Spring 5-4-2022

What is the Satisfaction of Youth Participating in a Pilot Reading and Food-Based STEM Education Program in Rural Appalachian Mississippi?

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WHAT IS THE SATISFACTION OF YOUTH PARTICIPATING IN A PILOT READING AND FOOD-BASED STEM EDUCATION PROGRAM IN RURAL APPALACHIAN MISSISSIPPI?

By
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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College.

Oxford, MS
December 2021

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DEDICATION

This thesis is dedicated to all who have encouraged and supported me throughout my college experience.

ACKNOWLEDGEMENTS

I would like to thank Dr. David H. Holben, my thesis advisor, for guiding and motivating me throughout this process. I would like to thank my committee for their commitment to supporting me through this process. I would like to thank the Sally McDonnell Barksdale Honors College for the many opportunities offered to me throughout my college experience. I would also like to thank my family and friends for supporting and uplifting me in all of my academic ventures at the University of Mississippi.

ABSTRACT

Science, technology, engineering, and mathematics (STEM) education is a vital subsection of primary education which focuses on imparting knowledge to foster STEM literacy and ultimately bolster the workforce of STEM related fields (Holmlund, 2018). Due to both geographic and socioeconomic challenges, STEM education in rural areas suffers from a lack of engaging learning opportunities and contributes to a shortage of STEM professionals originating from rural areas (Munn, 2019)(Murphy, 2020). Rural areas such as Calhoun County, MS, where the pilot program associated with this thesis was conducted, do not have the means to support interactive learning institutions such as aquariums and science centers, which can hinder the youth of the area's interest in STEM (Munn, 2019). Informal learning environments play a valuable role in STEM education. Encountering STEM concepts in an informal learning environment gives students the opportunity to make 'real world' connections to concepts that are traditionally taught in abstract ways and encourages students to form a personal connection and interest in the topic they are exploring (Vela, 2020). The pilot program associated with this thesis sought to engage K4-8th grade students with a reading and food-based STEM education curriculum of four weekly lessons which were pre-packaged and distributed in a drive-through format due to COVID-19. Upon completion of the program, participants were asked to denote their satisfaction with the program on multiple levels: 1) I liked doing this science activity

(LIKED); 2) I learned something new by doing this science activity (LEARNED); 3) I would do this science activity again (AGAIN); and 4) I liked reading the book as part of the science activity (READ). A 3-point “Thumbs up” Likert scale (Yes, Maybe, No) was utilized. The majority of respondents were male (72/158, 45.6%), White (127/158, 80.4%), non-Hispanic (127/158, 80.4%), and in grades K-3 (132/153, 86.3%). Respondents were highly satisfied (thumb’s up rating) with each aspect of the program: LIKED (156/158, 98.7%); LEARNED (156/158, 98.7%); AGAIN (153/158, 96.8%); READ (149/156, 95.5%). Each program was evaluated individually, yielding high satisfaction levels.

PREFACE

This thesis will seek to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children.

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Chapter 1

Science, Technology, Engineering and Math education (STEM) is an educational field with the goal of providing students with knowledge in the aforementioned subjects as a method of improving STEM literacy and strengthening the STEM-related workforce (Holmlund, 2018). The importance of STEM education for school children is a widely researched topic, with many scholars debating the efficacy of a myriad of educational styles. Research has suggested that, through a combination of STEM and literacy education, young children can greatly increase their understanding of science concepts (Finkelstein, 2020). Additionally, research has signaled that providing young students with an adequate foundation of STEM literacy can enhance their ability to successfully navigate social, political, and workplace environments as they mature (Falloon, 2020). Programs which seek to provide students with a more immersive STEM education than traditional science curriculums have become increasingly popular due to their success in developing student capabilities in reading and science thinking (Hovland, 2013). In addition, STEM education programs which utilize food concepts and grade-level appropriate literature to foster students' ability to perform scientific observations have emerged as an effective branch of STEM learning. Research specifically geared towards food and nutrition-based education programs has resulted in findings that support the efficacy of this niche of STEM education methods. (Hovland, 2013).

STEM education within rural communities poses its own, unique set of challenges. One of the most prevalent obstacles to successful STEM education in rural schools is recruiting and retaining high quality teachers, which affects the efficacy of a school's STEM education curriculum as a whole (Goodpaster, 2012). Goodpaster (2021) analyzed responses from multiple rural STEM teachers in hopes of uncovering factors that contribute to low teacher retention rate. Three of the main contributors to the unique environment of rural schools were found to be community interaction, professional development, and structure of rural schools. Teachers have been found to feel that with few ties to the community, few opportunities for professional development, and unique structure associated with some rural schools, there was not a sufficient reason for continuing to work in rural schools (Goodpaster, 2012). Without the guidance of consistent, high quality STEM teachers, youth in rural areas may suffer from subpar STEM education programs, and thus benefit from supplementary style programs hosted during school breaks.

