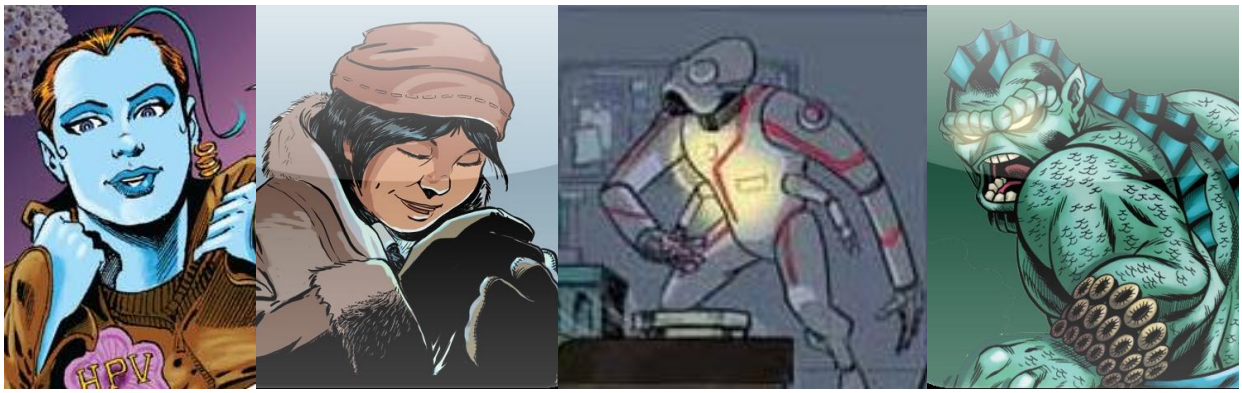
High School Student Insights into the World of Viruses Graphic Stories Qualitative Follow-up Report



June2012

by
Michelle Howell Smith, Ph.D.
Office of Qualitative and Mixed Methods Research

with:
Amy Spiegel, Ph.D., Center for Instructional Innovation
Julia McQuillan, Ph.D., Bureau of Sociological Research
Vicki Plano Clark, Ph.D., Office of Qualitative and Mixed Methods Research

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
Supported by the National Center for Research Resources, a part of the National Institutes of Health

University of Nebraska Lincoln

World of Viruses is funded by the National Center for Research Resources at the National Institutes of Health through the Science Education Partnership Award (SEPA) Grant No. R25 RR024267---01 (2007---2012). Its content is solely the responsibility of the authors and does not necessarily represent the official views of NCRR or NIH.

High School Student Insights into the World of Viruses Graphic Stories
Qualitative Follow-up Report

Executive Summary

Purpose:

The evaluation of the World of Viruses graphic stories presented an opportunity to further explore the findings from the quantitative study. The purpose of this qualitative study is to provide a richer and deeper understanding of how high school students perceive the impacts of the World of Viruses graphic stories. The broad research question was: What insights can be gained from interviews with high school students regarding the impacts of the World of Viruses graphic stories?

Methods:

Semi-structured individual interviews and focus groups with 16 high school students explored the students' reactions to elements of the graphic story in greater detail. Interviews were recorded and transcribed verbatim. Qualitative analysis was conducted using a general thematic coding approach.

Key Findings:

The participants in this study:

1. *Engaged* with the action of the graphic story and enjoyed the storyline and artwork
2. *Connected* with the characters in the graphic story
3. *Learned* something new from the graphic story, although they expected the information to be more direct
4. *Wanted more information* about viruses incorporated into the graphic story to "bring up the level," although they found that some of the information presented was "over (their) heads"
5. *Enjoyed reading* the graphic story, but felt the format (i.e. comic book) was more appropriate for junior high students
6. *Expressed interest* in reading additional World of Viruses graphic stories, but indicated that the materials did not increase their interest in science
7. *Articulated alternative interpretations* of the "viruses are cool" scale items that contributed to understanding the quantitative results

Implications:

The implications of these key findings include:

- Science-themed graphic stories are able to engage high school students and influence them to read more when the story and artwork are perceived as good quality.
- Science-themed graphic stories do not appear likely to change high school students' long held beliefs or attitudes about science, or their identification with science, but high school students suggest the materials may have an impact among junior high students.
- The marketing of science-themed graphic stories to high school students should reflect the sophistication of the materials given the teens' perception that "comics" in general are more appropriate for junior high students.

High School Student Insights into the World of Viruses Graphic Stories
Qualitative Follow-up Report

Full Report

The World of Viruses project was funded by the National Institutes of Health through a Science Educational Partnership Award (SEPA) (Diamond, 2007). The project created an array of materials geared at educating the public, and in particular, youth about viruses and infectious diseases. One component of the World of Viruses project was the development of five graphic stories each with a specific virus-related story. The graphic stories were developed by experienced, professional graphic novel writers and artists to adhere to the conventions of the graphic story format and were carefully reviewed by scientists to ensure accurate information about viruses. The graphic stories range from 10 – 20 pages in length and feature "edgy" virus-driven plot lines, dark and foreboding artwork, characters of diverse races and both genders, and scientifically accurate illustrations of viruses (Diamond, 2012).

The primary research team conducted a pilot and a larger-scale quantitative evaluation study during 2011 to measure the impact of the virus-themed comic books among high school students (Spiegel, 2011). The preliminary evaluation of these data, which sought to measure the impact of reading a virus-themed comic book on high school students' knowledge about viruses and attitudes about people who work with viruses, identified some additional research questions that were appropriate for qualitative exploration. First, in the quantitative evaluation, researchers had expected to see an increase in the participants' interest in science. When the results of the study did not indicate an increased interest in science, the researchers wanted to understand better why that was the case. Second, the pilot data suggested that some subgroups (based on ethnicity and gender) were responding differently to the attitude scales and the researchers wanted more insight into why those differences might be occurring. Finally, the participant responses to the items in the "viruses are cool" scale were relatively flat and did not correlate as expected with other items. It was not clear what the "viruses are cool" scale items were measuring and the researchers wanted to understand how high school students might be interpreting them. The primary research team asked the Office of Qualitative and Mixed Methods Research at the University of Nebraska-Lincoln to conduct a qualitative explanatory study to address these new research questions. This report summarizes the qualitative explanatory study.

Purpose Statement and Research Questions

The evaluation of the World of Viruses graphic stories presented an opportunity to further explore the findings from the quantitative study. The purpose of this qualitative study is to provide a richer and deeper understanding of how high school students perceive the impacts of the World of Viruses graphic stories. Semi-structured interviews and focus groups explored the students' reactions to the elements of the graphic stories in greater detail with the intent of providing a deeper understanding of the quantitative results.

The broad research question guiding this qualitative study was: What insights can be gained from interviews with high school students regarding the impacts of the World of Viruses graphic stories?

The specific research sub-questions included:

1. What is the appeal of the World of Viruses materials to high school students?
2. How do high school students perceive the World of Viruses materials?
3. How do high school students perceive the characters in the World of Viruses materials?
4. How do high school students interpret the information presented in the World of Viruses materials?
5. How do high school students interpret the items in the "viruses are cool" scale from the quantitative study?

Methods

This report presents the qualitative phase of a larger mixed methods evaluation of the World of Viruses project. The analysis of the quantitative data was not able to fully capture the impact of the graphic stories among the high school students who took part in the study. A qualitative explanatory phase was added to the evaluation study in order to provide a greater depth of understanding and to explore specific results that were not clearly interpretable based on the quantitative data alone. Mixed methods studies provide a deeper understanding of a phenomenon by not only collecting and analyzing both qualitative and quantitative data, but also integrating or linking the data in some way (Creswell & Plano Clark, 2011). Studies where an initial phase of quantitative data collection and analysis is followed by a qualitative phase of data collection and analysis for the purposes of illuminating or further explaining the quantitative results are categorized as mixed methods sequential explanatory research designs (Creswell & Plano Clark, 2011). A qualitative follow-up is particularly appropriate for evaluation studies when the initial quantitative evaluation measures raise new questions about the mechanisms behind the quantitative results.

Qualitative research methods are commonly used when the research question are geared to understanding how participants experience a particular phenomenon (Merriam, 2009). Denzin and Lincoln (2005) provide the following definition of qualitative research:

> Qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. (p.3)

Qualitative research is also characterized by focusing on broad "how" or "what" questions as related to a relatively small numbers of cases (Creswell, 2013).

Site Description

The qualitative follow-up study was conducted in spring 2012 at an after-school program in the same mid-sized Midwestern city as the quantitative evaluation study. The afterschool program is open to junior high and high school students from anywhere in the city, although the majority of regular participants attend schools within walking distance of the site. The program tends to attract students from diverse racial backgrounds and lower-income families. The program activities include a study lounge, computer lab, tutoring, rec room, gymnasium, snacks and meals, and mentoring activities.

