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Science for All: Exploring Science Communication for Public Engagement in Culturally Diverse Scenarios in The Americas

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SCIENCE FOR ALL:
EXPLORING SCIENCE COMMUNICATION IN CULTURALLY DIVERSE
SCENARIOS IN THE AMERICAS

by

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DISSERTATION

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DEDICATION

To all of the researchers, professors, and students who dedicate their work to the higher purpose of serving others from anonymous spaces.

To my parents, Oswaldo and Helena. All your love and support inspired me during the difficult times and made my happiness more meaningful in the good times.
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I also thank Dr. Judith White, for teaching me that being a good scholar and professor is not possible not only through academic duties but also through supporting others to achieve their goals with ethics and compassion. Special thanks to Dr. Laura Harjo, who opened a new universe for me through decolonial epistemologies and participatory action-research methods as a tool not only to create knowledge but to empower communities. I thank Dr. Ted Jojola, who taught me the value of local knowledge in research, and moreover, how my work can have a positive impact because I am a young scholar of color.

To my “Nasty Women” of LAII, Alice Donahue, Sabrina Hernandez, Alin Badillo, and Alexandra Villegas, I thank you all. Our days together always will be part of my most loved memories. To all my friends and colleagues in the Department of Communication and Journalism of UNM, Ivana Cvetkovic, Kimm Oostman, and Sumaira Abrar, academia made us colleagues and friends for a lifetime. I also want to acknowledge the support of UNM’s Latin American & Iberian Institute during my doctoral studies and for funding this study through the Ph.D. Fellowship Grant. Finally, I want to acknowledge the help of Dr. Glenda Canaca and Dr. Angélica Ochoa for giving me the opportunity to work with their research projects.
Universities in the United States and Ecuador must meet various policy guidelines concerning research and teaching that address the needs of their local communities. In Ecuador, the higher education law requires that universities undertake research and public outreach projects that respond to societal needs. In the United States, Carnegie Research Classifications motivate universities to serve their publics by carrying out community-engaged research. However, evaluations of public outreach projects and community-engaged research have consistently demonstrated that the segments of society that are ostensibly served by these initiatives are not meaningfully engaged in them; members of the public are treated as, and accordingly act as, merely research participants or recipients of free services, not as collaborators or contributors.

At the same time, research conducted by science communication scholars, and about the practice of science communication, recommends that science communication scholarship not only should focus on disseminating scientific content to the public but also should explore how to develop sustainable relationships between academia and the broader society. Crucial to these relationships are participation and dialogue.
In line with these goals, this present study applies a combined qualitative and participatory action research approach to the exploration of two case studies of health behavior change programs, one in the United States (Eat Smart to Play Hard, abbreviated as ESPTH) and one in Ecuador (ACTIVITAL). Specifically, this study combines an interdisciplinary research approach through communication (specifically, science communication, health communication, and media theories) and community and regional planning theories and methods (specifically, decolonial theories, planning principles). This study has two research goals: (a) to determine how to develop better strategies for motivating public engagement in such programs and (b) to determine how to improve engagement among the intended target audiences and researchers of such programs through the process of working together to find new options for collaboration. To achieve these goals, this study recruited student collaborators. In the ESPTH case study, the collaborators were teens (ages 13 to 15) who volunteered as health educators for the children (ages 8 to 11) who participated in ESPTH. In the ACTIVITAL case study, the collaborators were former program participants themselves: at the time of the present study, the collaborators ranged in age from 19 to 21; while participating in the actual ACTIVITAL program their ages ranged from 13 to 15. In each case, the students collaborated with the scientists/researchers who were running the program to propose new communication strategies oriented to improve the program’s engagement with future audiences.

Building on the findings from the case studies, the present project then provides guidelines for science communication for public engagement in the Americas. As a health communication research project, this study demonstrates how the health behavior
change models of socio-cognitive theory and social marketing can be applied to complement formative research criteria and to inform the design of effective health communication strategies. As a community and regional planning research project, the present study explores how to construct public engagement through participation for new collaborations among researchers and the public. Finally, unexpected findings of this study are discussed, revealing how the influence of funding agencies can affect science communication initiatives in the Americas.
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CHAPTER 1
INTRODUCTION

“What leads to human destruction? ... Politics without ethics, pleasure with no commitment, wealth without work, wisdom with the lack of character, business with no-morals, and science without humanity.”

