PODCASTS AND NON-SCIENCE STUDENTS' CURIOSITY IN SCIENCE

by

Jennifer Marie Vandenberg

A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2024

DEDICATION

I dedicate this paper and all the work involved in completing it to my husband, Chris Vandenberg. Thank you for suggesting we move to Montana and agreeing to Livingston as our new home so I could return to school at MSU. I look forward to our next stage in life after my graduation.

ACKNOWLEDGEMENTS

To complete the MSSE program, I needed a group of students to be my test subjects for assessments and other class assignments. I could not have succeeded without the help of the wonderful Montana State University students who worked with me at the Rendezvous Dining Hall. No matter how odd the survey was, they were eager to help.

I am especially grateful to the twenty students who participated in the focus group for my Capstone research. They all had lives and homework of their own, but they took time out of their busy schedule to help me complete my research.

Without the support of Andrew Slade, Rendezvous' general manager, and Kevin Ball, its evening operations manager, I would never have been able to collect the information I needed. Thank you for letting me use Rendezvous as my classroom.

When I came to Montana State University, I wanted a master's degree in some science area, but nothing seemed a good fit. Meeting John Graves convinced me that an MSSE degree could suit my ideas. For the last two years, he has been my biggest supporter, making the program exactly what I needed. Thank you for being such an inspirational advisor and teacher.

To finish my Capstone paper, I needed a science reader to help me improve my writing. I am grateful that Paul Anderson had time in his busy schedule to help me write the best paper possible. Thank you for your insights and opinions.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

GLOSSARY

Diversive curiosity – a need for something novel or unusual to gain knowledge

Empathic curiosity – curiosity that is shared with others.

Epistemic curiosity – a desire for knowledge

ABSTRACT

Students with a low interest in science may be unwilling to learn about the subject, have no curiosity, or have no desire to discuss the topic with others. Podcasts could be one way to increase a student's overall curiosity. A focus group of 20 Montana State University undergraduate students listened to three podcasts about science topics they were not interested in. All the students listened to a general science podcast, and then the group was split into three, with each subgroup listening to two more podcasts focusing on their non-interests. They took two surveys, one before and one after listening to the podcasts. These surveys asked questions that explored three types of curiosity: diversive curiosity, meaning a willingness to learn novel ideas; epistemic curiosity, which is an internal interest; and empathic curiosity, connecting people to each other. There was a statistically significant change between the initial and final survey answers, but the level of curiosity was stronger in some areas than others. The change in response between the two surveys indicated that 95% of the students in the focus group enjoyed the podcasts even though they had low diversive curiosity. Forty percent increased their epistemic curiosity after listening to specific podcasts, and 75% increased their empathic curiosity and would be more willing to talk about the topic with friends and family. Both diversive and empathic curiosity showed a large-event size effect, 1.40 and 1.33. Epistemic curiosity showed only a small effect, 0.38. Listening to science podcasts increased curiosity among students with a low interest in science. The level of increase depended on how much the student knew about the subject before listening. However, even students who knew something about the podcast's topic learned something new. Students who had no interest in a topic and may have been reluctant to learn about it found it more intriguing after listening to a podcast. Many students were willing to share their knowledge with friends and family. No matter how the students felt about the podcasts, all the students agreed that podcasts would be useful as part of a classroom curriculum.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

Before the internet, learning science outside the classroom was possible but not versatile. Watch Mr. Wizard, a half-hour science children's program, ran on both network and cable TV from the 1950s to the 1980s. Any child could sit in their living room and learn about a cool science experiment. The Public Broadcasting Service (PBS) had many shows in the seventies and eighties, such as 3-2-1 Contact, that taught children science. Bill Nye the Science Guy, possibly one of the most popular science TV shows in the 1990s, made learning science fun (ABC News, 2014). While these shows increased children's interest in science outside of the classroom, they kept children locked to the TV. Along with TV shows, there were science books for children, including encyclopedias and many DK Eyewitness books. Many of these books were large hardbacks, something a child might lie in bed and read rather than carry around. In some cities, museums and science centers engaged any child's science interests. While school field trips connected students with museums, it could be difficult for curious children to visit as often as they wished. These extra-curricular options required a time commitment and sometimes an agreeable parent or guardian. All this changed with the creation of the internet and, more importantly, the ubiquitous cell phone. While the cell phone is great for taking selfies and making phone calls, it has also allowed self-learning to leave the living room and museums.

Today, podcasts played on a phone or other audio device have broadened access to learning, making it available anytime and anywhere. There are approximately three million

podcasts, and around 1,000 are science-based (Howarth, 2023). There are podcasts that target everyone from baby boomers to toddlers. Unlike the science learned in a structured classroom, podcasts allow the listener to explore a topic of their choice. They can listen to the podcast while doing other activities, such as chores or exercise. Listeners can play podcasts again if they find the topic interesting or confusing. Podcast episodes can be shared among listeners with similar interests. It can also be a great way to explore new science ideas or even cutting-edge topics not easily covered in the classroom.

While the format that knowledge comes in can be easier to access and digest in some forms, curiosity is why we have had such a diverse selection of information sources. Various studies have broken curiosity into different types. Three common ones are diversive, epistemic, and empathic. From a young age, humans display diversive curiosity, a need to discover new things and choose the strange over the familiar. Epistemic curiosity runs deep through the history of humanity. This curiosity is why we explored new places and had a need to learn more about the world around us. However, for humanity to survive, we cannot keep the knowledge we gain from curiosity to ourselves. With empathic curiosity, humans have a desire to share information and learn what others in society know (Leslie, 2014).

The amount of each type of curiosity can vary from person to person. Someone with low diversive curiosity might be unwilling to try a new way to learn. Someone with low epistemic curiosity may not care if they learn something. If a person has no interest in sharing their knowledge with others, they may have low empathic curiosity. Perhaps with the right technique, these curiosities can improve, and learning new topics can become interesting.

I do not teach in a traditional classroom, but I interact with students daily through my work at Montana State University (MSU), a public land-grant research university in Bozeman, Montana. There are two dining facilities serving the students living on campus and the public working and visiting MSU. The Rendezvous Dining Hall, where I work, employs full-time undergraduate college students for up to 20 hours a week. I used a survey to create my focus group from the student employees at Rendezvous. The students chosen had no overwhelming interest in science, were willing to listen to three podcasts of various science content, and answered before and after surveys. Along with surveys, I provided ways for the students to record their thoughts to extract more detailed answers.