Participant Recruitment and Informed Consent

The University of Nebraska-Lincoln's Institutional Review Board approved this study prior to participant recruitment and data collection. The program director at the site identified 24 students as potential participants in the study. In order to be eligible, students had to be in high school and be a regular participant in the after school program. All eligible students were given a recruitment flyer (see Appendix A) about the study which directed them to request a parental notification letter (see Appendix B) from the program director. All 24 students requested the parental notification letter. The parental notification letter was sent home with each student and the parent had 5 days to return the form if they did not want their child to participate in the study. None of the forms were returned. Students were selected to participate in the study based on their interest and availability. A total of 16 students ultimately participated in the study. Participants varied by grade (3 freshmen, 3 sophomores, 4 juniors, 5 seniors, and 1 unknown), gender (6 female and 10 male), and race and ethnicity (11 African American, 3 Caucasian, 2 Hispanic). See Appendix C for a summary of participant characteristics and assigned pseudonyms. Each participant was provided a copy of the student assent form (see Appendix D) which was reviewed verbally. All participants provided verbal assent.

Data Collection

Qualitative, semi-structured interviews are an appropriate data collection technique when the goal is to understand participants' experiences, especially when the interviews provide context to quantitative findings and supplement a more comprehensive view of a phenomenon (Boyce & Neale, 2006). Michelle Howell Smith from the Office of Qualitative and Mixed Methods Research at the University of Nebraska-Lincoln collected data through semi-structured interviews with individuals ($n = 2$) and focus groups ($n = 4$) with high school students who regularly participated in an after-school program in March, 2012. Pizza was provided to the participants during the study to facilitate a casual environment and stimulate conversation.

The four graphic stories that were used in the quantitative studies were also used for this study. The stories included:

- The Frozen Horror (Powell & Floyd, 2012): Influenza Virus (FLU)
- Confined! (Powell & Floyd, 2012): Foot and Mouth Disease Virus (FMD)
- Phantom Planet (Powell, Angeletti, Angeletti, & Floyd, 2012): Human Immunodeficiency Virus (HIV)
- Curse of the Tree-man (Powell, Floyd, Rubinstein, & Beachler, 2012): Human Papillomavirus (HPV)

The focus groups and individual interviews typically lasted between 40 – 45 minutes, with the exception of the final focus group which lasted 60 minutes. The additional time can be attributed to the larger group size and additional questions as described in the interview protocol section below. This time includes all preliminary activities, such as introductions, eating pizza, and reading the graphic stories, which lasted approximately 15 – 20 minutes. The entire session was digitally recorded for later transcription.

Field notes were written at the conclusion of each interview to summarize key points from the discussion and to reflect on the data collection process. These notes were then reviewed with the primary research team at two different times during the data collection process and

adjustments were made to the interview protocol based on these de-briefing sessions. Preliminary findings were drafted based on the field notes (see Appendix G) and presented to the primary research team prior to data analysis to determine whether themes had sufficient data to support them, or if additional data collection was needed.

Interview Protocol

The initial protocol was developed with input from the larger research team. An informal pilot of the initial interview protocol with a convenience sample of three high school students helped to organize the questions around more general topics and provide a more logical flow of the conversation. The pilot also provided feedback on question wording to make sure items were phrased in a way that would be easily understood by participants. The final interview protocol is included in Appendix E.

Round I interview protocol. Round I of the interview protocol included the first two focus groups. The FMD and FLU graphic stories were each used with one focus group. The focus groups started with the participants reading the selected graphic story without much introduction. Once the participants had finished reading, the conversation began with talking about the story in general, characters, and artwork. Then participants were asked about the appeal of the graphic stories as compared to a science textbook. They were then asked to describe who they thought would enjoy graphic stories like the one they read. Next was a series of questions regarding the participants' virus knowledge and what they learned from reading the graphic story. A discussion about the participants' perceptions of scientists followed. The interview ended with asking the participants about their personal interest in science followed by an opportunity for them to make recommendations to the creators of the graphic stories. The comments from these two groups seemed to focus on the scientific content of the graphic stories, with the general consensus that the information was not at a high school level.

Round II interview protocol. Consistent with the emergent nature of qualitative data collection, the interview protocol was adjusted in response to previous data collection. While debriefing the Round I interviews with the research team, it was decided that the question asking participants to compare the graphic story to a text book set up an expectation that the graphic story would be used in the same way as a text book. Since the graphic stories were intended to serve as supplemental materials in an informal environment, the decision was made to eliminate that question from future interviews. The questions regarding the participants' interest in science and experience in reading comic books were moved to the beginning of the interview, before reading the graphic story, to serve as an icebreaker and set the context for the interview. Round II of the interview protocol was used with two individual interviews and one focus group. The individual interviews read the HPV graphic story and the focus group read the FLU graphic story.

Round III interview protocol. During the second de-briefing session, the primary research team decided to add specific questions regarding items from the quantitative evaluation study (i.e. the "viruses are cool" scale) that had puzzling quantitative results. Round III of the interview protocol was used with the final focus group, during which participants read the HIV graphic story.

Data Analysis

The purpose of qualitative data analysis is to reduce the volume of data and interpret it into relevant themes (Creswell, 2013). Prior to the analysis process, the digital recordings of the interviews were transcribed verbatim, excluding any personally identifiable information, by the staff of the Bureau of Sociological Research at the University of Nebraska-Lincoln. All transcripts were imported into MAXQDA, a qualitative data analysis software, for coding and analysis. Due to the explanatory nature of this qualitative study, an initial code list was developed based on the interview protocol and research questions. This preliminary code list was used to code the first two focus group transcripts. After the initial coding, the code list was revised, grouping the codes into thematic elements and sub-themes. The remaining four transcripts were then coded using the thematic code list, shown in Table 1. The theme of "paradoxes and contradictions" emerged during the coding process, and a final coding sequence identified data that was germane to that theme.

Peer debriefings and rich descriptions were used as validation strategies to ensure the data analysis was accurately reflecting the participants' experiences (Creswell, 2007; Creswell & Miller, 2000). Throughout data collection and analysis, the lead researcher of the qualitative phase of the study met frequently with the evaluation team of the larger study. These debriefing sessions provided an opportunity to further explore initial insights, challenge interpretations, and provide direction for the next steps of the project. This allowed for the interview protocols and data analysis to be emergent and responsive to the participants' experiences and the needs of the project. The report of the findings provides detailed descriptions of the participants' experiences as an opportunity for the reader to evaluate the analysis presented for him or herself.

Table 1: Thematic Code List

Nature of Curiosity: In order to provide a context for understanding the participants' comments, each participant shared their prior interest in comics and several participants disclosed their interest in reading in general. Participants also shared their interest in science, often by describing themselves as a "science person" or "not a science person."
Sub-Themes:
- Interest in Comics
- Interest in Science

The Graphic Story: The participants responded positively to the story and the pictures of the World of Viruses graphic stories. These elements were interesting and engaging to the participants.
Sub-Themes:
- Story/Narrative/Plot
- Setting/Location
- Artwork

Characters: The participants shared their opinions of the characters (both positively and negatively) during the interviews. Although none of the participants explicitly identified with a particular character based on gender or race or ethnicity, they did make reference to these characteristics.
Sub-Themes:
- Gender
- Race/Ethnicity
- Scientists
- Virus Characters

Appeal of the Comic: The participants shared strong opinions about who they thought the World of Viruses graphic stories would appeal to (junior high students and students who like science) as well as the rationale for their opinion (comic books are for kids and the science is not at a high school level). They also shared how their friends would likely respond to the materials and made comparisons with traditional classroom-based science education materials.
Sub-Themes:
- Friends' Opinions
- General Opinions
- Comparisons to Textbooks/Class

Virus Knowledge: Although not a primary focus of this study, participants shared a bit of their prior knowledge about viruses, what they learned about viruses from the World of Viruses graphic stories, and their perceived importance of viruses as a public health issue.

Paradoxes and Contradictions: An unanticipated theme that emerged from the interviews was contradictions between what the participants said when asked a direct question, and what they said in a different often indirect context. The tension between these contradictions provides insight into the participants' cognitive and identity development that may be influencing their responses to direct measures.
Sub-Themes:
- Paradox 1: The materials are geared to junior high students, but I liked them.
- Paradox 2: The materials need more scientific information, but I learned something from them.
- Paradox 3: The materials did not change my interest in science, but I want to read/learn more.

"Viruses are Cool" Scale: The final focus group protocol included questions about the "Viruses are Cool" scale from the quantitative study. The entire conversation about the scale items was coded here and revealed the diverse and literal ways the participants interpreted the items.

Results

The results from the qualitative data analysis are presented in order of increasing importance in answering the broad research question: What insights can be gained from interviews with high school students regarding the impacts of the World of Viruses graphic stories? The themes include the nature of curiosity, the graphic story, characters, appeal of the comic, viruses knowledge, paradoxes and contradictions, and "viruses are cool" scale. When possible, quotes are identified by the participant pseudonym.