Gandhi

People frequently think that scientists/researchers are a separate group of the society who live in a parallel world, where time and space run at a different pace, and that scientists are not genuinely concerned about the problems that society faces. Moreover, people often think that researchers speak in a language foreign to their understanding, full of technical terminology that is complicated, and yes, let's be honest, sometimes "dull."

The public also critiques scientists regarding their lack of interest in sharing their work outside the academic sphere. On the researcher/scientist side, some scholars might believe that society is not interested in knowing more about their work and that sharing their research findings with the public might have no impact on society.

However, in 2017, the March for Science movement demystified these inaccurate generalizations that people from across different cultures might have regarding the mutual perceptions of society and science. Since the beginning of the administration of Donald Trump, the 45th President of the United States, the government has developed a set of constraints for researchers regarding how they disseminate their research to the public. Several government agencies will no longer have the ability to disseminate or discuss their research with anyone outside their agencies, including the mass media or any other communication conduits such as blogs or social media (Rainey & Rainey,
As a response, scientists in different fields joined forces to protest these and other constraints that threaten the information interchange between science and the public (Lin, 2018). Several manifestations of support took place across the United States and in other countries, giving shape to an international social movement. March for Science helped to send a clear message: science must be a part of people’s everyday lives, and people are interested in getting involved in dialogue with scientists about their research.

Communicating Science to Society: Challenges and Opportunities in the Americas

In Latin American countries, there are no government restrictions on disseminating scientific information to the public. Nonetheless, as in other parts of the globe, there are other barriers such as the few available spaces in mass media for coverage of scientific content (Bucci, 2008); the lack of training of researchers in science communication techniques and skills (Govoni et al., 2010); and the limited number of funding opportunities for science communication (Stilgoe and Wilsdon, 2014).

However, there are several initiatives underway at universities in Latin America and the United States that motivate community-engaged research that could provide opportunities for science communication. In Ecuador, the higher education law requires that public universities develop research and public outreach projects to promote community engagement (CES, 2016). In the United States, several universities are motivating professors to develop community-engaged research by considering this type of academic work a requirement for faculty promotion (Da Cruz, 2018). Consequently, researchers need to explore strategies to approach communities and communicate effectively with “regular” people in order to develop community-engaged research and
outreach projects. These strategies are part of science communication for public engagement.

However, the science communication literature shows that researchers in the United States and Latin America have limited skills to communicate their research to the public (Leach, Yates, & Scanlon, 2008; Peters, 2013). Therefore, science communication skills represent an area of improvement for researchers in order to develop effective communication with the non-scientific community.

As a result, science communication encounters a challenging scenario in universities in the Americas. Still, community-engaged research initiatives constitute an opportunity for science communication research and practice to facilitate the construction of networks among society and academia. On the one hand, researchers need to explore how to effectively communicate the findings of their research projects to the general public. Consequently, science communication studies could facilitate the exploration of how researchers can approach people outside of academia with scientific content that will attract general interest. On the other hand, the outcomes of science communication studies can guide the design and implementation of different initiatives that motivate public engagement and collaboration among researchers and society.

**Justification for the Study**

The science communication literature claims that there is a need to explore how public engagement can create genuine participation and collaboration of society and researchers for developing meaningful new arguments and analysis around different topics of social interest.
The present dissertation emerged as a result of my professional experiences as a professor and communication practitioner in the field of strategic communication at the University of Cuenca, in Ecuador. New policy reforms in Ecuador’s higher education law have, since 2010, mandated that academic departments implement public outreach programs linked to their undergraduate programs. The primary goal of this policy was to encourage public universities to get involved with and to engage with society’s needs and concerns.

Ecuadorian universities found themselves in need of developing initiatives to meet this requirement for their accreditation. To that end, the University of Cuenca developed free public lectures and outreach programs to share the results of their faculty members’ research projects. The main difficulty the University encountered was to create engagement and participation of the general public in these initiatives. The attendees of the lectures were mostly the University’s own faculty members and students and their families, and, less frequently, activists, indigenous groups, and other citizens. It became clear that the public lecture initiatives were not attractive to the public, yet it was not clear why this was the case.