Focus Question

My focus question was, Can science podcasts increase science curiosity among students with a low interest in science?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

A Brief History of Science Communication

Science communication may be as old as humans. We will never know what our ancestors thought as they stared at the night sky while falling asleep around a campfire, content with the day's hunt and the protection the fire gave them from those animals who wished to hunt them. Did they share their observations? Did they communicate what they found as they migrated to new areas and created new societies? We do know that humans have been communicating science for more than 2500 years. While China and other societies have their own history of scientific communication, the formats that we in the Western hemisphere use today originated from the Ancient Greeks (Treadwell, 2021).

Before famous Greek philosophers such as Socrates and Aristotle discussed the world around them with their students, there was a group of inquisitive philosophers known as the Presocratic. The men of this presocratic era, 600-400 B.C., were some of the first to record their findings and share them with others. These men of science, known as natural philosophers, asked questions and created hypotheses to study the world around them, concepts that we continue to use today as part of the scientific method (Treadwell, 2021). Along with written texts, lectures were the primary way natural philosophers shared their discoveries about the world around them. This practice continued through the Middle Ages when kings invited men of science to share their findings with the royal court. New discoveries and old texts were written and rewritten by

monks, but in a world where most people were illiterate, science communication was reserved for the privileged few (Hughes, 2022).

During the Renaissance, natural philosophers such as Leonardo DaVinci used art to share their scientific observations. For art to be a form of scientific communication, the artist must have had the ability to draw accurately and have a deep knowledge of the subject. Copying was not the purpose. Instead, the artist had to bring forth the details they wanted the audience to understand. DaVinci called this "knowing how to see" (Shearer, 2019). However, even with new types of scientific communication, few would have absorbed this knowledge if not for the invention of the moveable-type printing press. Scientific knowledge left the hallowed halls of colleges, royal courts, and monasteries and found an enthusiastic home on the streets of the great cities of Europe. The scientific revolution in the 15th and 16th centuries, which Leonardo DaVinci, Galileo Galilei, Nicolaus Copernicus, and others influenced, came about partly because of the printing press. Books and pamphlets written and rewritten one at a time could now be reproduced in mass. Knowledge increased as more scientists shared their and others' findings. Collaboration increased the spread of scientific communication. Scientific organizations, such as the Royal Society, formed in 1660, and the National Geographic Society, founded in 1888, showed how this collaboration could be improved by printing booklets and magazines meant for a more general audience that showcased their members' discoveries (Bgiraudi, 2016).

While science communication did move from discussions by a few elite natural philosophers to the mass distribution of information, for most of history, average people did not connect with science. This began to change in the 1950s when most families began watching television. Reporters shared science news and interviewed scientists. Science communication

now included the general public. However, most people did not pay much attention to the work of scientists until the Soviet Union launched Sputnik in 1957. The space race between the United States and the Soviet Union gave people a reason to care about science. Science was no longer what academics did in some obscure lab. Instead, it impacted citizens directly. The public wanted to know more, and modern science communication emerged with better education, more resources for everyone, and a desire to make science communication as understandable as possible (Maktoufi, 2021).

What is a Podcast?

Podcasts are similar to radio programs in some ways and vastly different in others. Both are audio media that can share daily news, human interest pieces, and fictional stories. Many radio programs are also distributed as podcasts. But that is where the similarities end. Radio programs require listeners to tune in at a certain time and date. If part of a radio program is missed, there is no way to go back and listen again. Podcasts improve the medium by giving control to the listener. Podcasts can be played anytime, anywhere, and can be replayed. The content is also more diverse. With podcasts, topics that may be too short for a weekly or daily radio show, such as a four-part serial killer story (*The Serial Killer Podcast*) or a long form nuanced report on climate change affecting a small population (*Planet Texas*), can be shared with the listening public. Podcasts can also be lectures, following a classroom style (*A Brief History of Mathematics*). The versatility and convenience of podcasts are a great way to share science with the public. From general interest science podcasts (*Big Picture Science*) to niche ones (*Carry the Two*), podcasts bring science out of the classroom and into the pockets of everyone (Cunsolo, 2019).

Obstacles to Listening to Science Podcasts

Not everyone listens to podcasts, and not all podcast listeners listen to science podcasts. There are two main reasons for this: a potential listener's demographics along with their social connections and the listener's technological limitations. To increase podcast listenership, creators need to be aware of these obstacles. With this knowledge, they can reach a larger audience and increase science awareness (Tobin, 2022).

A person is more likely to listen to a podcast if they are curious about the subject. In a survey study by Stephanie J. Tobin and Rosanna E. Guadagno (2022), individuals who scored high in openness, curiosity, and extroversion were more likely to listen to podcasts. These individuals also used technology in other aspects of their lives, so listening to a podcast using an app on their phone was not a challenge.

Men listen to more podcasts than women, possibly because they use technology to gain information, whereas women focus more on connecting with others. Connected to this are social interactions. If a social circle does not encourage science literacy, a person in this group may not discover new podcasts or consider listening to podcasts at all. However, many listeners of podcasts feel they have a connection with the host. A podcast host can become part of a listener's informational social circle if the initial listening barrier can be overcome. Then, other group members, regardless of gender, are more likely to listen (Tobin, 2022).

Listeners find podcasts in a variety of ways, and some of these ways do not encourage the discovery of science podcasts. Dobkin and Satheesh (2020) found that listeners often started listening to a podcast because the host was a celebrity they already knew and enjoyed. This can be a challenge for science podcasters to overcome because few scientists are known in popular

culture. Additionally, the algorithms of podcast apps like Apple and Spotify promote creators who are already well-known, which can limit the new content a listener might discover. Algorithms in streaming services also hinder science podcast discovery by only exposing the listener to the same content they already enjoy. However, the authors noted that some listeners expressed interest in using a separate app or changing the algorithm within a streaming app that showed them a more diverse selection of podcast topics. This could lead them to discover lesser known but equally interesting podcasts on various topics, including science (Dobkin, 2022).