Another important factor to consider regarding STEM education programs is the use of informal learning environments. Research has shown that fifth through eighth grade students who participated in an informal learning environment summer STEM education program were able to increase their self-efficacy scores as a result of the curriculum (Maiorca, 2020). This type of informal STEM education has proven effective at increasing students' interest in STEM careers and concepts through hands-on, interactive experiences (Maiorca, 2020) (Roberts, 2018). Many students expressed the desire to pursue a career in STEM for empathetic reasons such as helping a family member in need. These results demonstrate the importance of providing students with learning experiences geared towards connecting STEM to everyday life (Maiorca, 2020). Not only do educational programs of this type increase students' interest in STEM, but they have also been shown to increase the likelihood of students' pursuing STEM-based careers. (Roberts, 2018). STEM education within informal learning environments is beneficial due to the fact that programs of this type often give students access to interactive opportunities within the field of STEM that they would otherwise not be exposed to (Maiorca, 2020) (Roberts, 2018).

In a dissertation (Finkelstein, 2020), the effects of STEM based activities and literacy curriculum on early childhood aged students was assessed. The study was designed to support the ideology that incorporating STEM-based and literacy focused activities into childhood curriculum would increase young children's understanding of science concepts by evaluating the results of classroom curriculum taught via three second grade science units (Finkelstein, 2020). Finkelstein (2020) highlights the importance of incorporating STEM based education into childhood curriculum due to the fact that children are often naturally curious and driven to learn about the workings of the world around them in interactive ways. Throughout the childhood stage, youth are often drawn to learning new concepts and do so more successfully when they are afforded the opportunity to make tangible connections between familiar aspects of their life and new concepts. The science units that were taught in order to carry out the study utilized children's literature on each of the three selected topics, as well as literacy strategies designed to assist with comprehension of the topics themselves (Finkelstein, 2020). Through this study, Finkelstein (2020) determined that, in order for children to have meaningful learning experiences, they must be presented with content that is grade level appropriate.

The specific niche of STEM education which is most pertinent to the purpose of this thesis was explored by Hovland, Carraway-Stage, Collins, Diaz, and Collins (2013). Through their research, it was determined that food-based STEM education increases multidisciplinary science knowledge in youth. An initiative called FoodMASTER, which stands for Food, Math and Science Teaching Enhancement Resource, was designed to use food as a tool in teaching math and science concepts. Through the use of FoodMASTER curriculum, student satisfaction, interest in food based science topics, and ability to form scientific observations has been proven effective. The study utilized an interactive, food-based curriculum in a total of eighteen 4th grade classrooms in North Carolina and Ohio. Additionally, sixteen 4th grade classrooms which followed their school's standard science curriculum in both North Carolina and Ohio were analyzed as a control group. As a method of evaluation, students in each classroom participated in an assessment of their science knowledge both before and after the start of the study. Following the summative examination, the students who participated in the FoodMASTER curriculum scored significantly higher than those who were only taught a traditional science curriculum. By utilizing topics and items that students are familiar with, food based STEM education like FoodMASTER marries science concepts with 'real world' experiences that students are already invested in. The promising results of this particular study amplify the need for continued research on and implementation of similar programs within a wide variety of student demographics. In order to confirm the universal efficacy of FoodMASTER style programs, this education method must be successfully applied in various settings over a more extended period of time. Assessing students' satisfaction with learning science concepts via a food based education curriculum would also be pertinent.

The purpose of this thesis was to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children. By marrying the concepts of effective food-based STEM education and supplementary STEM programs for rural school children, this study was designed as a first step to improving the science thinking capabilities of its participants.

Table 1. Research questions and hypotheses of the study.

Research Question	Hypotheses
What is the satisfaction level of youth participating in a pilot reading and food-based STEM education program located in Rural Appalachian Mississippi in an informal learning environment.	Participating youth will be moderately to highly satisfied with the pilot reading and food-based STEM education program in an informal learning environment located in Rural Appalachian Mississippi.

Chapter 2: Review of Literature

The purpose of this thesis was to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children.

