls’ story. Appeal of Izzie’s story was correlated with ratings of Izzie’s humor ( $r_s = .58$ ), meaning that liking Izzie’s story went along with the feeling that Izzie was funny.

Figure 8 shows that **63% of viewers felt that Izzie’s story made them more interested in watching the show**. The few (10%) who said that Izzie’s story made them less interested in watching the show thought that Izzie’s story was boring.



## Jake

Viewers were asked what they thought of Izzie’s friend Jake. **Those who liked Jake (43%) thought he was funny; another 13% thought Jake was funny but had reservations about his actions with respect to Izzie; 13% described Jake simply as okay; and 32% did not like the way he treated Izzie.**

- 43% were positive about Jake, most often describing him as *funny* but also *cool*. Some (10%) suggested expanding his role in the show.
- 13% voiced reservations about Jake, describing him as *funny but...*
  - ...he could be a little more supportive.
  - ...he was pretty mean.
  - ...he should be nicer.
  - ...he gives weird advice.
  - ...he should listen to Izzy more.
  - ...they did not have a good friendship. The conversations between them were offensive.
- 13% felt that Jake was okay.
- 32% did not like Jake, describing him as *rude, mean, a bully, not supportive, not helpful, not funny*.

## RESULTS: LEARNING

### Most interesting things learned from video

Viewers were asked to describe the most interesting things they learned from watching the video. **Viewers reported learning about how to make a puppet (30%), learning some of the details of the pig puppet's mechanicals (29%), and learning something about teamwork (21%):**

- 30% reported simply that they learned how to make a puppet.
- 29% described some more details of how to make a puppet; e.g.,  
*The most interesting part I learned from watching the show was how the smoke came out of the pig's nose. I also liked how they experimented with it, realizing that they did not have enough pressure to make it go up to the ears.*  
*How you can make smoke come out of a tube and make blinking eyes.*  
*The most interesting thing that I learned about were pulleys and level. I did not know about them before.*  
*How you can make a puppet blink with a metal colander. That you can carry a parade puppet with metal "backpacks."*
- 21% felt they learned about teamwork; e.g.,  
*That team work does count a lot especially when making something in front of a large group of people.*  
*That you can work together and be able to do small things.*  
*That if you team up, you could really make something like that work.*  
*Work together and solve things.*
- 8% learned what materials can make a puppet; e.g.,  
*What kinds of things you can make from scraps and how good they look when it's done.*  
*How to make puppets by finding different parts to make it.*  
*That you can use lots of odd materials to make puppets.*

## Quantitative ratings of clarity and learning

After viewing the video, participants rated clarity of the video and their learning as indicated in Table 3 below. **A majority thought the video was clear (83%) and felt that they learned from it (60%).**

Table 3. Mean Ratings of Video Qualities [% choosing 4 or 5]

	1	2	3	4	5
Confusing				4.3 [83%]	Clear
Learned nothing				3.8 [60%]	Learned a lot

## Confusions about engineering the pig puppet

In the discussion, viewers looked at photos from parts of the show where the SciGirls were engineering the pig puppet and asked to explain any confusions they had about what was happening in those parts of the show.

- A small portion (11%) of the sample expressed some confusion about the engineering of the eyes, as illustrated below:



*I was confused about the eyes, when they were doing that thing with the eyes, starting it, because I didn't know what they were doing at first.*

*I didn't really understand when they were trying to put the eyes together.*

*I didn't really know what the girls were arguing about because the girls had already settled on the prototype to do.*

*They could say what they made the eyes out of, the materials they used.*

*I didn't understand which one of the eye choices they used. They showed a couple different choices, and then I wasn't sure which one, or what happened.*

*Yes, this was confusing because they were speaking over each other, and they didn't really show how they resolved it.*

*The girls argued a lot so it was hard to follow what was being made.*



- A small portion (14%) of the sample expressed some confusion about the engineering of the body, as illustrated below:



*I think the body was just kind of fast, they didn't explain it, but they said that they did it.*

*They skipped parts and didn't show, for example, replacing the cardboard with wire. That was pretty important.*

*I don't remember them making the body. I don't remember when they put this kind of metal on this.*