Nature of Curiosity

In order to understand the context of the participants' comments, we first explored the nature of their curiosity and their interest in two domains relevant to this study: comics and science. Of the 16 participants, only one of them, Andre, was currently reading comic books and graphic novels. In particular, he enjoyed magna produced by Naruto and Bleach. Andre noted "Bleach is my favorite." However, many of the other male participants had read comics when they were "younger," giving them up sometime during junior high school. Only a few of the female participants had read comic books prior to the study, usually borrowed from a brother who was into them. For participants who had prior experience with comics and graphic novels, they were able to more easily follow the stories than their non-comic reading peers. Perhaps a more significant context for understanding the participants' comments was their lack of identity as a reader, regardless of genre or medium. Not only did many participants indicate that they do not read, but that most of their friends do not read either. Hector was very clear, "I don't like to read. I don't like to read a lot so…I don't read books at all." Sapphire shared "my friends really don't read." Hector reinforced Sapphire's comment by noting, "I guess you could say—most of the teenagers don't read." There were a few participants who did like to read, but were not interested in the graphic stories, such as Sapphire who shared "Well, I wouldn't read books like this, because I like more like books that talk about like romance and stuff."

The participants were fairly evenly split in regards to their interest in science. Approximately one-third of them did not like science. Javan noted, "there's just something about science and all the numbers and I don't like it that much. Science. I just really don't like it." Malika was bored by science and shared "I think about cells and with the, just learning about the different types of cells and what they do and then we have to draw the cells. I think that was kind of boring." Science ability is not always directly correlated with science interest, as described by Javan: "In school I'm good at science but I don't like it."

Another third of the participants had a mild interest in science, liked certain kinds of science, or used to like science. Hector explained, "I don't really like science. I mean—I guess—I wouldn't say I don't like it, I just don't—it's not one of my strong areas. It's not one of my strong suits." The type of science also made a difference in the level of interest for some of the participants. Malika observed, "When I think of scientists I think of like the CSI scientists, like looking at samples of blood and everything… all the science part, like crimes and everything. But like regular scientists seems kind of boring just sitting there looking, like with a microscope at bacteria, that seems sort of boring." Participants seemed particularly drawn to hands-on science activities like Sapphire who said, "I like it when teachers give you hands-on work, 'cause I really don't like working in the book." Unfortunately, some participants had a negative experience with a science class and were no longer interested in science. Orlando expressed an

interest in becoming a scientist, but changed his mind after taking a science class his freshman year. “I said nope. The class was too hard and I didn’t know anything about it.” Spike shared, “I always kind of liked science. I thought it was interesting. But then my teacher last year… oh my gosh. I hated him so much. I don’t like it (science) anymore because he’s a mean person.”

The remaining third of the participants had very positive views about science. Spike noted “I think it’s interesting. It’s so cool. I like it.” Andre also shared “I love science…. I just like it because you do like science experiments and stuff.” Brian had the opportunity to look at the influenza virus in a science class and that inspired an interest in virology. “I think it would be like cool to study them [viruses]. They’re unique, I think.” Enjoying science does not necessarily translate into interest in becoming a scientist. Andre shared, “I love science class. I really do. But it’s not something I would like to do.”

Regardless of whether the participants liked science or did not like science, they had a clear perception of themselves as a “science person” or not a “science person,” which is a way to characterize their level of identification with science.

The Graphic Story

The World of Viruses graphic stories were all positively received by the participants in the qualitative evaluation project. Participants were particularly attracted to the storyline. They felt the story was the primary feature of the book, not the science. Hector pointed out, “it’s more of a story than it is info.” The story helped the participants “stay focused" by engaging them in the action. They like the twists and turns of the plot, the mystery, and the drama. The story made it interesting so that they wanted to read it. Lacretia commented, “If it’s not interesting you don’t want to read all of it.” The participants also expressed a desire to know more about what was going on in the story. They wanted more details and more action. Kenyon suggested that “It’d be better with more story to it.” They wanted to experience the story step by step, and felt some of the stories were “rushed.” Some participants also expressed confusion or disappointment with the endings of some of the graphic stories, particularly with the FLU and HIV stories. They wanted to know what would happen next.

The artwork also received many positive comments from the participants. Many participants had low expectations for the illustrations and were pleasantly surprised when they opened the cover and saw the graphic story for the first time. Hector commented, “the pictures are really nice. I thought they were gonna be all dull, to be honest, at first. And when I opened it up, it was actually pretty cool.” For some participants, the artwork was what they liked best about the graphic stories. Mike noted, “I liked it because of the graphics. I liked looking at it.” Malika also commented on the artwork: “The bright colors caught my attention.” Sapphire shared that the pictures would be a big draw among her peers: “I’m being for real. I’m so for real. I’ve talked to so many people and they say they like reading more stuff that has to do with pictures. ‘Cause you can stay more focused than books, ‘cause it’s just words after words after words.”

The participants were impressed by the level of detail in the illustrations, particularly of the characters’ faces. Sapphire observed, “I like her face—like the facial expressions for everything. How they drew it looked really good.” The participants felt the illustrations of the

viruses were realistic with one exception. Brian, who had viewed an actual influenza virus in his science class indicated "I think its cartoon." The pictures helped to facilitate the participants' understanding of the story. Maria shared, "I didn't really understand like the words, because I don't understand science at all. So, the pictures helped a lot." The illustrations also provided clues as to what was happening in the story when the narrative was not explicit. For example, in the FLU graphic story, the participants debated whether the old woman character had turned into the duck that appears at the end of the story until Terrell commented, "Well she's watching him leave, so I don't think she's the duck. Like you see the shadow."

Characters

The characters were a very engaging part of the graphic stories, and the participants shared their opinions about the characters. The gender and race/ethnicity of the characters were explicitly noticed by the participants. Maria commented that the female scientist in the HIV story was "ripped." Andre commented on the "three black guys" in the FMD story, to which Javan corrected that one of them was "ginger." Sapphire, unsure of how to describe the inhabitants of the village decimated by influenza, referred to them as "natives."

The personification of the virus (HPV and FMD) seemed to resonate with the participants. They liked the prisoners (FMD) and wanted to know more about the different kinds of FMD virus that were mentioned. Spike, in particular, really liked one of the prisoners, "the guy with the bio hazard tat… he's cool." However, other participants thought the prisoners were a little "creepy" and "weird" when they got so excited by all of the livestock that had to be destroyed. The HPV character evoked a mixed reaction. Brian thought "someone had to get rid of her soon." Malika, on the other hand, thought "she seemed more like a secret agent or something."

Characters infected with a virus also were noticed by the participants. The people in the HIV story were seen as "zombies" (Emily) and the participants were not sure if that meant that HIV turns you into a zombie. Dede, the "Tree Man" infected with HPV, received empathy from the participants, both male and female when he was shunned by his wife and village. Brian commented, "I didn't like the part where they were displaying him like the showcase, 'cuz that's like another form of being bullied. I've been through the bullying a couple of times and it's - I don't really like that."

The scientist characters received a wide range of responses from the participants. In general, many of the participants had a negative view of scientists prior to reading the graphic stories. Scientists were called conceited by Javan because he thought "they know more than you do about one subject." Spike called scientists narcissistic because "they make fun of you if you say something wrong." Mike summed up the scientists with one word, "nerds." When asked if the comic inspired them to want to become a scientist, Spike responded, "I don't want to be like him (the male scientist in the FMD story)."

In contrast to these general ideas, when asked questions specifically about the science characters in the graphic stories, the participants had slightly different opinions. Those who read the FLU story expressed concern that the scientist did not seem "very intelligent" (Hector) because he did not heed the warning to leave the site of the flu outbreak and they blamed him for

bringing the flu back to other people. The participants who read the HPV story were very impressed with the scientist and liked that he "was there to help" (Malika). Orlando summed up this dual perception of scientists by saying "I never really liked scientists. I always thought they were whack until they come up with that, like what they do, to kind of save us." Emily thought what scientists do was kind of interesting because "they have to learn everything about a virus and then try to figure out the symptoms of it and then come up with the treatment." Malika wondered if people who study viruses have a personal connection because "if you know someone or if you had a virus I think you would be more likely to look for a cure or a treatment for a virus."

Appeal of the Comic

When asked who they thought the World of Viruses graphic stories would appeal to, the participants almost universally replied junior high students, although two participants thought the stories would appeal to students ranging from 5 – 16 or 17 years old. They provided a variety of reasons to support this assertion. First, they felt the length of the stories was ideal for this audience. Javan noted that "I know from experience like big books in middle school is not gonna work." They also felt that comics in general were geared towards a younger audience. Lacretia shared "by the time you get to high school you don't want to be reading comic books." Additionally the participants felt that high school students already knew the information presented in the stories. Lacretia stated "a lot of kids would get a little snotty to it. They'd be like 'oh that's way below me, like I don't want to read this.'" Orlando suggested that "maybe get a younger group and they might learn something." Malika commented that junior high students on the other hand, were "just learning about things, and I guess this information would be helpful so once they reach high school they will already know." Several participants felt that even for junior high students, the graphic stories would benefit from having more information included in them. And finally, participants thought the graphic stories would make learning about science more fun for the junior high students. A fun approach, as noted by Lacretia, would "definitely get more kids interested in whatever you're teaching."