These public outreach initiatives usually offered free professional services through the voluntary work of faculty members and graduating students under their supervision (Ramirez & Mintequiada, 2010). In the specific case of the University of Cuenca, initiatives involved health services in community-clinics, legal consulting services, and training programs in different fields offered by the universities in alliance with non-profit organizations.
Several evaluative studies assessed the social impact of such public outreach programs offered by the various universities in Ecuador. These studies acknowledged the positive contribution of outreach programs that focused on issues that affect the local community (e.g., safety, gender violence, preventive healthcare). Moreover, the evaluative studies showed how members of local communities wished to collaborate with these programs more actively (Falgueras & Crespo, 2016). The beneficiaries of the public outreach programs also identified the need to address interrelated issues in order to tackle the root causes of problems that affect their community (Bustamante et al. 2018) such as the high demand for free healthcare services for teen mothers in local high schools which would be provided by universities’ medical schools (Lopez-Cisneros, 2008).

The outcomes of public outreach evaluative studies piqued the interest of faculty of the University of Cuenca. How could these initiatives be incorporated and developed with the participation of different members of the community? How could research engage the concerns of the community? In this context, several researchers, including myself, got involved in developing collaborative initiatives that would bring together researchers/faculty members with members of the general public to talk about research projects related to the everyday life of the community.

Several of these experiences happened as informal events that included dialogues with researchers. We invited journalists and the public to different events and activities; these included biking events with researchers of geo-localization to explore transportation systems in Cuenca and open farm days to learn more about agriculture and cattle genetics in rural areas. Research conducted after these experiences yielded a new set of comments in the media and positive perceptions among the attendees of the events about the work
of the University of Cuenca. Moreover, these experiences allowed us as faculty to start a conversation about how researchers and people could work together on topics of mutual interest.

Of particular note, the dialogue spaces were useful in initiating trust-building for establishing relationships and networks for further participation. The involvement of the public in the process of developing these initiatives led us to ask several questions from our perspective as professors: What do we do next? How do we do it? What and who must be part of this discussion? In attempting to answer these questions, we realized that the university, and we as researchers, needed to develop strategies to improve practices of public engagement and move toward further co-participation among researchers and the public.

Inspired initially by these ongoing conversations with my colleagues at the University of Cuenca, the present study explores how to improve science communication within and about two different health behavior change programs through the participation and dialogue of the programs’ student collaborators and researchers. This study focuses first on the experiences of the programs’ student collaborators in order to better understand and incorporate the needs and concerns of audiences in the process of adopting healthy habits. Building on the outcomes of this portion of the study, the student collaborators and researchers in each program then designed strategies for science communication and proposed alternatives for future collaboration among researchers and the audiences of their projects. Finally, based on these findings, I propose several criteria to communicate science for public engagement in the culturally diverse settings of the United States and Ecuador.
The evolution of science communication research. Science communication as a discipline has developed in such a way as to successfully disseminate research outcomes/findings beyond publishing in scholarly journals (Fayard, 2004; Kerner & Hall, 2009). One of the leading research movements within science communication research is the paradigm of public understanding of science (PUS). According to Jane Gregory and Steven Miller in their 1998 book Science in Public, in the 1980s PUS won the significant attention of academics by understanding that the role of science is to contribute to society’s development and improvement. Since that time, science communication literature has considered the importance of not only disseminating information but also of establishing systems and mechanisms of interchange and dialogue among researchers and the public. Science communication research currently explores the use of different conduits, such as social media, to promote academic research, and the effects of such tactics on academic impact, such as determining the benefits to researchers of using social media or emergent media conduits to present their work (Liang et al., 2014).