STEM Education

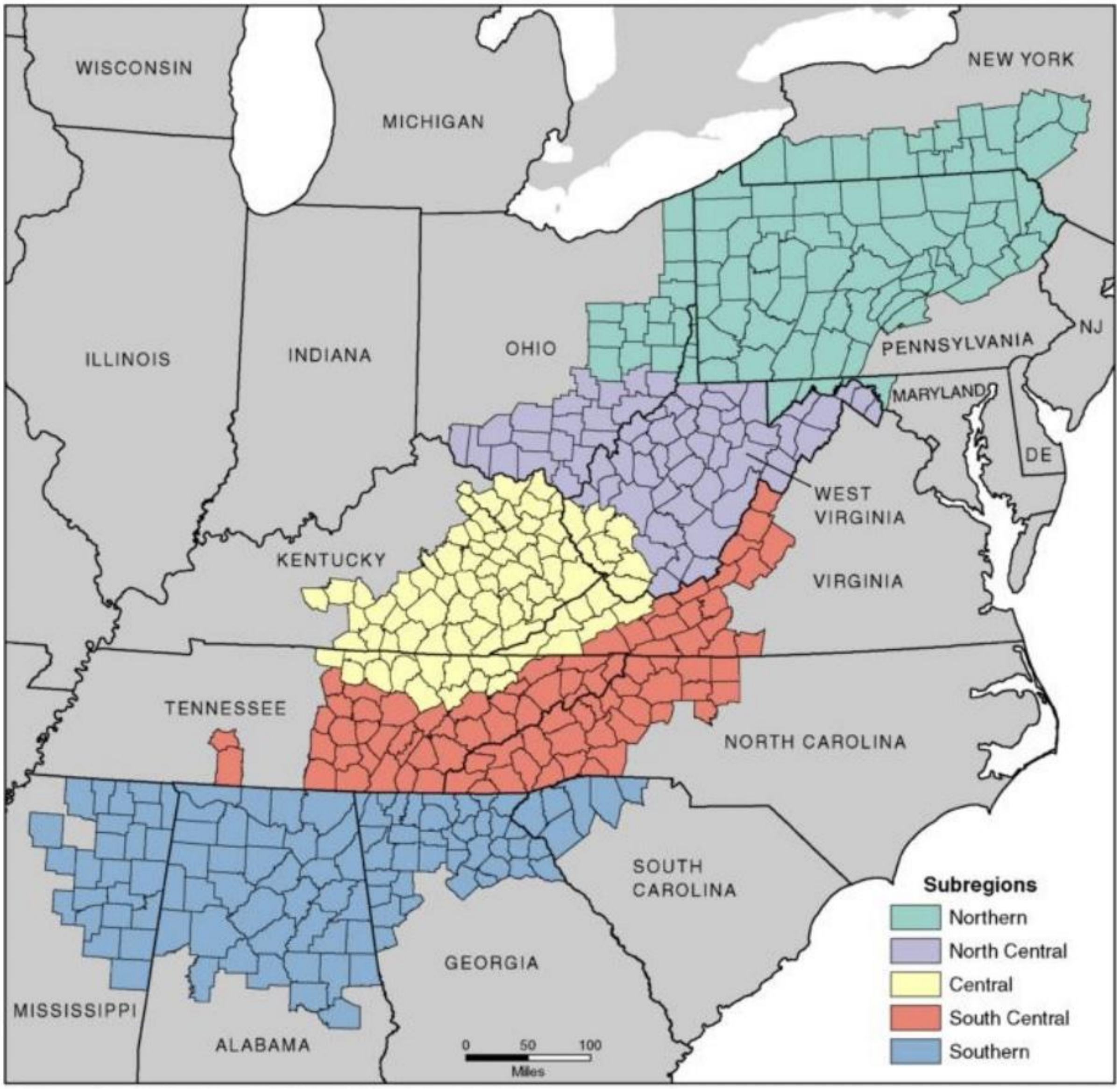
Science, technology, engineering and mathematics education (STEM) is a multidisciplinary subject which aims to impart knowledge from each discipline and teach students critical thinking skills that will prepare them for a career in one of the aforementioned fields (White. 2014). The true definition of STEM education and what it entails varies greatly based on grade level, with early elementary classes focusing on compulsory math and science concepts, and subsequent years offering more specialized, elective coursework (Xie, 2015). STEM education via a myriad of educational styles has been studied in a variety of settings and the potential to impact the future of the STEM career workforce (Holmlund, 2018).

Rural STEM Education in Appalachia

The study associated with this thesis was conducted in 2020 in Calhoun County, MS, a rural area in Appalachian Mississippi, where effective STEM education presents its own, unique set of challenges. According to the Appalachian Region Commission (ARC), Appalachia in the

U.S. is composed of 420 counties, spanning 13 states. Of these 420 counties, 107 are considered rural, including Calhoun County (ARC). Figure 1 is a map highlighting the Appalachian Region in the U.S. as designated by the ARC.

Figure 1. Map of the United States Appalachian Region of the United States (Appalachian Regional Commission, 2009).



Map by: Appalachian Regional Commission, November 2009.

In America, rural students make up a large portion of the population, with around 6.5 million students being enrolled in a rural school district. This population of rural students accounts for more individuals than the nation's 20 largest urban school districts combined and are a significant reservoir of untapped potential for the future of STEM (Harris, 2018).

While the demand for qualified individuals within STEM careers continues to grow, research has shown that a major complication with rural STEM education is a lack of access to engaging STEM related opportunities (Munn, 2019) (Murphy, 2020). School age children who reside in these rural areas often experience geographical and socioeconomic isolation from opportunities and experiences such as interacting with a wide range of STEM professionals, visiting science centers and museums designed for their age group, and interactive learning experiences like zoos and aquariums (Munn, 2019). Research has also found that, in addition to incongruence of access to educational opportunities, students residing in rural communities may suffer from disparity between local culture values and economic demand for STEM professionals. As a result of scarce access, rural communities do not often value or encourage engagement in STEM careers at the same rate as national demand. Lack of outreach programs to address these pertinent issues can often lead to rural schools being undervalued and under-assisted in improving their STEM education opportunities, which proliferates the cycle of challenges previously discussed (Harris, 2018).