When asked who else might enjoy the graphic stories, the participants identified other audiences: people who like science and people who like to read, particularly people who like to read comic books. An interest in science seemed to be the most salient factor in who the graphic stories would appeal to. Sapphire suggested that "people that are really into science and they love scientifical stuff" would particularly enjoy the graphic stories. Comic book readers, the participants thought, would be drawn to the story and be impressed by the artwork. Some participants thought that comic book readers were primarily male, but as Mike noted, "if guys get into it, then girls might start to like it" too.

The participants shared a variety of opinions regarding how they thought their friends might respond to the graphic story. Some participants thought their friends would like the graphic stories, even mentioning a few friends by name. Others thought their friends would think the graphic stories were boring either because their friends are not into reading or they are more interested in other subjects. Most of the participants gave a more measured response. Some participants thought their friends might like the graphic stories, but only if they did not know that they were science-oriented. Terrell noted "if you tell them it's about science and they'll be like 'why would I want to read that?' Then they read it and it's like 'there's science in there?'" Other

participants thought the response would depend on the person. Malika reflected, "most of my friends they are, well some of them would find it interesting. But others would find it like pointless to read a comic book about facts and everything. But the ones that would read it, I think they would find it entertaining. They like something new. And, this is like something new, so they'll probably read it out of curiosity. And then, like, eventually they'll find, well, they like it."

For the participants in the first phase of the interview protocol, where they were asked to compare the graphic stories to a text book, the graphic stories were overwhelmingly preferred over the text books. Sapphire commented, "science text books are boring. They're boring. They're just fact, after fact, after fact." Andre shared that the stories provided a "better learning experience" than textbooks because they were "fun" and "enjoyable" to read and that he would "rather read this than big textbooks." Lacretia commented that she "probably would've done better in that class if I would've had them. I probably would've read and done my homework." Lacretia disclosed that she has dyslexia, and therefore liked the way the information was reported in the graphic story. She noted "sometimes it gets really hard if you have big textbooks with a page full of words, you know. So the shorter blurbs were definitely better." Participants who were not asked to compare the graphic stories to a text book suggested that the graphic stories could be used as a way to supplement traditional instruction. Derrick shared, "I can see them used in class and like letting people understand the basic knowledge of it, and go over what's there, and then elaborate."

Virus Knowledge

Participants expressed a range of knowledge about the viruses presented in the graphic stories, and were able to articulate some of the information they learned about viruses from reading the stories. In general, the participants had heard of the viruses presented in the graphic stories (influenza, HIV, human papillomavirus, and foot and mouth disease) before although one participant mentioned that he had not heard of HPV prior to reading the graphic story. However, some participants did not have entirely accurate information about the viruses. When asked to name viruses that they had heard of, several participants listed conditions that were, in fact, not viruses: STDs, syphilis, chlamydia, gonorrhea, and laryngitis. Javan, confusing FMD with hand, foot, and mouth disease, described it as something that "goes on in daycares, that's why you have to be careful. Once one kid gets sick with something then everybody in the daycare has got it." Malika shared that "I learned that HIV back then was called leprosy and it had the same symptoms as HIV."

The information about viruses presented in the graphic stories seemed legitimate to the participants. Malika commented "it seemed real because, I know like, with the viruses I know about, like it seemed the same." In general, the participants thought the images of the viruses were realistic looking. Hector, who had read the influenza graphic story, pointed out the test-tube with the virus and noted "the little box picture—circle picture, whatever. They showed like what it was and just describing what those little things are. So, that was pretty interesting, 'cause that's what you see on a science text book--diagrams and what not telling you what it is." In terms of learning new information about the viruses, Terrell indicated that he learned that "you puke up blood from the flu." Spike learned that "small pox doesn't exist anymore." Malika learned viruses can "spread through open cuts", can "control all the cells and like cells die off and take control", and they can "spread to anybody."

Mike commented that viruses were a "pretty serious" public health issue because they are "not like bacterial disease where you cure it, like when you get vaccines." He felt that viruses were "just a little more important because people can get seriously sick." Different viruses were perceived differently by the participants. Brian felt that viruses "you could like have for the rest of your life" were more important than those that had a treatment or cure. Emily noted that without scientists studying viruses, "there would be like a lot of people dying. More people than there are now."

In terms of the format of the graphic story, Kenyon commented that "you take things a little bit less seriously when you see it in a comic book sometimes." Other participants, however, had a different perspective on the format. Maria felt the information contained within the graphic story made viruses seem like a more important public health issue than she thought before. Keisha had already felt that viruses were important, but did not realize that a "world-wide epidemic" could result from viruses. Regardless of the prior perceptions about the importance of viruses, Emily suggested the graphic stories serve as an important reminder that contracting a virus "it's not like it's the end of their life. They can still deal with it." Malika shared this observation about her perception of the moral of the graphic stories: "I think it was about like making sure you take care of yourself."

Paradoxes and Contradictions

During data collection for this qualitative evaluation phase, an unusual pattern began to emerge in the participant responses. The participants were giving one response when asked an abstract question about overall attitudes or perceptions, but they were giving somewhat different responses when asked to apply the ideas to the specific graphic story they were presented. Often times these contradicting responses were subtle, embedded in the context of the conversation. Only through deeper analysis did it become apparent that the paradoxes of opinions were significant in understanding the complex perspectives of the participants regarding the World of Viruses materials.

Paradox 1: The materials are geared to junior high students, but I liked them. One of the primary research questions of the qualitative study was to understand the appeal of the graphic stories. When asked directly, the participants largely indicated that they felt the graphic stories were geared toward junior high students. Probing deeper revealed that the participants felt that comics in general are geared towards junior high students or that the level of scientific information presented in the graphic stories was not challenging enough for high school students. Their opinion on this matter seemed very definitive, however, there were numerous comments made throughout the interviews that directly contradicted this stance. When asked more generally what they thought of the graphic story that they read Lacretia responded "well, I liked it" and Hector said "I thought it was interesting." Even participants who did not really like science or who did not read comic books liked the graphic stories. When Malika was asked "So you don't really like science you said, and you're not really a comic book reader, but you liked this?" she replied "Yes." The participants even noted an element of enjoyment when reading the graphic stories. Lacretia shared, "like I wouldn't mind reading comic books, you know. If we had to do it in class it would be fun."

The contradiction between liking the graphic stories but feeling they are geared to younger kids may be due to an element of social desirability among the focus group participants. None of the participants expressed a negative reaction to the graphic stories. In fact, they all commented that they liked them and found them enjoyable. However, once the suggestion was made that the materials were more geared to junior high students, everyone seemed to agree and no one challenged the suggestion. Social desirability may have even influenced the participants even when their peers were not present, as this paradox was also present in the individual interviews.

The implication of this paradox is that there may be a complex relationship between what high school students' like and what they think their peers would like. The interview protocol in this study was not designed to capture issues of high school students' social or cognitive development, although this contradiction suggests that those might be important issues for future studies.

Paradox 2: The materials need more scientific information, but I learned something from them. Participants in the first phase of the interviews, where they were asked to compare the graphic stories to a text book, thought that the level of scientific information in the graphic stories was not substantive enough for a high school audience. However, the participants also described the graphic stories as being "very informational" (Lacretia) and "pretty informative" (Spike). Malika commented that "like you can learn everything that you learned in a science class in this comic book." Andre even acknowledged that "I actually learned something out of it, even though I thought I already knew about it."

One explanation for this paradox may be embedded in the medium itself. The graphic stories were designed to be engaging and entertaining, while educating students about viruses. Orlando noted the education is "sneaky" while Andre stated "it's just a cover up. They're trying to make me learn." The participants felt they learned something from the graphic stories, but some struggled to articulate just what it was. Lacretia shared "if I was given a lesson I wouldn't quite know what the lesson was. If they put more information in, the person can get more of an idea of what you're actually supposed to be learning." The participants expected the education to be more explicit. So while they felt they learned something, Spike noted it was "like nothing you could've used like on a test." However, participants in other phases of the interviews where the textbook comparison was not mentioned, were able to articulate specific information that they learned from the graphic stories: Terrell learned "that you puke up blood from the flu." Malika learned "like with open cuts and stuff and viruses spread through that. And then like it can control all the cells and like cells die off." Even Spike from the first phase of interviews mentioned that he learned "that it [FMD] killed like cows and livestock first."

The participants in the textbook comparison phase also noted several instances where they felt the material in the graphic stories was actually beyond their understanding and thought that the story should have provided additional details to explain the information. Spike commented that "I think if they could explain like what some of the, like things were like I didn't know what the little term words were, like F and D and stuff like that. If it told you what that was you might have been able to know what they meant….If they would've explained it more like, I felt like they jumped a lot. If they would've explained one subject for a little bit and make sure

you understand it that would make it better." A more balanced view was offered by Lacretia who said "sometimes I feel like it wasn't very informational at all and then sometimes I felt like some of the stuff I think they just put out there like not a lot of people would actually know what it is."