Type of Science Videos That Produce the Best Results

While podcasts are delivered primarily in an audio format, there is an increasing trend in creating video podcasts or recording a podcast in both an audio and video format. The content is the same, but more people can access science because it is delivered in more formats. For example, some YouTube channels have turned their videos into podcasts (Eons), demonstrating that audio and video media can be interchangeable. This easy access to information, be it a podcast or video, connects listeners to the hosts, 65% of whom are scientists. From Neil Degrass Tyson to Seth Shostak, more scientists are becoming minor celebrities thanks to the spread of science communication (MacKenzie, 2019).

When creating videos, the goal is to combine accurate science concepts with design techniques that keep a student engaged and entertained. One aspect to consider is the length of the video. A research study where students either watched two ten-minute videos or one twenty-minute video found that the results differed based on gender and learning ability. For all the students, the length of the video did not impact scores on quizzes taken immediately after watching them. However, boys and those with learning disabilities remembered the information

for a longer time from the shorter videos. Videos that can be tailored to a certain type of student can be made to a certain length, and shorter is often preferable for any student. The students reported being more interested and engaged with shorter videos. This technique could help with retention because smaller chunks need to be processed at one time (Slemmons, 2018).

Science videos today can be quite complex, with a lot of information to import. The content presented can impact how much a student comprehends. Derek Muller (2005), the creator of the award-winning science video show, *Veritasium*, studied what design elements a focus group found most useful to their understanding of a science video. The focus groups comprised college physics students with varying interests and expertise in science. They all watched the same animated video that used a cat landing on its feet to explain terminal velocity. The top feature the students commented on that made the video work was the context of the video. Using animation, science could be explained without damaging any cats, and in that animated world, it was easier to understand the concept visually. Along with the context, they rated the explanation high. The narration was needed to explain the cat's purpose and how terminal velocity was explained by the animated cat falling (Muller, 2005).

An important concept to remember when creating science content, whether podcasts or videos, is the intended audience. The focus group in this study consisted of college students, and no matter their interest level in physics, they all commented that the video would be more suited for middle and high school students. This was not just because it was animated but also because a cat was used to explain a physics concept. The students with a high interest in science added that this was the type of video they would use when teaching younger students. Those in the

focus group who stated they had a low interest in physics felt that a lecture could have explained the concept just as well (Muller, 2005).

Three Types of Curiosity

One of the most important human traits is curiosity. This need to find new experiences, gain knowledge, and explore unknown environments has motivated humans of all ages, both now and in the past (Heinemann, 2022). Since humans are so curious, it makes sense that they would study curiosity. One of the original and longest-lasting studies was by psychologist Daniel Berlyne. In his 1954 paper, he defined two types of curiosity still used by researchers today: diversive curiosity and epistemic curiosity (Butcher, 2024).

Epistemic curiosity is a desire for knowledge. Inside epistemic curiosity is specific curiosity, which explains why people may be curious about one topic but not another. They have a specific interest, and focusing their curiosity on something else can be difficult. Diversive curiosity is similar to epistemic curiosity, but along with a desire for knowledge, it has the added influence of looking for something novel. If a person has low diversive curiosity, they will stick with learning methods they are familiar with, while people with high diversive curiosity are always looking for the next new thing (Butcher, 2024).

Anthropologist Gregory Bateson, collaborator and husband of Magaret Mead, described a third type of curiosity in a 1973 paper. Empathic curiosity is curiosity that is shared with others. People with high empathic curiosity share what they have learned with others and listen to what others are sharing, too. These people have a curious attitude and search out ways to share with others so that all of society benefits. This form of curiosity can be strongest in people who work

well in groups, which is one reason why humanity is as connected as we are. We want to feed our empathic curiosity (Butcher, 2024).

Curiosity manifests in many ways. One way that can help people learn more is by learning more. The more a person knows about a subject, the more they want to know. Treating this as a mystery, not just a puzzle, can have longer-lasting results. It is as if they have received a taste and cannot stop once their epistemic curiosity is engaged. Another way is with creativity. Bringing something new into the world can increase diversive curiosity. Triggering this type of curiosity can also happen if old information is presented in a new way. For empathic curiosity, a shared experience can cause this curiosity to increase. Learning from others makes us want to learn more from others (Butcher, 2024).

CHAPTER THREE

METHODOLOGY

Demographics

Montana State University, located in Bozeman, Montana, is a public land-grant university. It is the largest university in Montana, with an undergraduate population of 14,631 students in Fall 2022. There were 4,901 (33.5%) freshmen, 3077 (21.0%) sophomores, 2,584 (17.7%) juniors, 3,524 (24.1%) seniors, and 542 (3.7%) students in other categories. Of the undergraduates, 7,737 (52.9%) were male, 6,798 (46.5%) were female, and 96 (0.6%) were non-identified. The majority of students, at 12,308 (84%), were White. The next largest group comprised 821 (5.6%) Hispanic or Latino students. American Indians and Alaskan Natives made up 168 (1.2%) of the students, and there were 167 (1.1%) Asian students. Fifty-eight (0.4%) of undergraduate students were Black or African American (Office of Planning and Analysis, 2022).

The undergraduate students in my focus group were all employees at the Rendezvous Dining Pavilion on the Montana State University campus. Eight-six students worked in the building for up to 20 hours a week. Their ages ranged from 18 to 25 years old and from first to fifth year. I used a science interest survey to create a smaller group to test my focus question.

Treatment

In January 2024, when the students returned to Rendezvous, I asked them to complete a survey. From their responses, I separated them into two groups: those with science majors and those that were not. For some degrees, like those in the College of Arts and Architecture and the College of Business, placing students in the non-science major category was easy. Others, like

those in the College of Engineering or Nursing, were harder to decide. I used one of the survey questions to help me separate science majors from non-science majors.

Since my action research question involved non-science majors with a low interest in science, I went through the list of non-science majors to find those who marked It's okay, Not really, or Absolutely not! for the question, Would you say you like science? The question had four options, with the other being Absolutely. From this smaller sample, I counted how many students answered each question choice. Very few students answered Absolutely not! and Not really, so I only excluded students who had marked Absolutely. From the remaining students, I created my focus group.

One of the questions in the Survey asked what science topics interested the students. There was not one topic that all the students agreed they had a low interest in, so I split the focus group into three groups. I then wrote, recorded, and edited six podcasts for the students to listen to so each subgroup listened to three original podcasts. All the students listened to the same general science podcasts. The other two podcasts varied for each subgroup so that the topics were not interesting to those students (Table 1). This gave me the greatest chance of seeing if there was any improvement. From the first survey, I knew the most popular way students liked to listen to podcasts, so I added my podcasts to that platform. I wanted the students to interact with these podcasts like any other ones they had enjoyed.