Another research movement under the science communication banner is known as science communication for public engagement. Studies developed in this movement argue that public engagement of science requires new efforts to build relationships and networks among scientists and society (Stilgoe & Lock, 2014). Some research initiatives in this vein have proposed strategies that are designed explicitly to promote public engagement; for example, mechanisms intended to build trust among researchers/scientists of different disciplines with the purpose of developing participatory collaborations (Cooper, 2016). This approach focuses on how to canalize public attention towards common interests, concerns, and issues that could be addressed in participatory
and collaborative research projects to analyze issues of social interest. However, such collaboration initiatives among academia and society first need to explore how to communicate scientific content to motivate audience engagement. For this reason, the present study focuses on facilitating a collaborative exploration of science communication strategies intended to improve audience engagement with the participation of audiences and researchers of health programs.

Inclusive research frameworks as alternatives for science communication research. The approach of science communication for public engagement is an alternative framework to reflect how universities, and scientific institutions produce knowledge and communicate it to the public. Particularly, science communication for public engagement moves away from western-hegemonic models in which researchers hold power over decision-making and frame the reality of a phenomenon (Bowater & Yeoman, 2013) to a participatory research framework that unites researchers and non-scientists in the process of exploring science content and determining how communication initiatives can motivate dialogue and collaboration (Bucchi, 2008).

Western research models frequently portray members of the general public as “dirty,” “poor,” and “broken,” leading to their oppression and silencing (Tuck, 2009). These regressive portrayals are especially common across the globe in research focusing on minorities and indigenous groups; further, they share a common history of colonization, oppression, and discrimination through “otherizing” people (Martin-Barbero, 1993; Smith, 1999). Western communication frameworks have also influenced science communication research, and have led to the scholarly perception that regular
people are only passive recipients of information, lacking the opportunity to give their opinion, critique, or answer back to scientists (Holliman et al., 2009).

In the case of Latin America, including Ecuador, the western research tradition has also affected communication studies. As a response, in Ecuador, a new epistemological framework has emerged to propose new inclusive frameworks for research through decolonial epistemologies (Walsh, 2014). This new inclusive framework is based on the principles of the indigenous epistemology of *Sumak-Kawsay* from the Andean Region (Venezuela, Colombia, Ecuador, Peru, and Bolivia). Decolonial epistemologies such as *Sumak*-Kawsay propose to restructure the production of knowledge and research; and to explore alternatives for reconciliation among different segments of the population (Walsh, 2009). Specifically, decolonial research explores the role of researchers in the complex scenario that is present in Ecuador, but also in other parts of the world regarding how academia and society can collaborate for mutual benefit.

Decolonial epistemologies informed the design of the present study, which uses qualitative-participatory research on science communication in culturally diverse scenarios. Further, decolonial scholarship provided the criteria for the ethical considerations and research procedures used in this study; specifically, decolonial ethical considerations guided the research process by creating an egalitarian setting for participation and discussion among the student collaborators and researchers. As a result, the research setting provided a voice to the public through the participation of the student collaborators and centered the exploration of the study on the needs, concerns, and ideas that emerged from each of the case studies for health behavior change for adopting healthy habits.
**Purposes of Study**

The present study takes an interdisciplinary approach, building on principles, theories, and practices from the fields of communication and participatory planning. I brought together components of these scholarly disciplines to explore how to communicate science to the public. This study also considered the existing issues that are frequent in science communication studies. The most common research approach of science communication studies centers only on two of the actors of the science communication process: the researchers and the media, or on the interrelationship between the two. However, less frequently, science communication research addresses the role of audiences in the process of communicating science to the public. For this reason, the present study was centered on involving audiences as active participant-collaborators in the research process, with the student collaborators, which will be explained further in Chapter 3.

In order to facilitate the active participation of audiences in this study, the methodological design combined the paradigms of participatory action research (PAR) (Chevalier & Buckles, 2013) and qualitative research (Marshall & Rossman, 2013). PAR, as a methodological framework, allowed the research process of this study to provide a voice to the audiences of the two research programs under study. Specifically, the PAR methodology enabled me as a researcher to not only identify new ways of communicating science to audiences, but also to encourage equal participation and dialogue among audiences and researchers. As a result, this study allowed me to discuss and propose alternatives for more efficient science communication, and to suggest ways that future collaborations among researchers and their audiences may be possible.
Additionally, this study explored ways to develop and improve the effectiveness of science communication by combining a participatory action research approach with a qualitative approach. To do so, I used the case study method (Yin, 2017), combining two research projects concerning the nutritional habits of teenagers in Ecuador and the United States, respectively. The case studies involved student collaborators who were the audiences of health educators in the Eat Smart to Play Hard program in Albuquerque, United States, and the former participants of the ACTIVITAL program in Cuenca, Ecuador, and the teams of researchers of each case study. The case study approach enabled me to propose several criteria for designing science communication initiatives based on the interests and suggestions of the programs’ audiences in order to improve engagement.