The important take-away from this contradiction was that even though the participants said that the material in the graphic stories was beneath them as high school students, they actually did learn something from reading them. Andre commented, "now I can actually go home be like 'hey Dad I learned something today.'"

Paradox 3: The materials did not change my interest in science, but I want to read/learn more. One of the hoped-for outcomes in producing informal science education materials is that over time they will increase readers' interest in science, but it is very difficult to measure the collective influence of a variety of experiences and materials. The qualitative data provided some insight into the potential impact of the World of Viruses graphic stories. The participants, when asked directly, did not express an increase in their interest in science as a result of reading the graphic stories. When asked if her interest in science had increased, Sapphire replied "no, not really. I'd be like this is boring." Hector shared that he was more interested in the story than the science. He said "somewhat, not really, 'cause like I'm more like reading the book—reading the comic itself." The participants felt very secure in their identity as a "science person" or "not a science person" and did not feel the graphic stories had any effect on changing their perception of themselves.

There were many instances, despite these views, where the participants both directly and indirectly indicated that they were, in fact, interested in learning more about science in general or viruses in particular. When asked if they were interested in reading more of the World of Viruses graphic stories, (as opposed to learning more about science) the participants across all of the interviews and focus groups said yes, but in a more idiomatic and colorful way:

> Yeah, I would. (Brian)
> I totally would. (Spike)
> Yeah totally, that's 100% yeah. (Andre)
> Yeah, I probably would. Just to like—just for like curiosity. (Keisha)
> If they were interesting and had pictures, I would read it. (Sapphire)
> I liked it enough to where I'd keep reading it if there was more to it. (Hector)

Hector, in particular, was disappointed with the end of the influenza graphic story. He commented "is this just—is that like the end of the comic or is there more to this?" He was ready to read the next installment then and there. The participants' interest in reading more of the World of Viruses graphic stories was perhaps most direct after the interviews had concluded and the digital recorder had been put away. Without exception, the participants were disappointed that they had to return the graphic story they had just read. They genuinely wanted to keep them. Unfortunately, the research protocol did not allow for that to happen. However, when they were told that a box of the bound graphic stories would be delivered to their after-school program once they were finished by the publisher, they were very excited by the news.

While the increased interest in reading more of the World of Viruses graphic stories is certainly encouraging, we must be careful not to draw too broad of a conclusion from this finding. The graphic stories did not appear to increase the participants' level of interest in becoming a scientist. High school students, it appears, prefer to present themselves to others as having well developed and defined interests. As stated earlier, the participants seem to be secure in their identity as a "science person" or "not a science person." They do not seem to view their interests as malleable; therefore direct questions regarding a change in their interest in science would likely not reveal any increase. To acknowledge that they were more interested in science as a result of reading the graphic stories would be inconsistent with their already determined science identity. Additionally, the science curriculum tends to build from course to course and it would be a challenge for students to "catch up" on the prerequisites necessary to pursue a scientific career if they had not already identified themselves as a "science person" and planned those courses into their academic schedule.

It may be possible that in increased interest in reading more World of Viruses graphic stories is related to an increased interested in becoming a more informed citizen regarding scientific issues. The participants did indicate that they would be more likely to watch a television show or read other materials about the virus featured in the graphic story that they read. However, even watching a television show about viruses faced barriers. Maria explained that "I mean, if it, like, pops up on TV then I would watch it. If there's nothing else on. Like, if Jersey Shore is not on."

"Viruses are Cool" Scale

The responses to items in the "viruses are cool" scale in the quantitative study prompted further exploration. It was unclear as to why the responses were flat and not correlating with other measures as expected. Three items were selected to prompt discussion in the final focus group that might illuminate the quantitative results: "Viruses are cool," "My friends would think it was awesome if I studied viruses," and "People who work with viruses are not fun." The response options to these items were presented in a 5 point Likert scale format.

The first item, "viruses are cool" prompted quite a discussion among the participants. Kenyon was the first to reply with "Well, what do they mean by cool?" Derrick suggested that if "you're thinking of like 'cool' as in, 'Alright, well it's extremely advanced. It's not even technically considered to be living.' That's—I think that's pretty cool." Keisha was quick to challenge this perspective by sharing her opinion that "I think you're pretty insane if you think that viruses are cool. Because like, I mean, viruses kill people like every day." Kenyon agreed, noting that viruses "kill people, a lot of people, every year. So, then I don't think that's very cool." Kenyon suggested the item needed further refinement and specificity in order for him to be able to select a response option: "So just even the question about 'viruses are cool'—what about viruses? You need to ask like what part…what about viruses do you think is cool? You need to clarify the question."

The discussion regarding the item, "my friends would think it was awesome if I studied viruses" also generated a lively discussion among the participants. Keisha stated that the item simply was not relevant to her experience: "I wouldn't just sit there and discuss that type of stuff

with my friends." Emily was not sure if she would tell her friends that she wanted to study viruses. She seemed to think aloud, "I wouldn't tell anybody, 'cause I wouldn't really think—I wouldn't care what they think. Like I would tell them, but like I wouldn't really care—it's not like I'm gonna stop doing it just because they said, 'Oh…that's lame or something like that.'" Maria admitted that her friends would "like look at me like I'm dumb. 'Cause my friends don't really…I don't know, I guess, you'd call like them 'bad' kids or whatever. Like they get in trouble a lot." Kenyon's concern in responding to this item was that if he told his friends he wanted to study viruses, they would be confused. He explained that "most of my friends…that's not how they know me. Like, I am going to Law School. But they would be supportive."

The final item from the "viruses are cool" scale presented to the participants was "people who work with viruses are not fun." Although the discussion regarding this item was much shorter than the other items, it demonstrated how the participants interpreted it in different ways. The students did not interpret the item as asking them to rate virologists' lack of "fun" as people. Maria seemed to interpret the item as asking if the people who work with viruses thought viruses were fun. She offered "if they enjoy it and they find it fun, then they should do it." Emily continued this interpretation with her opinion, "I feel like if that is what they like to do then that is what they should do."

The participants reactions to the quantitative "viruses are cool" scale items identified alternate interpretations of the items, confounding contextual factors, and issues of word choice and relevancy that help to explain the flat results of this quantitative scale.

Discussion

The overall goal of this research project was to provide a deeper understanding of the reaction of high school students to the World of Viruses materials for the purpose of illuminating the quantitative results. Each research sub-question will be answered, followed by a discussion of the broad research question: What insights can be gained from interviews with high school students regarding the impacts of the World of Viruses graphic stories?

Q1. What is the appeal of the World of Viruses materials to high school students?

The World of Viruses materials had a positive reception among the high school participants of this study. They were particularly drawn to the story elements, the action, the characters, and the artwork. Although the stories were about viruses, the participants felt the scientific information presented took a subordinate role to the entertainment provided by the format (a graphic story). The format felt more accessible to them and made the "learning" enjoyable.

Q2. How do high school students perceive the World of Viruses materials?

The participants consistently articulated a positive response to the World of Viruses materials. They enjoyed reading them and many of them described learning something new. When asked how their peers might perceive the materials, there were mixed reactions among the participants. While there was a consensus of the participants that the World of Viruses materials would have the most appeal among junior high students, there were different rationales provided for this opinion. Some participants felt that comics, regardless of content, were most appropriate for junior high students. Other participants, particularly those in the Round I interviews where

they were asked to compare the graphic stories to text books, felt the level of scientific information in the comics was not adequate for high school students and that their peers would feel the materials were "beneath" them. Many participants suggested that the graphic stories would have the best opportunity to influence more people to be interested in science during junior high school, before the students had committed to a particular science identity.

Q3. How do high school students perceive the characters in the World of Viruses materials?

The participants in this study connected with the characters, whether a person or a personification of a virus, in a variety of meaningful ways. The participants were very attentive to the way the characters in the graphic story were visually portrayed. They frequently commented on the race, ethnicity, or gender of a specific character. They commented on the clothes the characters were wearing (e.g., the female scientist in the HIV story). They also commented on the characters' dialogue when it didn't seem genuine (e.g., the FMD story). They expressed empathy with and admiration for the characters (e.g., the HPV story), and they even expressed annoyance with the characters (e.g., the HPV character).

Q4. How do students interpret the information presented in the World of Viruses materials?

The participants in the study felt that the scientific information presented in the World of Viruses materials was accurate and legitimate. A few participants commented that the information seemed consistent with what they had previously learned about viruses. As for the importance of viruses as a public health issue, participants described a stable or slightly increased sense of the importance of viruses. Some of the graphic stories described wider-reaching or more serious effects of the viruses then the participants had previously realized.

Broad Research Question: What insights can be gained from interviews with high school students regarding the impacts of the World of Viruses graphic stories?