A suggested solution to the scarcity of interactive STEM experiences within rural communities is to supplement classroom instruction with informal learning environment opportunities to engage students through events such as a Science and Engineering Festival.

(Munn, 2018). Festivals of this type are designed to engage and excite students about science concepts, expose students to STEM concepts and encourage students to consider a career in the fields of science, technology, engineering and mathematics (Munn, 2018). By creating an inclusive and accessible environment for students to be exposed to and engage in informal learning about STEM topics, rural school children are given the opportunity to develop their interest in STEM careers.

Types of Settings for STEM Education

Food-Based STEM Education

Science, technology, engineering and mathematics literacy is imperative to developing a holistic understanding of health concepts as well as the pursuit of a career in STEM (Duffrin, 2020). Additionally, research has found that connecting the public with accessible opportunities to comprehend STEM concepts is fundamental in technological advancement as well as the inspiration of school age children to pursue STEM based careers (Macbeth, 2020). By marrying STEM education with food-based learning, the FOODMASTER Initiative provides students with opportunities to experience interactive health science learning within their K-12 instruction environments. The mission of the FOODMASTER Initiative, was established to address and supplement the intrinsic scarcity of realistic STEM education opportunities for youth. By providing educators with engaging classroom learning activities, this program seeks to improve knowledge and perception of STEM education among youth (Duffrin, 2020). The FOODMASTER Initiative includes a variety of math and science supplemented lessons which focus on different food groups, food safety, and nutrition concepts. Through both summative and formative evaluations of pilot programs implementing FOODMASTER, data support the continued use of the FOODMASTER initiative as an effective tool for engaging students and improving their STEM learning experience (Duffrin, 2020).

As the role of STEM education through the use of agriculture, food and natural resources grows more prominent, the opinions and beliefs of educators who teach the material also becomes more pertinent. The instructional practice and degree of application of new curriculums are often largely influenced by the beliefs of the individual educator (Wang, 2020). It has been determined that STEM and agriculture education are a natural pairing, and that STEM concepts and practices can be effectively taught through the implementation of STEM-based agriculture, food and natural resources. While research supports the efficacy of integrated STEM and agriculture, food and natural resources education, it has also been found that educators may require a more holistic understanding of how STEM-based agriculture, food and natural resources can be taught effectively (Wang, 2020). By continuing to suggest the value and validity of integrating food-based STEM education into institutional curriculum, this type of learning will gain more traction in the minds of educators who are instrumental to the effective implementation of food-based STEM programs.

Informal Learning Environments

The value of utilizing informal learning to supplement STEM education and increase students' interest in pursuing STEM related careers has been proven through a myriad of research studies (Vela, 2020)(Roberts, 2018)(So, 2018). In response to the growing demand for skilled individuals within STEM careers, the need for supplementing and improving the educational opportunities for budding students within the field grows along with it. Additionally, it has been found that, as a student's interest in STEM concepts increases, their desire to pursue a career in STEM increases as well (Vela, 2020). This finding makes it imperative to understand and improve students' perceptions of STEM concepts and careers in order to adequately plan the future of STEM-based education programs (Vela, 2020). Informal learning environments are a valuable learning tool for students because these experiences require students to apply their academic knowledge of the subject matter in a new way. Informal learning can foster communication skills, collaboration among students, technology literacy, and leadership skills (Vela, 2020). By introducing STEM concepts to students in an informal environment, they are encouraged to form genuine interest in the topic, and engage with new information in a 'real world' way that is designed to pique their interest.

A specific type of informal learning environments typically utilized for STEM education are STEM camps. Through STEM camp activities, students are tasked with collaborating with their peers and challenged to communicate and work towards a common goal. These types of activities promote the development of a feeling of ownership over their own STEM learning and often include the use of discipline-specific technology to allow students to use tools similar to what scientists use on a daily basis (Vela, 2020). Additionally, informal learning in environments like STEM camps give students the opportunity to form a personal connection with the material they are learning. Real life applications and engaging, interactive lessons are utilized to bring the curriculum to life before the students eyes and promote STEM learning (Vela, 2020).

Research has proven that, as a result of informal learning environments focused on STEM education such as STEM camps and various summer programs, students have a more positive perception of STEM careers. Additionally, studies have shown that students who participate in STEM-based informal learning experiences are more likely to indicate their interest in pursuing a career in STEM (Vela, 2020) (Roberts, 2018). Through the continued implementation of STEM education within informal learning environments, students can improve their STEM knowledge, become more engaged with STEM concepts, and be inspired to pursue a career within STEM.

Chapter 3: Methods

The purpose of this thesis was to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children.