Table 1. Chart of podcast episodes listened to by each subgroup.

Topic	Length (Minutes)	Sub-group 1	Sub-group 2	Sub-group 3
General Science	12	X	X	X
Anthropology	5	X		
Oceanography	9	X		
Chemistry	12			X
Physics	6		X	X
Earth Science	10		X	

I then wrote pre- and post-surveys to measure any change using multiple-choice and 1-5 rating questions. After receiving IRB approval for these surveys, I gave my focus group an online pre-survey and a link to the three podcasts. Depending on the students' choice, I either emailed or texted them. Every time I communicated with the focus group members, I asked them to respond so I could keep track of who was actively participating and who I needed to speak to in person to ensure they could access and act on the information I sent.

Along with the survey and podcasts, they were given information on how to listen to them, including where they could find the podcasts, the title, topic, and length of each podcast. I also provided a form so that the students could record their thoughts as they listened and include information like where, when, and what they were doing while listening. In my instructions, I encouraged them to fill out the documents as soon as possible after listening. I wanted them to write down their thoughts so that the post-survey, which might not be taken immediately after listening to the podcast, would reflect their opinions at the time.

In addition to receiving emails or texts from the students on their progress, they were to contact me once they had listened to all three podcasts. At that point, I sent them an online post-

survey. Once they returned it, I compared all the answers to see what more information I wanted from my focus group.

I worked at Rendezvous with many of the students in my focus group so I could interview them in person during our breaks. Their answers were added to their post-survey for a more rounded result. I used semi-structured interview questions because I knew from interviewing students that they normally give one or two-word answers unless encouraged to say more. With semi-structured questions, I hoped to keep them on topic and give them room to express their opinions beyond yes or no.

The research methodology for this project received an exemption from Montana State University's Institutional Review Board, and compliance for work with human subjects was maintained (Appendix A).

Data Collection and Analysis Strategies

To find the students for my focus group, Montana State University undergraduates working at the Rendezvous Dining pavilion took a Science Interest Survey, which asked how interested they were in science (Appendix B). The initial questions asked them what their major was and when they graduated. To be considered for the focus group, students had to have a non-science major and be in school during the entire study. Two questions asked if the students listened to podcasts and how they listened. Students in the focus group did not need to listen to podcasts regularly. I asked these questions because if most students were unfamiliar with podcasts, I would introduce them to the podcast streaming landscape.

Two of the questions asked how the students felt about science, and students could pick science topics they liked from a list. Some, like geology and physics, were obvious sciences.

Other areas, like engineering and math, were less clear. To get an idea of what the students considered science, I asked them to pick from a list of vague science topics. These questions helped me create science-based videos for the focus group using topics they told me they had no interest in.

The final question asked the students if they wanted to be in the focus group. Joining the focus group was voluntary. Those who said they were uninterested were not included in further data analysis. The primary purpose of the Science Interest Survey was to assemble a focus group for my action research. To that end, I used the answers to eliminate students and uncover topics for the podcasts. I did not use this survey to answer my research question.

There were not three science topics that all twenty students had a low interest in, so I split the group into three subgroups. One subgroup comprised of six students, listened to podcasts about anthropology and oceanography. The second subgroup of eight students listened to Earth science and physics episodes, and the third subgroup of six students listened to chemistry and physics episodes. All the subgroups listened to the same episode on general science. In total, each student listened to three podcasts.

Before the students listened to any podcasts, they were sent the Initial Science Interest Survey as a Microsoft Form. This survey was designed to assess how much the students in the focus group enjoyed science before listening to the podcasts (Appendix C). Questions four and five asked students to rate how much they looked forward to learning about the two specific topics assigned to them. These two questions allowed me to assess their change in diversive curiosity. Questions six and seven asked of the questions asked students to rate how curious they were about the science topics, which would show changes in their epistemic curiosity. Questions

eight and nine were multiple-choice questions to gauge their empathic curiosity. When asked if they would discuss these topics with friends and family, they could choose, Never, I might if the other person brings it up, or Sure.

Each student was emailed or texted instructions for listening to the podcasts and what was required of the focus group (Appendix D). The message included various links to the podcasts on Spotify so they could listen in a familiar way (Appendix E). As the students listened to the podcasts, they used a Podcast Reflection Sheet to jot down anything they found interesting or had questions about (Appendix F). At the top was the podcast's name and a place where they could write the date they listened and what they were doing while they listened. There was a space below where they could write their thoughts while listening to the podcasts. The purpose of the Podcast Reflection Sheet was to help the students complete the Final Podcast Listening Survey (Appendix G). I collected the Podcast Listening Reflection forms to see the comments, use the data for qualitative analysis, and learn how to improve the podcasts.

After the students listened to all the podcasts, they took the Final Science Interest Survey to see if their interest in science had changed (Appendix G). The questions were designed similarly to the initial survey to see if the results had changed and assess whether there had been improvements in their various types of curiosity. The questions were asked for each of the low-interest science topics. One additional question asked if students thought adding podcasts to a science curriculum would increase interest in science among students.

Table 2. Data Triangulation Matrix.

	Data Collection Methods			
Research Question	Source 1	Source 2	Source 3	Source 4
Can science podcasts increase science curiosity among students with a low interest in science?	Science Interest Survey	Initial Interest in Science Survey	Podcast Listening Reflection Sheets from Students	Post-Podcast Listening Survey

CHAPTER FOUR

DATA ANALYSIS

Results

The results of the Final Science Interest Survey indicated that 95% of the students in the focus group enjoyed the specialized podcasts assigned to them even though they had low interest/diversive curiosity in the subject, 40% increased their epistemic curiosity after listening to the specific podcasts, and 75% had an increase in empathic curiosity meaning they would be more willing to talk about the topic with friends and family (Figure 1), (*N*=20).