This study addressed several of the difficulties that emerge in the process of planning and executing science communication practices and research: (1) selecting opinion leaders for science content, (2) framing of scientific content and message design, and (3) criteria for the selection of communication conduits. The data set was analyzed collectively with the student collaborators and the researchers of each of the case studies. As a result, science communication strategies were designed to address the communication goals of each case study to improve audience engagement and explore scenarios of future collaboration.

Goals of Research

The research goals for this project were the following. First, to construct a set of guidelines for researchers and communication practitioners that could work in culturally
diverse scenarios. These principles could provide useful guidelines for developing science communication for public engagement in the United States and Ecuador.

A second goal was to develop public engagement through participation oriented to exploring how collaborations among researchers and audiences of their research projects could happen. In this manner, science communication could promote not only information dissemination but also new ways of building participation and collaboration in research on topics that address the needs and interests of society.

The present study sought to develop new alternatives for addressing the common issues that emerge in the process of developing initiatives of science communication for the public. At the same time, this study also takes a holistic approach that describes the issues and difficulties that occur in science communication processes and proposes viable initiatives and tactics to address them. Specifically, this study:

(a) explores and describes emergent issues and identifies the critical points for planning and developing science communication initiatives oriented to audiences of children and teenagers;

(b) develops science communication strategies designed to improve the practice and research of science communication initiatives for public engagement, and

(c) creates dialogue spaces among researchers and audiences of research projects to collaborate through their interests and needs.

These goals informed the design of the two research questions guiding the study:

- **RQ 1**: How can researchers/scientists of health behavior studies develop better science communication strategies for public engagement, from the perspective of teenage/young-adult audiences?
• RQ 2: *How can teen audience engagement with science/health communication be improved?*

**Overview of Chapters**

**Chapter 2.** The next chapter will explore the state of the scholarship of several disciplines to construct the literature review for this study. This chapter has three sections. The first section addresses science communication research and the theoretical models’ tensions in research and practice of this discipline; it also reviews the existent gaps in the literature and the suggestions that existing studies propose for research. The second section reviews health communication studies using various models of health behavior change and peer-health education models which correspond to each of the two case studies undertaken in the present project. The third section discusses the decolonial studies that informed the epistemology of the present study and the design of its ethical considerations.

**Chapter 3.** The third chapter explains the research design of the present study. In detail, this chapter discusses the research questions vis-à-vis the qualitative and participatory action research methodologies used to conduct the study. Additionally, this chapter describes the ethical considerations guiding each of the two research questions of this study, the data collection methods, and the procedures followed for data analysis.

**Chapter 4.** This chapter provides the findings, analysis, and discussion of the *Eat Smart to Play Hard* case study, followed by suggestions and implications.

**Chapter 5.** This chapter provides the findings, analysis, and discussion, of the ACTIVITAL case study, following by suggestions and implications.
Chapter 6. This chapter presents the conclusions and a discussion of the overarching themes emerging from the case studies; final considerations and implications for future research; and limitations of the present study.
CHAPTER 2
LITERATURE REVIEW

In this chapter, I will review theories, inquiry, and models of science communication and health communication. The scholarship cited in this section addresses specific streams of communication studies in science communication for public engagement that informed the interpretation of the results and analytical processes for each of the case studies (ESTPH and ACTIVITAL).

Other streams of literature cited in this section will address decolonial theories that compose the epistemological foundation that guided the methodological procedures for conducting this study. Altogether, the content of this chapter will inform the conclusions and the implications that this study developed and that aims to contribute to the field of science communication as adapted to different scenarios in the United States and Ecuador.