The findings from the qualitative follow-up study provided insight into the participants' perception of the impact of the World of Viruses graphic stories beyond what was measured in the quantitative study. The results provided insights to specific questions from the quantitative analysis (e.g., the "viruses are cool" scale) as well as a general framework for understanding how high school students perceive the World of Viruses materials. It was clear from the interviews that the participants enjoyed reading the World of Viruses graphic stories, although they felt the format (i.e. comic book) was geared to junior high students. They found the plot to be engaging and the artwork to be of high quality. The participants also connected with the characters in the graphic stories, noting their physical characteristics and commenting on their actions. The World of Viruses graphic stories also taught participants something new about viruses that they didn't know before. However, the participants seemed to be looking for a more direct "lesson" and thought that more scientific information would "bring up the level" of the materials and help explain concepts or terms that were "over [their] heads." And while the participants reported that World of Viruses materials did not increase their interest in science, they all wanted to read more of the graphic stories.

Significance of the Findings

The findings from this qualitative follow-up study have several implications that are significant. First and foremost is that science-themed graphic stories are able to engage high school students. When the story is compelling and artwork is perceived as good quality, high school students are interested in reading more of the materials. The graphic story format is an effective vehicle for engaging high school students in scientific concepts. Another implication of the findings is that although science-themed graphic stories are not likely to change high school students' long held beliefs or attitudes about science, or their identification with science, the participants suggested that the materials may have an impact among junior high students. They felt that junior high students were likely not yet committed to a specific identity related to science interest and therefore the materials may influence some junior high students to consider a career in science.

The final key implication of the findings from this study is the importance of the terminology used to describe the World of Viruses materials. When invited to participate in this study, participants were told it was about "science-themed comic books" and the interview protocol referred to the materials as comics. The materials read by the participants were presented in a plain white cover with only the words "World of Viruses Study, Spring, 2012" to indicate the contents. The booklets remained closed during the introductory activities and it was not until the participants were instructed to begin reading that they saw the artwork. Many participants shared Hector's surprise that the illustrations were of a higher quality than what he expected. He noted that "the pictures are really nice. I thought they were gonna be all dull, to be honest, at first. And when I opened it up, it was actually pretty cool." It would seem reasonable that the reference to the World of Viruses materials as "science-themed comic books" set up an unanticipated negative expectation among the participants, and may have influenced their perceptions that the materials were geared towards junior high students. The term "comics" has developed a pejorative connotation (Shanower, 2005) and conjures images of newspaper comic strips, line-drawn or simply colored illustrations, or serialized booklets that are collected and read by children. The term, "graphic novels," on the other hand, seems to refer to larger works that generally have a single story arc and a high level of artistry. While the precise distinction between what is called a comic book and what is called a graphic novel varies among authors, artists, publishers, book sellers, librarians, and readers, it is clear that there are different expectations of works labeled as comics from graphic novels. Kenyon, a participant who used to read comics, indicated he would call the World of Viruses material he read a graphic story because "the illustrations were good." When marketing the world of Viruses materials to high school students, it would be wise to refer to them as Kenyon suggested, "graphic stories" rather than "comics," in order to more accurately portray the quality and sophistication of the work.

References

Boyce, C. & Neale, P. (2006). Conducting in-depth interviews: A guide for designing and conducting in-depth interviews for evaluation input. *Pathfinder International Tool Series: Monitoring and Evaluation – 2.* Pathfinder International.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five traditions (3rd ed.)*. Thousand Oaks, California: Sage Publications.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice 39*, 124-130. doi:10.1207/s15430421tip3903_2

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research (2nd ed.)*. Thousand Oaks, CA: Sage.

Diamond, J. (2007). *World of Viruses.* National Institutes of Health Science Education Partnership Award (SEPA) Grant No. R25 RR024267-01 (2007-2012).

Diamond, J., Floyd, T., Powell, M., Fox, A., Downer-Hazell, A., & Wood, C. (2012). *World of Viruses*. Lincoln, NE. University of Nebraska Press.

Denzin, N. K., & Lincoln, Y. S. (2005). *The Sage handbook of qualitative research (3rd ed.)*. Thousand Oaks, CA: Sage.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation (2nd ed).* San Francisco: Jossey-Bass.

Powell, M. (w) & Floyd, T. (a) (2012). Confined! In Diamond, J., Floyd, T., Powell, M., Fox, A., Downer-Hazell, & Wood, C. (Eds.), *World of Viruses* (pp. 6-16). Lincoln, NE. University of Nebraska Press.

Powell, M. (w) & Floyd, T. (a) (2012). The frozen horror. In Diamond, J., Floyd, T., Powell, M., Fox, A., Downer-Hazell, & Wood, C. (Eds.), *World of Viruses* (pp. 48-58). Lincoln, NE. University of Nebraska Press.

Powell, M. (w), Floyd, T. (p), Rubinstein, J. (i), & Beachler, S. (c) (2012). Curse of the Tree-man. In Diamond, J., Floyd, T., Powell, M., Fox, A., Downer-Hazell, & Wood, C. (Eds.), *World of Viruses* (pp. 61-78). Lincoln, NE. University of Nebraska Press.

Powell, M. (w), Angeletti, P. (w), Angeletti, A. (w), & Floyd, T. (a) (2012). Phantom Planet. In Diamond, J., Floyd, T., Powell, M., Fox, A., Downer-Hazell, & Wood, C. (Eds.), *World of Viruses* (pp. 20-30). Lincoln, NE. University of Nebraska Press.

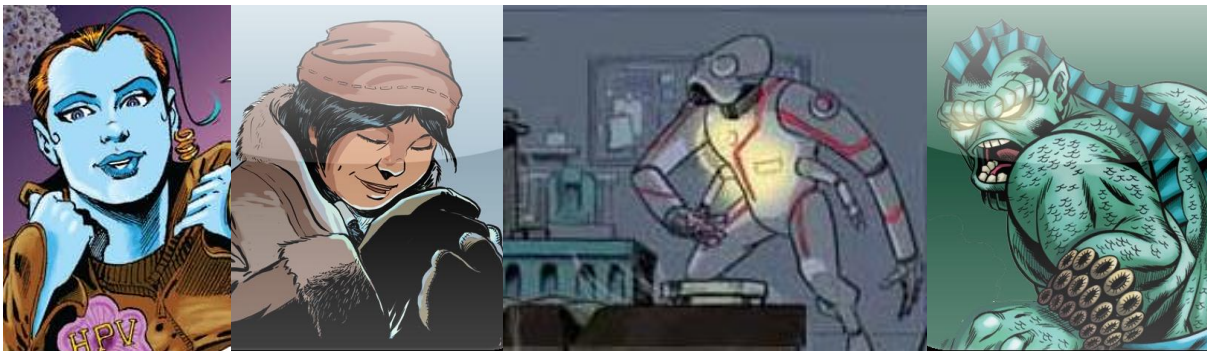
Shanower, E. (2005). The art of the graphic novel. *The ALAN Review 32*(2).

Spiegel, A. N. (2011). World of Viruses summative evaluation process: Testing the pilot study instrument. Lincoln, NE. Center for Instructional Innovation, University of Nebraska-Lincoln.

Appendix A: Recruitment Flyer

Do you like telling others what you think?

We want to listen.



The [redacted] has partnered with the University of Nebraska State Museum to conduct an evaluation study of science-themed comic books. We want to talk with high school students to understand what they think about these comics and how effective the comics are.

It doesn't matter if you like science or read comics. We want to hear what you really think.

You can choose to join a small focus group or an individual interview. Either way, we won't take more than an hour of your time. And we will feed you pizza!

Interested?
See [redacted] at the [redacted].
She will give you some additional information to take home and get you signed up.

University of Nebraska Lincoln

Appendix B: Parental Notification Letter

University of Nebraska Lincoln

University of Nebraska State Museum

DATE: March, 2012
TO: Parent/Guardian
FROM: University of Nebraska State Museum
SUBJECT: Parent Notification for the Science Comic Book Evaluation Study

[redacted] has partnered with the University of Nebraska State Museum to conduct an evaluation study of science-themed comic books. The data gathered from this study will be used to help us understand how appealing and effective the comics are at teaching scientific concepts.

As a high school student participating in [redacted] activities, your son or daughter has expressed an interest in participating in this study. In the study, your student will be asked to read a short science-themed comic book and then provide verbal feedback, either individually or as a group. The study, including the reading and the interview/focus group, will take about an hour and will take place at the [redacted]. [redacted] staff will facilitate scheduling the session at a convenient time for your student after school or early evening. Dinner will be provided. Your student may find participating in this study interesting and fun as it gives them an opportunity to share their opinions on these educational materials. Participating in this study poses no risk to your child and covers materials similar to what students learn in science class.

Study procedures have been designed to protect your child's privacy. We will not keep any record of your child's name. Interviews will be audio recorded, but the audio recording will be done solely for the purposes of completing transcriptions of the conversations. Professional transcriptionists at UNL will prepare the transcriptions, and all names and other identifying characteristics will be deleted from the transcripts.