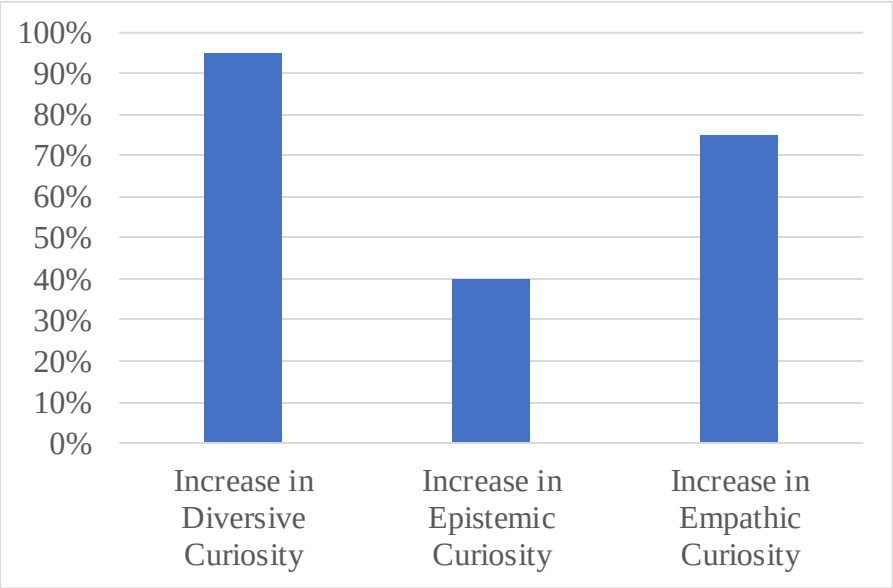

Figure 1. Percentage of focus group members who showed increased curiosity after listening to the specified podcasts, (*N*=20).

The podcasts caused different reactions from different students. About the physics podcast, one student wrote, “Head slightly exploded HAHA, but also amazing.” Another student said, “I remember when I learned this in my physics class in high school, it confused me in high

school, and after listening to this podcast, it's less confusing." A student new to the physics topic texted, "The quantum realm thing confused me; thought that was like a Marvel thing."

All students listened to the same general science podcast. Forty percent of the focus group increased their epistemic curiosity about general science topics after listening to the podcast (Figure 2). Empathic curiosity also increased, with 55% of students considering discussing science with friends and family (Figure 3). The general science podcast consisted of five science facts and five debunked myths. Different students found their curiosity peaked about different facts. One student who had listed no interest in anthropology on his focus group survey said, "Maybe anthropology is more interesting than I gave it credit for." Another student found a different fact intriguing: "I found the topics on this podcast interesting. I especially liked the discussion on the percent of the brain we use."

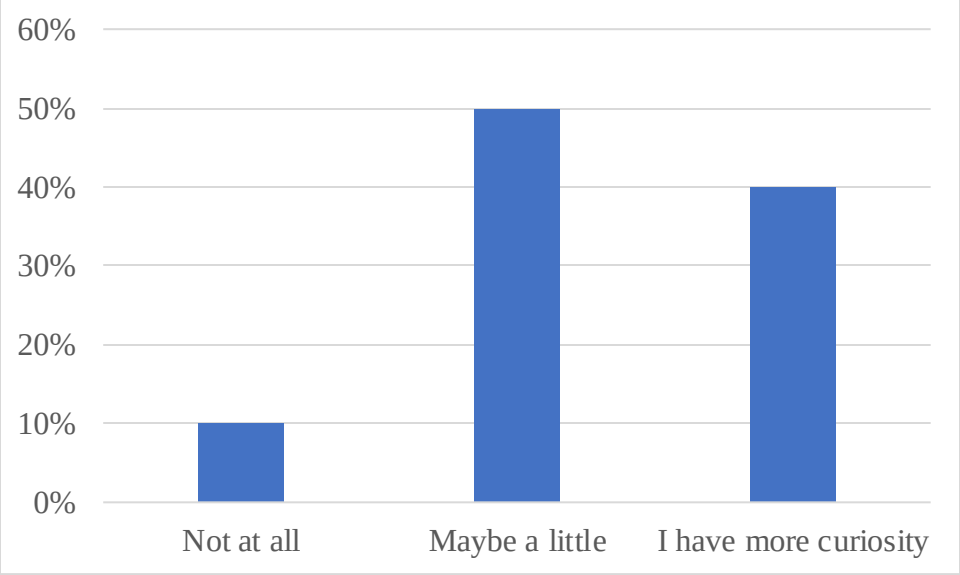

Figure 2. Percentage of Responses to Final Science Interest Survey, Did the podcast about debunking science myths increase your curiosity about general science? (Question 11), (*N*=20).

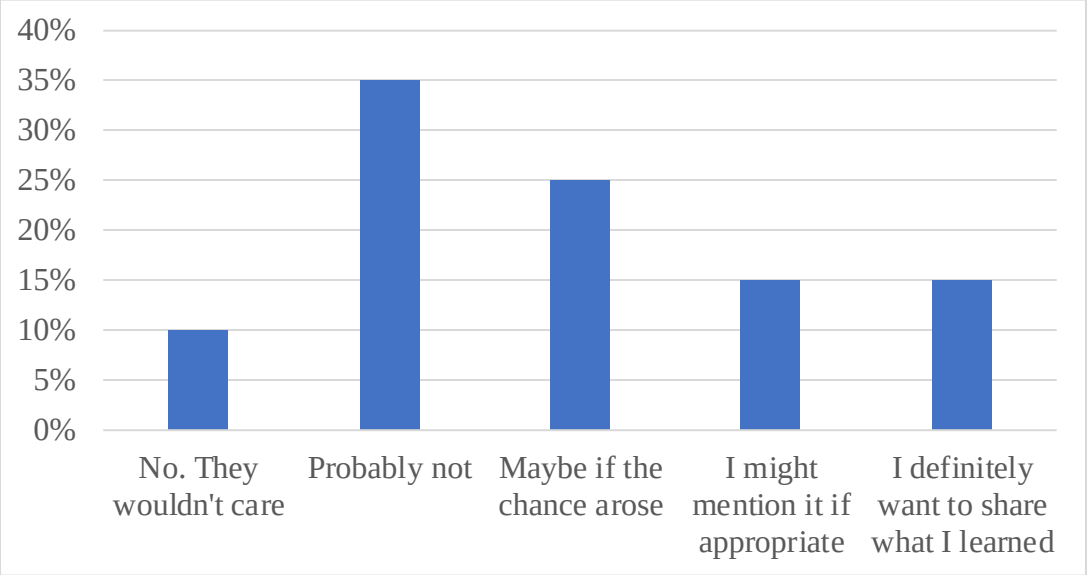

Figure 3. Percentage of Responses to Final Science Interest Survey, Would you share what you learned about general science with your friends and family? (Question 13), (*N*=20).