*I didn't understand how they made the body more rounded. Did they just put wire around it?*

*I think this one was because why would they wrap it around. I can understand the wire but why would they use the strips?*

*I was a little confused when they were building the body, because like the way they tied it and everything, it looked kind of complicated and so it was a little complicated when they did it. Like during the steps like for the body, they could explain everything they were making and doing and writing little facts about it.*

*I couldn't really tell what parts were what when they were building the body.*

*I didn't really see how they got the material for the body and how they put it together. It went too fast I think.*

*On the body when they got like the bicycle tire strip thingy I was wondering how they got those off of a bike tire.*

- One-quarter (25%) of viewers were confused about the “smoke” from the pig nose, as illustrated below:



*I didn't know what that thing was [points to bellows]*

*How did they blow the smoke during the parade? Did they just use those up and down things[bellows]?*

*Just explain how you have to use it and what they used to do it. I think I probably have seen one of these, it's sort of like sometimes perfume bottles they have this little thing, it's probably just gianter and probably they use some kind of gas and they put it in.*

*How did they fill up the bellows? I didn't get what they were putting into it.*

*What was the powder? I didn't get what that was and how they put it in there, it went too fast.*

*That was powder? I thought it was smoke.*

*I thought it was smoke, too.*

*Cause it's not completely clear like when they were trying to fill up the tubes you didn't know what they were filling it up with*

*The nose smoke part was confusing because I couldn't tell what they were putting in the tubes. It didn't tell how they made the smoke and stuff.*

*I was confused about the nose. That when they were trying to figure out how the powder came out of the nose.*

*I liked the smoke but I didn't really get how they did it. The smoke was a little confusing.*

*The smoke was confusing.*

*I didn't get why they fought about the eyes and the nose smoke during the parade.*

*I was confused about what happened in the middle of the parade.*

*It was a little hard to tell how the smoke thing worked. I saw it coming out but I didn't really see what they did to put it together.*

*I don't get how they made the smoke. That would be fun to try though.*

- A small portion (13%) of viewers were confused about the pig's tail, as illustrated below:



*I just was confused about how the tail worked. This part went kind of fast but some of the other stuff whizzed by too. Maybe they showed too much of Izzie, so they didn't have time to show all that other stuff.*

*The tail was kind of unexplained.*

*Yes, they never showed the girls making the tail.*

*I don't think they ever showed how they made the tail. I remember them testing it out, and they said it twisted around.*

*I was trying to figure out what the tail was made of.*

*I guess I was confused about the tail. I didn't understand like how you like turn it to make the tail go, because I thought the tail was too far away from the handle.*

*The tail part didn't really show how they got it to turn and how they made it.*

*Maybe they could have a camera inside and outside while they are showing the tail, so it would be easier to tell what they were doing while they were making it.*

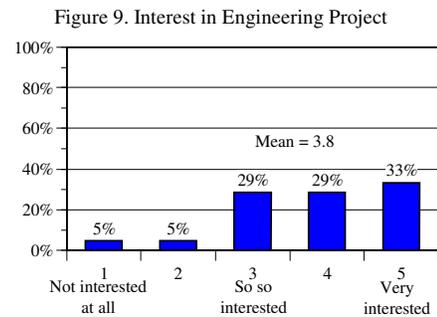
## **Ability to build a project**

**Three-quarters of the viewers (76%) agreed that they could build a project like the girls in the show did.** In discussing why they thought they could build a project, 44% said that they would need the help of a team of friends; 33% pointed out that the video modeled the steps to make a puppet; 32% suggested that they could get access to supplies and materials as the girls did; 14% suggested that they would need adult help; and 8% noted that planning or prototyping was a good idea.

The one-quarter (24%) of the sample who believed that they could not build a project, felt that they had no ideas (10%), that it would be too hard (8%) or too time-consuming (8%).

## Interest in doing an engineering project

**Two-thirds (62%) of the fifth-grade girls expressed an interest in doing an engineering project like this with their friends** (see Fig. 9). The few respondents who chose a “1” or “2” felt that a project would be *too hard, take a lot of time* or they were *not interested in engineering*.



## DISCUSSION

Small groups of 63 girls entering fifth grade viewed, rated and commented on a rough cut of a program from the *SciGirls* series.