Science Communication: Concepts, Historical Review of the Discipline, Models, and Theoretical Approaches

Defining science communication is a difficult task. One of the main reasons several authors acknowledge is that the concept and research of this discipline have evolved (Holliman et al., 2009). As a practice and as a field of study, scholars not only define but also name science communication differently, depending on the different functions and meanings they developed through their research and conceptualization. For example, some scholars refer to science communication as science popularization, scientific divulgation, scientific culture, or nonformal education of science (Rocha, Massarani, & Pedersoli, 2017). It is important to acknowledge that the different
definitions of science communication are directly related to specific research movements in specific historical contextual phases that have evolved over several decades.

Research Movements of Science Communication Studies

Science communication studies have gone through several phases of research, one evolving after the other: scientific literacy; public understanding of science (PUS); from deficit to dialogue; and public engagement with science and technology (PEST), also known as upstream engagement (Bowater & Yeoman, 2013; Stilgoe & Wilsdon, 2014).

Scientific literacy appears first as a research movement tied to the ideas related to implementing scientific education for society. The four components that characterized this movement were (a) knowledge of a basic textbook about scientific facts; (b) creating an understanding of the scientific method, i.e., experimental change; (c) promoting an appreciation of the positive outcomes of science and technology; and (d) rejecting superstitious beliefs (Gregory & Miller, 1998). As a research movement, science literacy implies that the public should have a stock of scientific knowledge as part of its educational schooling. Notwithstanding, the testing methods used in science literacy research were applied as an evaluation process of society’s knowledge of science, which commonly portrays people as “ignorant” and describes their knowledge deficits. This research was developed in the United Kingdom and the United States in 1989 by Durrant and was published in Nature magazine. The study was reproduced in 1992 by the same European research team. The results yielded comparative data. This study found that 66% of UK citizens had a relatively good knowledge of science in comparison to American citizens, who had only a 17% score in the same study that asked, through the
Eurobarometer Quiz, about general knowledge of science and used true or false questions (Bowater & Yeoman, 2013).

Consequently, this study was critiqued because it focused only on the deficits and the lack of education in culturally different populations (Holliman et al., 2009). Science literacy focused on filling the “knowledge gap” of people between scientists and the public by imparting factual science information to the population, which gave birth to what is known today as the deficit model of science communication.

The second phase of science communication is PUS, a rather unpleasant acronym for “public understanding of science.” This research movement emerged in the mid-1980s, raising concerns about the public’s attitudes toward science. A historical study, The Bodmer Report (1985), produced by Sir Walter Bodmer and The Royal Society, described the new paradigm of PUS around the world. The central claim of the report called for the improvement of science education in schools in order to develop adequate understanding of science among the general public. Moreover, the report described in detail the issues of the deficit model of science communication. The new approach suggested that the principal goal was to work for making more understandable and accessible to society scientific findings of researchers. Nonetheless, the portrayal of people as “ignorant” about science knowledge persisted (Silgoe & Wilsdon, 2008).

The Royal Society, The Royal British Association, and the UK Committee on the Public Understanding of Science (UK-COPUS) collaborated by providing funding for speakers to address organizations (e.g., women’s organizations that received talks about preventive healthcare importance from applied research projects) and initiated schemes of promotion.
However, PUS had multiple issues and critiques as the research of social scientists developed further. Many authors agreed that the movement reinforced two aspects: (a) that all knowledge and expertise lay with scientists (b) and that more knowledge of science on the part of the public would generate a more-significant appreciation of science (Gregory & Miller, 1998). Therefore, science illiteracy was understood as a deficit of knowledge, and public lack of understanding of science was seen as a deficit of attitude toward audiences, under the assumption that they were ignorant (Bowater & Yeoman, 2013). Moreover, the practices developed under PUS also followed and perpetuated the deficit model by developing strategies that allowed only one-way communication processes. Communication developed through the PUS movement guidelines interrupted and failed to encourage the relationship between science and its audiences in the general public (Stilgoe & Wilsdon, 2008). For this reason, by the 1990s, scientists and UK governmental organizations detected the need to establish new links and explorations of science communication that would promote dialogue between science and society. PUS was left behind as a “backward-looking vision” for developing science communication (Holliman et al., 2009).