Since my focus group was split into three groups of six, six, and eight, I did three t-tests to find the null hypothesis for each subgroup. I compared group one, who listened to an anthropology and oceanology podcast, to group two, who listened to an Earth science and physics podcast. Group two was compared to group three who listened to a chemistry and physics podcast. Group one and group three were also compared. Instead of seeing if the data had significant differences, I wanted to ensure the data lists met the null hypothesis ($p>0.05$) with no significant differences between the answers even though different podcast episodes were used. Meeting the null hypothesis meant that I could combine the answers of the three subgroups as a sample size of 20 instead of six, six, and eight. All the data for T-tests one and three met the null hypothesis. One of the questions in T-test two did not meet the null hypothesis, but at $p=0.04$, it was close enough that I decided the subgroups could be combined without affecting the results. (Figure 4).

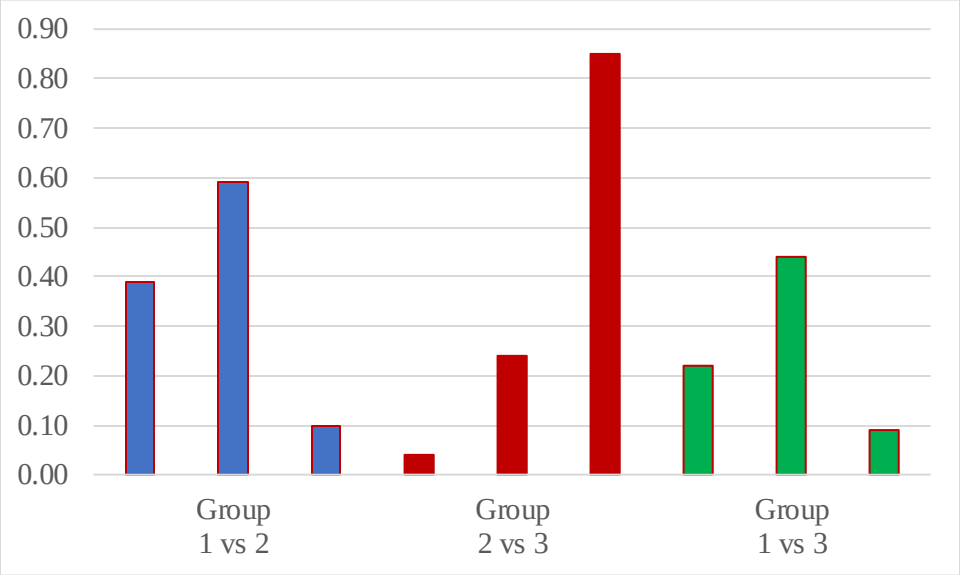

Figure 4. T-Test results for the three subgroups. The null hypothesis is 0.05, (*N*=20).

To answer my focus question about whether curiosity increased by listening to science podcasts, I did T-tests and event size calculations between the initial and final survey answers. The results of these tests would show if the change in curiosity from before listening to the podcasts to after was large or small. The T-test showed a significant difference at the 95th percentile ($p<0.05$) for diversive curiosity. The same held for empathic curiosity. For epistemic curiosity, the null hypothesis was met (0.28), and the difference in curiosity before and after listening to the podcasts was not significant. These results were mirrored in the event size. Both diversive and empathic curiosity showed a large-event size effect (1.40 and 1.33). Epistemic curiosity showed only a small effect (0.38). There was a statistically significant change between the initial and final survey answers ($p<0.05$) (Table 3).

Table 3. Statistical results between the Initial Science Interest Survey and the Final Science Interest Survey for the specific topic podcasts, (*N*=20).

Test	Diversive Curiosity (Large)	Epistemic Curiosity (Small)	Empathic Curiosity (Large)
T-Test P	0.00	0.28	0.00
Event Size	1.40	0.38	1.33

CHAPTER FIVE

CLAIM, EVIDENCE, AND REASONING

Claims From the Study

Based on the evidence from this study, I can confidently make the following claims: overall curiosity for science increases, but not a lot since the students in my focus group were already curious about science, curiosity in science topics with low interest among students can change when listening to podcasts, and the desire to share this newfound interest with others also increases.

Diversive curiosity includes an interest in the subject and how novel the way the subject is being learned. Nineteen of the twenty students in my focus group did not listen to science podcasts, and the one student who did listen to science podcasts only listened to one. For most of these students, science podcasts were a novel way of learning science. Unlike a class lecture, which often has the teacher pouring information onto the students, podcasts combine education and entertainment. The podcasts I created had humor, intermissions, sarcasm, and a passionate speaking style. These novel changes helped increase their diversive curiosity.

Anyone who does not know something about a topic will be reluctant to talk about it with others. Those who do so often sound uninformed, which can harm how others judge them and how they feel about themselves. However, people want to share what they know, so empathic curiosity increased after the students listened to the podcasts. They increased their knowledge of science topics they were unfamiliar with and were more willing to share their newfound knowledge afterward. This is an advantage of podcasts. Unlike a class lecture that may have to

meet some teaching guidelines for a test or study unit, podcasts can share fascinating and unusual information. For example, in the oceanography podcast, I described a squat lobster that is neither squat nor a lobster. This is the type of easily shared information that increases empathic curiosity.

The students in my study group were college undergraduates with a strong sense of curiosity. Based on their survey answers, it was unsurprising that they did not have a large increase in epistemic curiosity. Even though they did not know much about the topic before listening to the podcast, they did have a high curiosity level. Most successful students who voluntarily attend college have a well-developed sense of curiosity, or they would do something else with their time. Knowing these students were willing to listen to the podcasts and participate in the study group gave me the challenge of picking podcast topics that would increase their already well-developed epistemic curiosity. There was a small increase in this area, so the podcasts were a success.

Value of the Study and Consideration for Future Research

Podcasts are a convenient way to learn because students can listen whenever and wherever they want. It is a great medium to extend science teaching outside of the classroom. YouTube videos are common, but podcasts can also be effective in adding more information to a lesson plan. Many science podcasts are available for students to learn from, so teachers do not need to create their own. However, the technology needed to record and distribute podcasts is easily available and potentially free. Many public libraries have recording studios, and streaming services such as Spotify have options that allow you to download podcasts for free. The low cost

allows students and teachers to create science podcasts to share what they have learned with others.