IRB Approval

This study was approved by the University of Mississippi IRB before the collection of any data.

Setting for Study and Participants

Study Setting

This study was conducted in June 2020 in Calhoun County, MS, a rural area in Appalachian Mississippi. The USDA Rural Urban Continuum code categorizes Calhoun County as non-metro, describing the county as rural or less than 2,500 urban population, adding that it is not adjacent to any metro areas (USDA ERS, 2013). The Appalachian Regional Commission designates Calhoun County as economically “at-risk”, denoting 2 distressed areas (Appalachian Regional Commission, 2019). Additionally, the Appalachian Regional Commission categorizes Calhoun County as one of 107 rural counties within the Appalachian region of the U.S. (Appalachian Regional Commission, 2009).

According to the U.S. Census Bureau’s most recent evaluation in 2019 (U.S. Census Bureau, 2019), Calhoun County had a population of 14,957 residents. Of these individuals, an estimated 23.2% were under the age of 18. The three largest racial demographics of Calhoun County are as follows: 69.7% White, 28.5% African American, 6.3% Latino. These same three demographics were analyzed in conjunction with the evaluation assessments given to participants of the study.

Within the span of 2015-2019, the Census estimated that 77.5% of Calhoun County residents 25+ years of age had achieved a high school diploma, while only 11.8% of the residential population achieved a bachelor's degree or higher. In the same time period, the mean annual household income of Calhoun County residents was estimated to be $37,263, while 17.2% of residents were in poverty (U.S. Census Bureau, 2019).

Participants

The participants of this study were local youth residing within Calhoun County, Mississippi, ranging in education level from K4 to 8th grade. The program was offered during the area schools' 2020 summer break, in collaboration with the local library's summer programming. For each of the four weekly food-based science education and reading programs, 100 students were recruited to participate. Students were voluntary participants in the reading and food-based informal learning environment program designed to enhance their STEM thinking abilities.

STEM Intervention

The intervention was hosted in a drive-through format due to COVID-19 concerns in collaboration with a local library, and participants were encouraged to pick up pre-made kits once weekly which contained all of the materials needed to complete the respective week's activities. Postage-paid evaluation postcards to rate satisfaction with each program were also provided.

Over the course of four weeks, the students participated in food-based reading and STEM education lessons revolving around a different food item and children’s book each week designed to both engage the participating youth and enhance their reading and STEM thinking capabilities. Table 2 summarizes the lessons for the intervention.

Table 2. Lesson Plans for STEM intervention.

Lesson Title	Session Objectives	Instructional Materials	Learning Activities	Messages
Growing Beans!	State that a scientist can pursue a career in food, nutrition, and agriculture. Observe how a seed changes throughout its life cycle. Describe what a plant needs to grow and survive. Observe the beans growing. Record the growth of the beans.	1 small drinking cup 1 package of bean seeds Soil pod Water	Read “Jack and the Beanstalk” (A video read-aloud was provided) Grow beans by following provided instructions. Did your beans grow like Jack’s magic beans? Fill out and mail in the postcard about this activity. There is already a stamp on it! The remaining seeds in the packet are yours to keep, they are Scarlet Runner beans. Plant them 1-1 ½ inches below the soil in a sunny area, and provide them something to climb on. Continue learning about beans using the online resources provided.	Scientists can pursue a career in food, nutrition, and agriculture. Registered Dieticians are scientists. Seeds go through a life cycle of growth. Plants need water and sunlight to grow. If given water and sunlight, our seeds will grow like Jack and the Beanstalk.

Making Butter!	State that a scientist can pursue a career in food, nutrition, and agriculture. Explain that milk is an emulsion of fat and water. Explain how butter is made, Create a butter emulsion. Record the movement of the marbles and changes in thickness as the emulsion forms.	1 plastic jar with lid 1 bowl 2 marbles ½ cup heavy whipping cream	Read “Snipp, Snapp, Snurr and The Buttered Bread.” (A video read-aloud was provided) Make butter following the instructions provided. Were you surprised that you could make butter in a jar by shaking cream? Fill out and mail in the postcard about this activity. There is already a stamp on it! The extra whipping cream can be used in other recipes or to make more butter. Continue learning about butter using the online resources provided.	Scientists can pursue a career in food, nutrition, and agriculture. Registered Dieticians are scientists. Butter is an emulsion of milk fat and water. Butter is made using milk from cows.