Student participation is encouraged and appreciated, but is completely voluntary. There are no consequences if a student does not participate. **If for some reason you do not wish for your child to participate, please complete and return the form on the reverse of this letter.**

If there is any additional information you would find helpful or to see a copy of study materials, please contact Michelle Howell Smith at 402-472-9108, or by email at mhowell2@unl.edu.

Thank you so much for your assistance with this important project.

Investigator Information:
Dr. Judy Diamond, University of Nebraska State Museum, jdiamond1@unl.edu or 402-472-4433
Dr. Amy Spiegel, Center for Instructional Innovation, aspiegel1@unl.edu or 402-472-0764
Dr. Michelle Howell Smith, Office of Qualitative and Mixed Methods Research, mhowell2@unl.edu or 402-472-9108.

If you have questions or concerns about your rights as a study participant that have not been answered by the investigators, or to report any concerns about the project, please contact the University of Nebraska-Lincoln Institutional Review Board at 402-472-6965.

307 Morrill Hall / University of Nebraska-Lincoln/ Lincoln, NE 68588-0338

University of Nebraska Lincoln

University of Nebraska State Museum

Parental Notification Form
Science Comic Book Evaluation Study

Please return this form by _____, 2012 if you do **NOT** wish your son/daughter to participate in this study.

I have read the information about the Science Comic Book Evaluation Study being conducted by the University of Nebraska-Lincoln Museum.

I do **NOT** want my son/daughter to take part in the Science Comic Book Evaluation Study.

Student Name (please print) _____

Signature of Parent/Guardian_____

Date_____

Please return this form to:

[redacted]

A self-addressed stamped envelope has been provided for your convenience. You may also contact [redacted] via email at [redacted] or via phone at [redacted].

Appendix C: Participant Characteristics

Graphic Story	Interview Round	Pseudonym	Science Interest	Comic Interest
FMD	Round I	Lacretia	Likes science	Doesn't read comics
FMD	Round I	Spike	Likes science	Used to read comics
FMD	Round I	Javan	Used to like science, but doesn't like it anymore	Doesn't read comics
FMD	Round I	Andre	Likes hands-on science	Currently reads comics
FLU	Round I	Sapphire	Likes hands-on science	Doesn't read comics
FLU	Round I	Hector	Doesn't like science	Doesn't read comics, but works with people who are really into them
HPV	Round II	Brian	Doesn't really like science	Used to read Superman comics until 6th grade
HPV	Round II	Malika	Doesn't really like science	Read a few of brothers' comics
FLU	Round II	Terrell	Does not like science (never did, never will)	May have read one when he was a kid
FLU	Round II	Orlando	Likes hands-on science	Used to read comics until 10th grade (they got boring)
FLU	Round II	Mike	Likes science to a point	Used to read comics until 10th grade
HIV	Round III	Emily	Likes science pretty well	Used to read brother's comics when she was 5 or 6
HIV	Round III	Maria	Doesn't really like science	Never read a comic
HIV	Round III	Keisha	Doesn't really like science	Only ever read 1 or 2 comics
HIV	Round III	Derrick	Likes science a little	Read comics until 9th grade, just for fun
HIV	Round III	Kenyon	Really likes science	Read comics until 9th grade

World of Viruses Graphic Stories

The Frozen Horror (Powell & Floyd, 2012): Influenza Virus (FLU)
Confined! (Powell & Floyd, 2012): Foot and Mouth Disease Virus (FMD)
Phantom Planet (Powell, Angeletti, Angeletti, & Floyd, 2012): Human Immunodeficiency Virus (HIV)
Curse of the Tree-man (Powell, Floyd, Rubinstein, & Beachler, 2012): Human Papillomavirus (HPV)

Appendix D: Student Assent Document

University of Nebraska Lincoln

University of Nebraska State Museum

Youth Assent Form

Science Comic Book Evaluation Study

Thank you for volunteering to participate in our research study. *World of Viruses* is a project that has produced comic books to help teach people about viruses.

The study consists of a one hour interview or focus group where you will read a comic book and provide feedback. Our conversation will help us understand how appealing and effective the comics are. This study will take place at the [redacted], and dinner will be provided.

There are no known risks to you in participating in the interview or focus group, and you may find reading the comics and providing feedback interesting. You do not have to be in this study if you do not want to, and you may stop participating at any time. There are no consequences if you do not participate. However, we hope that you decide to help us with this study.

All interviews will be audio recorded. Later someone else will type what was said, so we'll have an accurate record of your opinions. Your privacy will be protected and your name will not be collected or reported in anyway with the study.

If you have any questions, you may ask me at any time during the study. My contact information is listed below in case you have questions after the study is complete.

If you participate in the interview or focus group, it means that you have read everything on this form and agree to participate in this study. You are welcome to keep a copy of this form if you would like.

Thank you for sharing your opinions of our comics!

Investigator Information:

Michelle Howell Smith, Office of Qualitative and Mixed Methods Research
mhowell2@unl.edu or 402-472-9108
Amy Spiegel, Center for Instructional Innovation
aspiegel1@unl.edu or 402-472-0764

307 Morrill Hall / University of Nebraska-Lincoln/ Lincoln, NE 68588-0338

Appendix E: Interview Protocol

1. I thought we could start our conversation by talking about the comic in general.
    a. What did you think about this comic?
    b. Tell me about the story in the comic. What was it about? What was the main point?
    c. What did you think of the characters? Who did you relate to?
    d. What did you think about the pictures? How did they help you understand what was happening?

2. Now I'd like to shift our conversation a bit and talk about the appeal of comics like these.
    a. How does this science comic compare to a science text book? (brainstorm lists)
    b. How accurate does the information in the comic seem?
    c. Who do you think would like a comic like this? Why would they like it?
    d. Would you want to read more science comics like this? why or why not?
    e. Would you recommend comics like this one to your friends to read? Would they think it is cool?

3. Now I would like to focus on viruses specifically.
    a. I am interested to hear about what you knew about this virus before you read the comic? (heard of it before? know someone who as it?)
    b. What did you learn about this virus from reading the comic?
    c. What was new, surprising, stood out to you, occur to you about this virus?
    d. How important do you think it is to learn about viruses and why?

4. The next section of questions deals with the scientists who study viruses.
    a. What do you think about the people who study viruses?
    b. What did you learn about the people who study viruses from reading the comic?
    c. How has reading this comic changed your ideas about the people who study viruses?

5. Now I'd like to learn more about your interest in science and viruses.
    a. How has reading this comic changed your interest in science?
    b. Can you imagine someone like you as a scientist?
    c. Would you like to learn more about viruses after reading this comic? Why or why not?
    d. What do you think is interesting about studying viruses? Anything not cool?

6. That is all of the specific questions I have for you. I would be interested in hearing any recommendations you might have for how we could improve science comics like these or any other feedback about the comics that you would like to share.

Appendix F: Field Notes

Field Notes from Interview #1: Focus Group

I had 3 boys and 1 girl, all African American participate today. They all really wanted to do it together, so it just seemed easier to have a slightly larger group then to make one of them wait. I had them pick out pizza and drinks, but it took 45 minutes for delivery. We ended up starting without the pizza ad took a break when it arrived. So now I have pre-purchased some pop and will order the pizza for delivery ahead of time. If it turns out that anyone doesn't like meat lovers pizza, then I will order an additional one and they can eat after. I also ordered cheese sticks and cinnamon sticks, so there is something else for them to snack on.

It was a Monday and the house was busy...lots of people coming and going. The focus group was in an upstairs balcony/lobby area so there was a lot of background noise from the students on the main floor. Staff and students frequently interrupted to say hello and give everyone a hug.

It turns out we didn't have a room to meet in - it was an open balcony area on the second floor of the house - so we got a lot of background noise from the kids downstairs. We also had a lot of interruptions with kids and staff coming up to say hello. It seems to be the norm that everyone hugs everyone else upon arrival. The participants were very engaged and often exchanged hugs while still listening or even talking. The visitors were not very intrusive and left after greeting everyone. All four students seemed very engaged in the conversation and actively shared their thoughts and opinions.

There also was a staff member with us upstairs during the focus group - I learned that the students are supervised by a staff member in every room at all times. They sat across the room and were working on a computer at a cubicle. I do not think they could hear much with all of the other noise and the students didn't seem to notice them much.

The conversation was really wonderful. The students had a mixed reaction to the comic (I used FMD). They really liked it and thought they learned something. But then they thought the comic appealed to Jr. High students. They thought it could use more information about the virus. What was there was general in their opinion. They didn't understand what the dogs at the airport had to do with the rest of the story. They liked the prisoners but wanted to know more about the different kinds of FMD. They thought the dialogue was stiff and not natural, especially with the scientists. They liked the female scientist, but thought it was weird that the guy didn't say much. They also didn't like the ending...too vague. When I asked about the virus, they all said they had heard of it, but when I asked for details, only one of them said he thought it was over in Africa. Another student thought it affected little kids at day care (Hand, Foot and Mouth). They also didn't know that small pox had been eradicated completely - they discussed whether it was still around in some lab or something. I asked them all if they liked science and if they read comics. Only one was a regular comic reader, but 3 liked science. One who didn't like science said it was because he didn't like his science teacher.