Eight out of ten girls liked the video and would watch another show in the series. A majority rated the story as interesting and the video as visually appealing.

The main story of the video is the engineering of a parade-size pig puppet with moving parts, and viewers pointed to this aspect of the video as what they liked the most. Nine out of ten girls liked that the video showed a real-life project. This result reflects *SciGirls*' front-end findings in the STEM research literature that “girls look for compelling real-life contexts for science.”<sup>2</sup> When asked what they learned from the video, most viewers reported learning about how to make a puppet and learning some of the details of the pig puppet’s mechanicals. However, one-quarter of the sample voiced confusion about how the “smoke” from the pig’s nose worked. Viewers were unfamiliar with bellows, did not understand that powder was used to simulate smoke and did not grasp the mechanism by which the “smoke” was produced. Despite this lack of clarity, three-quarters of the sample agreed that they could build a project like the girls in the video did, with the help of a team of friends and modeling the steps in the video. Two-thirds of the viewers expressed interest in doing an engineering project. The viewers identified with the onscreen girls, recognized that construction of the pig puppet was “doable,” and as a result felt interested, comfortable and confident in their own ability to implement the same sort of project. As one viewer summarized: *I think we can do it, if they can. They are our own age. It was all things that were pretty easy to do, and materials that are pretty easy to get.*

Another component of the engineering story was the teamwork among the onscreen girls. Seeing the process of the girls’ teamwork was pointed out as a most appealing aspect of the video, again reflecting conclusions from the STEM research literature that “girls prefer to experience science in group settings” and “girls benefit from extended

<sup>2</sup> Twin Cities Public Television (2007). *SciGirls: A New Science TV Series for Girls*. National Science Foundation Proposal.

communication and collaboration.”<sup>22</sup> All but a few of our viewers liked that the girls worked together as a team, and three-quarters liked that the girls talked a lot about their ideas. These results again demonstrate what the *SciGirls* staff has learned from STEM research literature that “girls value different ways of knowing, seeing and describing the world, and like to discuss these diverse visions with their peers.”<sup>2</sup> However, one-quarter of viewers did not like to hear disagreements among the team and were either annoyed by the disagreements or felt that such discussion interrupted the flow of the puppet making content.

Interstitials in the video showed website presentations of the SciGirls’ other interests and their lives at home. Two-thirds of the fifth grade viewers liked these segments and liked hearing about the SciGirls’ background. Minority viewers in particular enjoyed learning about the lives of the onscreen girls who represented a diversity of ethnic groups. A quarter of viewers felt that these webclip presentations interrupted the show or were irrelevant to the main storyline.

The parallel animated story in the video involves Izzie’s effort, at her friend Jake’s instigation, to make herself taller and more competitive in her class president’s race. Three-quarters of viewers liked the animated character of Izzie. Viewers liked her personality; half thought she was funny, and others described her as confident, nice, or cheerful. Most viewers thought Izzie was about their age, and almost half wanted to see more of Izzie. Despite Izzie’s appeal as a character, her story was rated appealing by fewer viewers (56%), and fewer (63%) felt that her story made them more interested in watching the show. Those who did not find Izzie’s story appealing did not see connections between the two stories, or felt that Izzie interrupted the more appealing main story about puppet making, or disliked the idea that one had to be tall to be successful.

The fifth grade viewers were of two minds about how to react to Jake – he was either *funny* or he was *mean* -- because of his distracted attention and his remarks about Izzie’s campaign chances and results of her puppet-making. By introducing Jake into Izzie’s story, the series takes on the added responsibility of communicating messages about gender relationships. Beyond being a mechanism to connect weekly shows, the Izzie/Jake storyline will also be conveying social messages that need to be considered for their audience impact.

In conclusion, the rough cut video overall is competitive with other popular PBS shows, as eight of ten girl viewers expressed interest in seeing more shows. The research-based strategies for attracting ‘tween girls to science and engineering topics were successfully implemented in the video, and the audience responded positively to them as planned. The animated storyline of Izzie and Jake was accepted by viewers; nevertheless, viewer reactions suggest further definition of the role of the animated story and more thought about the duo’s relationship in both attracting and educating the tween audience.