While my research showed increased curiosity using podcasts, my focus group consisted of undergraduate students, many of whom took science classes. Montana State University is a research school, so many students would be interested in science. To truly see how podcasts can be effective, a different group of students should be used as the focus group. Instead of students who willingly pay for higher education, a group of high school students with no choice but to take a science class might give different results. The ideal group would have little to no interest in science on any subject, so they could all listen to the same podcasts.

Studying groups with less interest in science may yield more definitive results, either positive or negative. This evidence could reinforce the value of podcasts, which may encourage more teachers to add them to their curriculum. Or it could show no effect, and teachers would know not to add podcasts to their already overwhelmed schedules. More research using a focus group of students with a low interest in science would be helpful in planning. Whether more research is done or not, listening to podcasts has very few disadvantages.

Impact of Action Research on the Author

I enrolled in the MSSE program, not because I am a traditional classroom teacher, but because I am interested in science communication through social media. Specifically, I want to create podcasts to bring fascinating science to the public, both those who are no longer in school and those who were not that interested in science when they were in school. I have created podcasts in the past, but they were not science-based. Through my podcasting experience, I have

the technical knowledge, but I did not know if I had the storytelling ability to make science interesting. An MSSE degree would help me reach my new podcasting goal.

By doing action research on science podcasts, I learned that podcasts could increase curiosity in science and that I can create science podcasts that people want to listen to. When I handed out the reflection sheets to my focus group, I told them to be completely honest in what they wrote. I also told them to write anything they thought about while listening to the podcasts. Many of the comments, as listed above, had to do with the science topics, but some of them had to do with the podcast recording themselves. While most of these students know me from work, many said I did a good job creating the podcast, and they enjoyed listening to me speak. These comments were written down. A few students told me in person what they liked and did not like about the podcasts. Their input was just what I needed to hear and will help me become a better science communicator.

REFERENCES CITED

Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology*, *45*(3), 180.

ABC News. (2014). '80s, '90s educational shows we wish would come back. *ABC News.* https://abcnews.go.com/Entertainment/80s-90s-educational-shows-back/story?id=23913784

Bgiraudi. (2016). The printing press during the scientific enlightenment. *The Scientific Enlightenment, Algoma University.* https://scientificenlightenment4726.wordpress.com/

Butcher H.K. (2024). Originating research ideas. *Nursing Science Quarterly*, *37*(1), 9-17. https://10.1177/08943184231207371

Cunsolo, M. (2019). Podcasts vs traditional media: What's the difference? *Podcast.Co* https://blog.podcast.co/inspire/podcasts-vs-traditional-media#:~:text=Although%20there%20is%20a%20wide,topics%20to%20more%20niche%20areas

Dobkin, B., & Satheesh, B. (2020). To compliment a complement? Modeling new avenues for podcast content discovery. *Cornell University Library.* https://ecommons.cornell.edu/items/1193c8a0-391b-48c7-bffe-61e7b4b38e56. https://doi.org/10.7298/4rq3-9x77

Heinemann, H., Mussel, & Schäpers, P. (2022). Curious enough to start up? How epistemic curiosity and entrepreneurial alertness influence entrepreneurship orientation and intention. *Frontiers in Psychology* https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2022.1003866/full

Howarth, J. (2023). How many podcasts are there? (New 2023 Data). *Exploding Topics.* https://explodingtopics.com/blog/number-of-podcasts

Hughes, T. (2022). Why was 900 years of european history called ‘the dark ages’? *HistoryHit.* https://www.historyhit.com/why-were-the-early-middle-ages-called-the-dark-ages/

Leslie, I. (2014). *Curious.* Basic Books.

MacKenzie, L. E. (2019). Science podcasts: Analysis of global production and output from 2004 to 2018. *Royal Society Open Science.* https://royalsocietypublishing.org/doi/10.1098/rsos.180932

Maktoufi, R. (2021). From Sputnik to Twitter: The history of science communication. *Science Friday.* https://www.sciencefriday.com/articles/science-communication-history/

Muller. D., & Sharma, M. (2005). Determining the factors affecting student perceptions of a popular science video. *Australasian Journal of Educational Technology*, *21*(4), 491–509. http://dx.doi.org/10.14742/ajet.1316

Office of Planning & Analysis. (2022). Montana State University Institutional Profile. *Montana State University*. https://www.montana.edu/opa/facts/current-year.html

Shearer, B. (2019). Leonardo da Vinci: Renaissance science communicator. *PLOS SciComm*. https://scicomm.plos.org/2019/11/13/leonardo-da-vinci-renaissance-science-communicator/

Slemmons, K., Anyanwu, K., Hames, J., Grabski, D., Misna, J., Simkins, E., & Cook, P. (2018). The impact of video length on learning in a middle-level flipped science setting: Implications for diversity inclusion. *Journal of Science Education and Technology*, *27*(5), 469–479. http://dx.doi.org/10.1007/s10956-018-9736-2

Tobin, S. J., & Guadagno, R. E. (2022). Why people listen: Motivations and outcomes of podcast listening. *PLoS ONE, 17*(4), e0265806. https://doi.org/10.1371/journal.pone.0265806

Treadwell, S. (2021). A history of science communication. *Blue Marble Space Institute of Science*. https://bmsis.org/a-history-of-science-communication/

APPENDICES

APPENDIX A

MSU INSTITUTIONAL REVIEW BOARD EXEMPTION FOR CAPSTONE

Your protocol was reviewed by the IRB and has been approved.

PI: Vandenberg, Jennifer
Approval Date: 1/22/2024
Title: AN INVESTIGATION INTO WHETHER PODCASTS CAN INCREASE NON-SCIENCE STUDENTS' INTEREST IN SCIENCE

Protocol #: 2024-1025-EXEMPT
Review Type: Exemption
Expiration Date: 1/22/2029

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describes research practices being conducted.

Institutional Review Board for the Protection of Human Subjects | Office of Research Compliance | Montana State University

.

APPENDIX B

SCIENCE INTEREST SURVEY

I am looking for students willing to participate in my Capstone project's focus group. You would listen to several podcasts during the spring 2024 semester and take a before and after survey. All answers are confidential, and your names will not be used. This survey is to both help me find students for my focus group and improve the podcasts I am creating for the research.