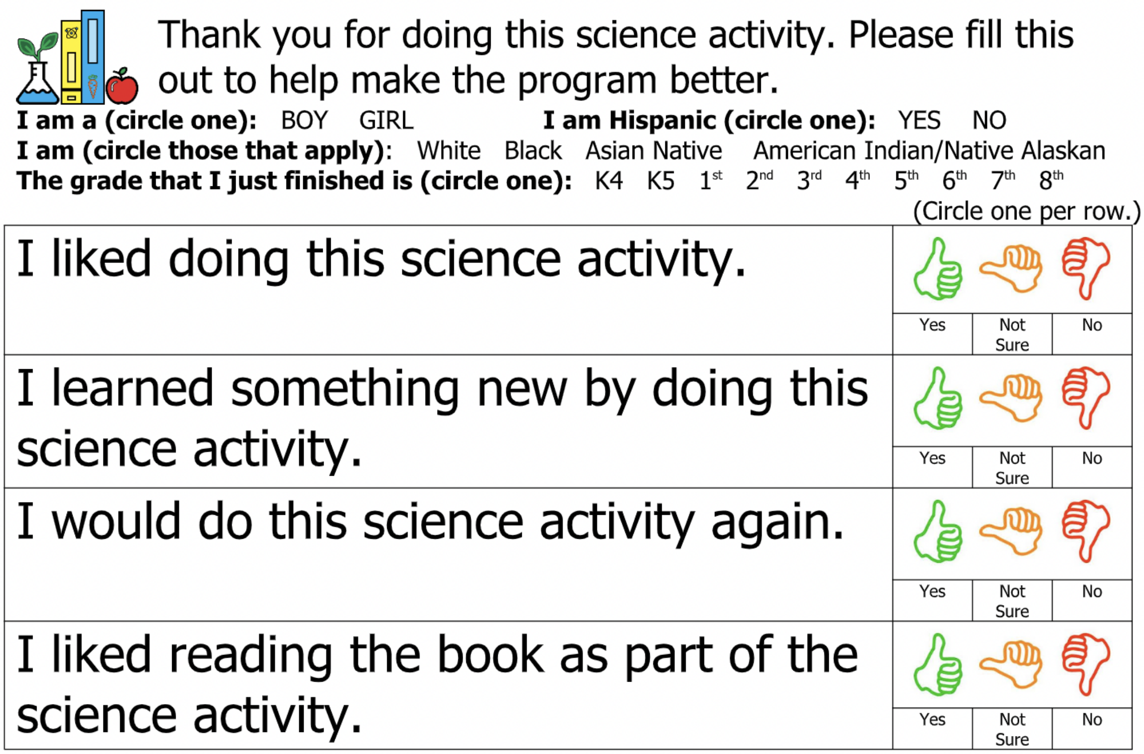
Popping Corn!	State that a scientist can pursue a career in food, nutrition, and agriculture. Describe what happens to the shell of a hardboiled egg when preserved in vinegar. Observe the differences between different types of popcorn. Explain how popcorn is made. State different ways corn can be used.	⅓ cup of raw popcorn Microwave oven 1 brown lunch bag	Read “The Popcorn Dragon” (A video read-aloud was provided) Make popcorn following the instructions provided. Did your popcorn pop like Dexter’s? Do you think popcorn could pop in a field? Fill out and mail in the postcard about this activity. There is already a stamp on it! Popping corn in a lunch bag is less expensive than buying pre-packaged microwave popcorn. Ask your family about making popcorn this way to save money. Continue learning about popcorn using the online resources provided.	Scientists can pursue a career in food, nutrition, and agriculture. Registered Dieticians are scientists. Popcorn comes from corn. Farm animals are fed with corn.

Sprouting Spuds!	State that a scientist can pursue a career in food, nutrition, and agriculture. Observe a potato with sprouts. Explain how a potato grows. Prepare a potato to take home and sprout. Record the changes at home as a potato.	1 small drinking cup or jar 1 potato Wooden picks or toothpicks Water	Read “The Enormous Potato” (A video read-aloud was provided) If you plant your potato, do you think that your potato will grow as big as it did in the story? Fill out and mail in the postcard about this activity. There is already a stamp on it! Continue learning about potatoes and vegetables using the online resources provided.	Scientists can pursue a career in food, nutrition, and agriculture. Registered Dieticians are scientists. A potato is a vegetable that sprouts and creates spuds. When placed in the right conditions, a potato will grow sprouts.

Assessment of Satisfaction

Participant satisfaction was assessed by collecting responses to the following statements via a 3-point “Thumbs up” Likert scale (yes, maybe, no): 1) I liked doing this science activity; 2) I learned something new by doing this science activity; 3) I would do this science activity again; and 4) I liked reading the book as part of this science activity. Figure 2 displays the template used for the postage paid evaluation postcards.

Figure 2. Postcard used for science activity evaluation



Thank you for doing this science activity. Please fill this out to help make the program better.

I am a (circle one): BOY GIRL **I am Hispanic (circle one):** YES NO

I am (circle those that apply): White Black Asian Native American Indian/Native Alaskan

The grade that I just finished is (circle one): K4 K5 1st 2nd 3rd 4th 5th 6th 7th 8th

(Circle one per row.)