I was surprised during this conversation about the disconnect with what the participants were saying. They liked the comics, but felt that they would appeal more to Jr. High kids. They felt they learned something, but that the comics needed more info. They liked the characters and the story, but thought much of it was irrelevant to what they thought they should be learning.

Field Notes from Interview #2: Focus Group

I had one female African American and one male Hispanic student participate today. It was a Tuesday and it was raining, so the house was much quieter. There weren't as many students around, so there weren't as many (or even any) interruptions. The female student did not have her glasses and also had something bothering her eye. She made several references to being a slow reader and once the male was done reading, she gave up and did not finish reading the comic. Even with several prompts, she would not continue reading. I asked her if she stopped reading because she felt uncomfortable with others watching her or if she just didn't like the comics. She insisted that she liked the comics, but that she just didn't want to slow the discussion down.

This group also expressed concern over the low level of science in the comic, very early on in the conversation. They weren't quite as direct about the comics appeal to only Jr. High students as the first group, but they mentioned several times that there was not enough information.

They felt the story was realistic/believable. They liked that it was a story and that the pictures were "gory." They thought the comics would appeal to people into science or native issues. They felt they didn't really learn anything new about the flu, but the story was cool. They didn't like the ending and wanted to read more to find out what happens back at the lab.

Field Notes from Debriefing #1

After meeting with Amy to update her on the first 2 focus groups, we had a few realizations:

1. Both groups commented that there was not enough science information, but I think they were making that observation based on comparing the comic to a text book. I think the mention of being an alternative to a text book set the comic book up to provide information that could be demonstrated on a test, which is different than just reading the comic for fun.
2. I was concerned about the student who wouldn't finish reading the comic. I try to re-read the comic along with the group, so I will slow down and keep pace with the slowest reader. Also, I will direct the students to "read" the pictures, not just the words, for clues as to what is happening in the story. That may help to level the reading time, while helping non-comic readers make more sense of the story.
3. Amy asked to frame the questions about their interest in learning more about the virus in terms of a TV/Discovery channel special – not a formal study to learn more.
4. Amy also wanted to know if viruses seemed less "important" as a social/public health issue after seeing them in the comic.

Field Notes from Interview #3: Individual

This was my first individual interview. I was excited to try some changes to the protocol, to see if that lessened the recommendation of the comic for Jr. High students. Unfortunately, this student was only a freshman, so not that far away from Junior High. He also was very soft spoken, both in terms of volume and in terms of content. He just didn't have much to say.

The student seemed to identify with the "tree man" and felt bad for how others treated him and were rude to him. He liked that he was cured so quickly. He hadn't heard of HPV, but had heard of HIV and STDs. He thought his friends would be bored by the comic because they are into sports, not science.

Field Notes from Interview #4: Focus Group

This was a very animated group. We met in the homework room, not the balcony, so we had a closed door that was keeping a lot of background noise at bay.

They liked the graphics and the mystery and the twists and turns of the story. There was a lively discussion about what happens after the comic ends. They didn't feel they learned anything about the flu, but a younger group probably would have. They liked that the scientist was out in the world doing cool stuff, trying to help people. But they also thought he should have heeded the warnings.

They like the artwork and thought the comic would appeal to kids interested in science or mysteries, or comic book fans in general. When pressed for more description, they thought pre-teens, but then up to 17 years old. They thought guys more than girls would like it, but that guys might get their girlfriends interested in it.

They thought the myth about the village was fiction, but that the digging up the virus was real. The virus drawing seemed realistic to them. They thought that viruses were a serious issue because they killed so many people. They thought scientists were both "nerds" and "cool." They thought their friends would enjoy the comic as long as they weren't told it was about science beforehand. They thought the story could use more action, like a fight scene with the virus fighting the vaccine.

Field Notes from Interview #5: Individual

This was a great 1-on-1 interview. The student had a lot to say! She thought the comic was cool because it was informational and enjoyable. It was easier to read than a textbook and there was a storyline to it. The pictures made it visually interesting and helped her to understand the story. It wasn't what she expected.

She had heard of HPV before, but didn't really know anything about it. She thought the point of the story was to take care of yourself and protect yourself from infection. She doesn't read comics but liked this one. She thought people who were into science would like the comic. She thought that viruses are an important social/health issue since they can make people really sick, especially when not treated. The artwork in the comic seemed realistic, but not as gory as "real" viruses.

When asked about the HPV character, she thought she was like a secret agent, hiding from the T cells. She liked the scientists because he was helping the tree man, but felt bad that he ended up getting infected at the end. (she thought the band-aid on the last page was the scientist's.) She thought being a scientist would be boring, but being a CSI scientist would be okay. "Regular scientists seem kind of boring."

She thought some of her friends would like the comic and some would be bored. She thought she would be likely to watch a TV show about HPV. She thought that people who had some kind of personal experience with a virus might be more interested in studying viruses. She had heard of HIV (previously called leprosy), syphilis, chlamydia, gonorrhea, laryngitis, mono.

She thought more action would make the comic more appealing – like super heroes fighting. She also suggested making comics for girls – like with girls talking about viruses, maybe setting in a high school so it is more relatable. She also suggested activities, like mazes and stuff. She thought the comic would most likely appeal to middle school students.

Field Notes from Debriefing #2

We (Amy, Vicki and I) discussed the possibility of doing follow-up interviews with a few select students, but decided to go ahead with the final focus group and then do follow-up interviews if necessary once we had done some formal data analysis.

We did change the protocol to ask the students specifically about some of the survey items on the "coolness" scale to get some insight as to how students were answering those items.

Field Notes from Interview #6: Focus Group

This group was a bit overwhelming. The size made it difficult to manage the conversation, and one participant in particular seemed to keep trying to take the conversation off topic. We didn't get through much of the normal protocol. However, I was able to ask some direct questions about a few quantitative items.

In terms of viruses being cool – the students said they do not really use that word, but they clearly know what it meant. They felt conflicted about how they would answer that item. Viruses are cool because they are such simple organisms yet they can do very complex things. Viruses are not cool, though, because they kill millions of people.

In terms of friends thinking it was awesome if they studied viruses –the students seemed to answer the question based on them imagining themselves telling their friends that they wanted to study viruses and how their friends would likely react in that moment. The students felt their friends would be *confused* if they told them that they wanted to study viruses, because their friends know them and know that they have other interests. So if they were into viruses and had been planning on studying viruses, their friends would be supportive of that. One student mentioned that his friends wouldn't think it was awesome if he wanted to study viruses, because he has been focusing on going to Law School for the past three years.

One student who used to read comics indicated that he would call these "graphic stories." One student commented on the attire of the scientists once they had removed their "space suits." One student disclosed having two family members with HIV towards the end of the focus group.

Appendix G: Preliminary Findings from Field Notes

I would offer the following items as a preliminary summary from the focus groups…

1. The students liked the comics. Across the board students enjoyed reading them and had a positive reaction to them. (Although they certainly were able to articulate ways in which they might be improved.)
2. The story or narrative of the comic seemed to be the major attraction to the comic. They liked the mystery, suspense, and plot twists.
3. The students connected with the characters commented on the characters' race and/or gender in almost every interview.
4. Reactions to the scientists were mixed. Students generally liked the scientists who were out in the field, doing cool stuff, and helping people. They did not like scientists in the labs doing boring stuff and speaking with scripted/stilted language.
5. The students felt the comics needed more scientific information presented, particularly with FMD and FLU. The HPV character provided a lot of direct information and the HIV comic had a few "boxes" that explained some of the details from the story.
6. The students almost universally agreed that these comics would be most attractive to junior high school students. This is based partly on the perception that "kids" read comics. Several of the participants had previously read comics but reported that they stopped reading them once they got to high school. The participants also indicated that the level of information provided seemed appropriate for junior high as well. Finally, if the goal of the comics is to get more kids interested in science, the participants thought they would be more effective with junior high students. They thought that their own interests were fairly well established by high school and did not think the comics would have much effect in influencing high school students.
7. The participants expressed an interest in wanting a more stream-lined story, particularly with FMD. They didn't understand the relevance of the airport dogs to the rest of the story.
8. The participants also wanted more details and action provided about the story. They didn't seem to attend to the time references in the text, so more frames indicating the passage of time and transition from one thing to the next would have been positively received.
9. There were several indicators that the students were interested in learning more about the viruses after reading the comics. The students had questions about what happens next in the story, particularly for FLU, but also HPV and HIV. The students had questions about the "truth" of the stories for FLU, HPV and FMD. The students made statements about pieces of information presented in the story ("I didn't know chicken pox didn't exist anymore") that seemed to interest them. Finally, the students were almost always disappointed when I asked for the comic to be returned, but they were excited about getting a hard-bound version once they are done from the printer. My impression from these indicators was that if the comic-based essays had been included, they would have read them; if other comics had been available, they would have read them; and if there were activities with supplemental information about the virus, they would have done them.