1. Please provide your full name.

2. In what month and year are you graduating?

3. What is your major?

4. How many podcasts do you currently listen to in a week?
   - o 0
   - o 1-5
   - o 6-10
   - o 11 or more

5. How do you listen to podcasts? (Mark all that apply)
   - ☐ Apple (iTunes)
   - ☐ Google
   - ☐ Spotify
   - ☐ YouTube
   - ☐ Other _____

6. Would you say that you like science?
   - o Absolutely
   - o It's okay
   - o Not really
   - o Absolutely not!

7. Do you like to learn about any of these sciences? (Mark all that apply)

   - ☐ Anthropology
   - ☐ Astronomy
   - ☐ Biology/Botany
   - ☐ Chemistry
   - ☐ Geology/Earth Science
   - ☐ Oceanology
   - ☐ Physics
   - ☐ Zoology

8. Would you classify any of the following subjects as science? (Mark all that apply)
   - ☐ Art
   - ☐ Computer coding
   - ☐ Economics
   - ☐ Education
   - ☐ Engineering
   - ☐ Genetics
   - ☐ History
   - ☐ Math
   - ☐ Nursing
   - ☐ Psychology
   - ☐ Sociology
   - ☐ Writing

9. Are you interested in learning more about science?
   - o Yes
   - o No
   - o Maybe

10. Are you willing to help me with my Capstone project by listening to several science podcasts and taking two confidential surveys?
    - o Yes
    - o No
    - o I would need to know more, but possibly.

11. If you want to be involved in my research, please provide your email below.

APPENDIX C

INITIAL SCIENCE INTEREST SURVEY

Before listening to three podcasts for Jennifer Vandenberg's research focus group, take this survey.

1. Provide your full name.

2. How many science podcasts do you listen to in a week?

3. If you typed 1 or higher above, what is your favorite science podcast?

4. How much do you like learning about XXX?

    Give one to five thumbs up

5. How much do you like learning about YYY?

    Give one to five thumbs up

6. You will be listening to a podcast on XXX. How curious are you to listen?

    Give one to five thumbs up

7. You will be listening to a podcast on YYY. How curious are you to listen?

    Give one to five thumbs up

8. Do you ever discuss XXX with friends or family?

    - *Never*
    - *I might if the other person brings it up*
    - *Sure*

9. Do you ever discuss YYY with friends or family?

    - *Never*
    - *I might if the other person brings it up*
    - *Sure*

10. Do you think your interest in XXX or YYY could change?

    - *Probably not*
    - *Maybe XXX but not YYY*
    - *Maybe YYY but not XXX*
    - *Maybe both XXX and YYY*
    - *Sure, I'm always open to new ideas*

APPENDIX D

EMAIL WITH PODCAST INSTRUCTIONS

I am creating three podcasts for you to listen to. They are between ten and fifteen minutes each. The link to the first one is below. It is found on Spotify. If you cannot open it, please let me know as soon as possible.

I plan to send you the links to all three podcasts by Friday. Email me once you listen to all three, and I will send you the final survey. You have until the end of spring break, March 17, to listen to the podcasts and complete the survey. My statistics class starts on March 18, so I need your responses by then.

To help you remember what you listened to, since I am sending them to you separately, I have included a reflection sheet. I will also hand you one in person, so you don't have to print it out. Use this however you want so you can answer the final survey accurately.

APPENDIX E

LINKS TO PODCASTS

Spotify Channel: A Single Light

https://open.spotify.com/show/18PZgKHYgy94ZODedSvvfT

General Science Episode – Let's Bust Some Science Myth

https://spotifyanchor-web.app.link/e/7IR4OLPMNHb

Anthropology Episode – Spark - A Time Before Talking

https://podcasters.spotify.com/pod/show/jennifer-v49/episodes/Spark---A-Time-Before-Talking-e2grk0r

Chemistry Episode – The Day Dmitri Took the Train and Revolutionized Chemistry

https://spotifyanchor-web.app.link/e/AXrn8LPMNHb

Earth Science Episode – The Earthquake We Never Talk About

https://spotifyanchor-web.app.link/e/WwFbxLPMNHb

Oceanography Episode – Fascinating Finds "Under the Sea"

https://spotifyanchor-web.app.link/e/ympKcLPMNHb

Physics Episode - The Double-slit Dilemma

https://open.spotify.com/episode/4mzUigXWosLWJcHcekEJQp

APPENDIX F

PODCAST REFLECTION SHEETS

Name_____

Name of podcast:

Date listened:

Time of day when listened:

What were you doing as you listened?

Number of listens:

Feelings, thoughts, insights while listening (continue on back if needed):

Name of podcast:

Date listened:

Time of day when listened:

What were you doing as you listened?

Number of listens:

Feelings, thoughts, insights while listening (continue on back if needed):

Name of podcast:

Date listened:

Time of day when listened:

What were you doing as you listened?

Number of listens:

Feelings, thoughts, insights while listening (continue on back if needed):

APPENDIX G

FINAL SCIENCE INTEREST SURVEY

Before listening to three podcasts for Jennifer Vandenberg's research focus group, take this survey.

1. Provide your full name.

2. You listened to a podcast about XXX. Rate how much you enjoyed the podcast.

    Give one to five thumbs up

3. Did the podcast about XXX increase your curiosity about XXX?

- *Not at all*
- *Maybe a little*
- *I have more curiosity about this subject*

4. Would you share what you learned about XXX with your friends and family?

- *No. They wouldn't care*
- *Probably not*
- *Maybe if the chance arose*
- *I might mention it if appropriate*
- *I definitely want to share what I learned*

5. Would you listen to other podcasts about XXX now that you have heard this one?

- *No, thank you*
- *If one came into my feed, I might click on it*
- *I might search for a podcast about XXX*
- *I am definitely going to listen to more podcasts about XXX*

6. You listened to a podcast about YYY. Rate how much you enjoyed the podcast.

    Give one to five thumbs up

7. Did the podcast about YYY increase your curiosity about YYY?

- *Not at all*
- *Maybe a little*
- *I have more curiosity about this subject*

8. Would you listen to other podcasts about YYY now that you have heard this one?

- *No, thank you*
- *If one came into my feed, I might click on it*
- *I might search for a podcast about YYY*
- *I am definitely going to listen to more podcasts about YYY*