I liked doing this science activity.	Yes	Not Sure	No
I learned something new by doing this science activity.	Yes	Not Sure	No
I would do this science activity again.	Yes	Not Sure	No
I liked reading the book as part of the science activity.	Yes	Not Sure	No

Statistical Analyses

IBM SPSS Statistics 27 (2020) was utilized to tabulate and analyze the data. Cross tabulation and frequency procedures were used. Frequency analysis was performed to determine the percentage of participants who were satisfied with each aspect of the program. Table 3 summarizes the procedures used to answer each research question.

Table 3. Research Questions and Statistical Procedures.

Research Question	Analysis
What is the satisfaction level of youth participating in a pilot reading and food-based STEM education program located in Rural Appalachian Mississippi in an informal learning environment?	The satisfaction of participants was assessed by collecting responses to the following statements via a 3-point “Thumbs up” Likert scale (yes, maybe, no): 1) I liked doing this science activity; 2) I learned something new by doing this science activity; 3) I would do this science activity again; and 4) I liked reading the book as part of this science activity. Frequency analysis was used to determine the percentage of participants who were satisfied with each aspect of the program.

Chapter 4: Results

The purpose of this thesis was to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children. By marrying the concepts of effective food-based STEM education and supplementary STEM programs for rural school children, this program was designed to improve STEM awareness and interest.

Participants

Table 4 summarizes the demographic characteristics of the pilot program's participants.

Table 4. Demographic characteristics of the participants.

Gender (n=158)	n	%
Male	72	45.6%
Female	70	44.3%
No response	16	10.1%
Hispanic(n=158)		
Yes	5	3.2%
No	127	80.4%
No response	26	16.5%

Ethnicity (n=158)		
White	127	80.4%
Black	10	6.3%
No response	21	13.3%
Student Classification (n=153)		
K4	36	22.8%
K5	30	19%
1st grade	30	19%
2nd grade	19	12%
3rd grade	17	10.8%
4th grade	7	4.4%
5th grade	4	2.5%
6th grade	5	3.2%
7th grade	1	0.6%
8th grade	4	2.5%

Satisfaction of Participants

Table 5 summarizes the level of satisfaction of participants with the science activities. As previously summarized in Chapter 3, level of satisfaction was assessed in four categories: I liked doing this science activity (LIKED), I learned something new by doing this science activity (LEARNED), I would do this science activity again (AGAIN), I liked reading the book as part of the science activity (READ).

Table 5. Satisfaction of participants with regard to the science activities.

Growing Beans! (n=37)	"Yes"	"Not Sure"	"No"	% Satisfied
LIKED	37	0	0	100%
LEARNED	36	1	0	97.3%
AGAIN	37	0	0	100%
READ	35	2	0	94.6%
Making Butter! (n=43)				
LIKED	43	0	0	100%
LEARNED	43	0	0	100%
AGAIN	43	0	0	100%
READ	42	1	0	97.7%
Popping Corn! (n=40)				
LIKED	40	0	0	100%
LEARNED	40	0	0	100%

AGAIN	37	3	0	92.5%
READ	38	1	0	97.4%
<u>Sprouting Spuds! (n=38)</u>				
LIKED	36	2	0	94.7%
LEARNED	37	1	0	97.4%
AGAIN	36	2	0	94.7%
READ	34	3	0	91.9%

Chapter 5: Conclusion and Discussion

The purpose of this thesis was to evaluate the satisfaction of a pilot reading and food-based STEM education program for youth in an informal learning environment located in rural Appalachian Mississippi by school children.

Discussion of Results

The data collected in this study indicates that participants were highly satisfied with the pilot program. As previously discussed in Chapters 3 and 4, students were given the opportunity to evaluate their experience with the program on a 3-point Likert scale, denoting their level of agreement with statements in the following four categories for each of the four lessons offered: I liked doing this science activity (LIKED), I learned something new by doing this science activity (LEARNED), I would do this science activity again (AGAIN), I liked reading the book as part of the science activity (READ). Overall, each evaluation category received over 90% cumulative satisfaction from the participants, with a substantial number of categories earning remarkable 100% satisfaction rates. Students indicated a particular appreciation for the "Making Butter!" lesson, denoting 100% satisfaction in the categories of LIKED, LEARNED, and AGAIN. These results are highly satisfactory, as they suggest the pilot program's success in capturing the fascination of the participants, and engaging them in interactive learning activities that they found enjoyable.

As previously discussed in Chapter 2, a large portion of the student population in the U.S. is composed of rural students, who, if given the right resources, could largely impact the future of STEM occupations (Harris, 2018). The demand for individuals pursuing careers within science, technology, engineering, and mathematics is on the rise, and research has indicated that one of the most grave discrepancies within rural STEM education is a lack of opportunity to participate in engaging, hands on learning of STEM concepts (Munn, 2019) (Murphy, 2020). Additionally, many rural school children experience both geographical and socioeconomic isolation from enriching STEM learning opportunities purely because their hometown is not large enough or centrally located enough to support interactive learning institutions, such as science centers, aquariums, and zoos (Munn, 2019). These factors and many more display the dire need for a STEM education program within informal learning environments such as the one discussed in this thesis at a local library. One specific program that seeks to bridge the gap of engaging STEM education within rural classrooms is called the FoodMASTER Initiative (FMI). FoodMASTER integrates STEM education with food-based learning to provide students with interactive learning opportunities within their K-12 institution (Duffrin, 2020). The pilot program associated with this thesis applied many of the principles and ideals of the FoodMASTER program within an informal learning environment to deliver immersive food-based STEM education to students in the form of a voluntary summer program in partnership with a local library.

By providing food-based STEM education free of charge within a rural community, the students living there are afforded a unique opportunity to participate in active, engaging learning experiences designed to strengthen their understanding of STEM concepts. The results indicate that the sample who participated in the study was highly satisfied with all aspects of the pilot program, indicating that implementation of iterations of this program in the future may experience similar degrees of success.

Proposed Programmatic Changes

If this study were to be replicated free of the constraints placed upon it by time, funding, and outside influences, such as COVID-19, there are several avenues through which the program could be improved in order to implement effective rural STEM education within an informal learning environment. Implications of COVID-19, experimenting with alternative evaluation methods and goals, as well as remodeling aspects of the program in an effort to foster a more immersive learning environment, could potentially contribute to the future success and longevity of this program.

Implications of COVID-19

Due to the prevalence of COVID-19 during the time in which this program was implemented, it was conducted via drive-through format in collaboration with a local library in Calhoun County, Mississippi. Participants were given the opportunity to pick up pre-made kits containing all of the supplies they would need to complete the assigned lesson, including the postage-paid evaluation postcard which was used to rate the participant's satisfaction with the week's lesson. The restrictions placed upon this program due to the COVID-19 pandemic certainly contribute limitations to the program's immersiveness and efficacy. Research has shown that informal learning environments are highly valuable because of their ability to encourage students to apply their knowledge in new, interactive ways. The act of learning in these environments often requires communication and collaboration among peers, fostering literacy and leadership skills within participating students (Vela, 2020). The drive-through format of this program eliminated the opportunity for students to interact and problem solve together, effectively reducing one of the key components of informal learning. Although some students may have collaborated with friends and family to complete the education, it was not measured. Regardless, Satisfaction with this learning experience was exceptional, and it could further improve if students were able to interact with each other throughout the learning process. This hypothesis is worthy of exploration within future programmatic applications.

Evaluation Methods

The goal of the participant evaluation of this program was to determine the level of satisfaction with multiple aspects of each lesson of the program. The results of this study unequivocally confirm that the program was satisfactory to the participants, thus further exploration of programmatic efficacy and participant learning is warranted.

Evaluation of student learning through both summative and formative assessments with the goal of determining the level of intellectual growth exhibited by students as a result of participating in each lesson of the program, as well as the program as a whole could provide valuable results. Collecting baseline data on each student's STEM thinking and reading comprehension capabilities before the start of the program would allow for accurate evaluation of student learning resulting from the learning activities. Additionally, student attitudes and preconceptions regarding STEM concepts and STEM careers both before, during, and after the program in an effort to determine what, if any, influence the lessons have on the students' interest in the subject matter should be evaluated. Pairing a condensed version of the satisfaction evaluation from the current study to ensure the program is still appealing to students is also necessary to preserve student engagement. This new set of evaluations will allow the researcher to gain a holistic understanding of the program's relevancy, efficacy, and level of enjoyability.

Remodel of the Program

In order to create a more immersive and interactive learning environment for the students participating, the program should be hosted fully in person. The concept of partnering with a local library in order to host the program is an effective way to ensure that the location of the program is as centralized as possible within the community it is designed to serve. In order to host the program fully in person, an appropriate sized space within the library will have to be dedicated to the execution of the program to accommodate all of the participating students. Each week, the space could be decorated and arranged to coincide with the lesson being taught in an effort to replicate the immersive, informal learning environments often found in science centers and interactive children's museums. In this program model, all of the lessons taught could remain the same, with small changes being made to incorporate more peer interaction and active learning. For example, in the "Growing Beans!" lesson, students could be instructed to interact with each other as they work to complete the steps of planting their seeds. These peer and professional interactions will not only strengthen the students' understanding of the activity, but can also foster leadership and communication skills as they navigate effective ways to collaborate with other students.

Additionally, the plausibility of a modified version of the science festival discussed by Munn (2018) is a possibility worthy of exploration. Hosting a STEM festival with the goal of exposing students to STEM concepts and professionals may be beneficial in mimicking informal learning environments found in more metropolitan areas. Tables and small booths could be set up in collaboration with a local library or event space to teach students about STEM concepts and STEM careers, with STEM professionals from neighboring communities and institutions volunteering their time to participate. Giving students the opportunity to explore and celebrate STEM concepts in this environment may likely spur genuine interest in the topics.

Ideally, both the new evaluation methods designed to monitor student learning and the updates discussed above aimed at making the program more immersive would be implemented simultaneously in order to bolster an already successful program.

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