The third movement, “deficit to dialogue,” emerged as a response to PUS as an effort to bring together science and society. This movement promoted questioning PUS assumptions about science, the role of audiences, and the nature of understanding that composed the deficit model. Moreover, dialogue promoted the dismantling of the assumption of the ignorance of the public and the unchanging nature of science and its universality. Social scientists began to pay attention to audiences and developed studies about the perception and needs of people in relation to science. The studies revealed that
the image people had about science was misguided, mostly because of the application of the deficit model to the development of science communication initiatives (Stilgoe & Wilsdon, 2008). Consequently, people were skeptical about science. Sadly, at the same time, their information needs were not satisfied. People wanted to hear more about science and be involved in the topics of their interest, but they also wanted scientists to listen to their needs and interests in different topics. People wanted to make their voices heard by those in power and to join forces with scientists and their work in order to effect change in decision making and policymaking in different areas (Wynne, 1995).

Through the dialogue movement, social scientists understood that a better research approach for science communication would be one that was interdisciplinary. The main reason was that the findings of research projects intertwine politics, science, and public uncertainty (Stilgoe & Wilsdon, 2008). Consequently, research would be required to develop a broader engagement with stakeholders. In this process, a productive dialogue among scientists, society, and policymakers around issues of interest was one of the main goals of public engagement of science communication.

Additionally, the movement of the public engagement of science centered on the development of tactics and activities that promoted the attention and interest of society in science topics (Jensen & Holliman, 2009). Therefore, the design of science communication strategies would, ideally, be guided by the goal of public engagement and outreach of society and the execution of these activities.

Several scholars have approached the research of science communication for public engagement from quantitative and qualitative approaches. First, most of the quantitative research has tested the hypotheses of prior studies. Second, qualitative
research instead explored the balance of the construction of a comprehensive plan for communicating different research projects of diverse disciplines (Jensen & Holliman, 2009). However, instead of primarily testing only theories, other studies argue that science communication must instead follow an inductive and exploratory qualitative research approach. This methodological suggestion was based on the study developed by Barney Glaser and Anselm Strauss (1967) that argued that models of social life should be developed from the data of everyday experiences and should be integrated with existing literature and theory at a larger stage in the process, as grounded theory suggests.

As a fourth phase, “upstream engagement” seeks to facilitate the discussion of innovation, science and technology, and society. This movement in science communication embraces several questions: Why technology/science? What needs does society have/know about a specific topic? How are these topics related to the quotidian life of people? And perhaps most important, why is this topic necessary for people? In summary, upstream engagement demands genuine openness of scientists to dialogue with society (Stilgoe & Wilsdon, 2008).

Prior to developing a concept for science communication, it is crucial to review the evolving process of the discipline across time and how it transformed and shaped its goals and scope.

**Conceptualizing Science Communication**

Latin American scholar Sánchez-Mora defined science communication as “the transmission of scientific knowledge from the authors and/or sources to a diverse audience of different educational levels” (2003, p. 9). This approach is similar to that taken by the advocates of PUS. Another definition of science communication is the use of
the appropriate skills, media activities, and dialogue to produce one or more responses in audiences (Bowater & Yeoman, 2013). Some are:

- Awareness, including familiarity with new aspects of science.
- Enjoyment or other affective responses (e.g., appreciating science as art or entertainment).
- Interest, as evidenced by voluntary involvement with science or its communication.
- Opinions, the forming, reforming, or conforming of science-related attitudes.
- Understanding science content, its processes, and social factors.

Further, as Weigold (2001) pointed out, science communication can involve science practitioners, mediators, and other members of the general audience, either peer-to-peer or between groups.

In practice, for researchers and scientists in different fields, science communication strategies and tactics comprise a broad set of activities and notions to develop a specific activity to communicate their research work. Most researchers practice and introduce activities to communicate their research, including goals such as increasing the spread of knowledge and becoming a driving force to change policy or decision making (Bowater & Yeoman, 2013).

Another challenge, addressed by researchers to define science communication, is its own multidisciplinary nature; science communication is itself a discipline that attends to other disciplines for developing studies that focus on to how to develop communication strategies for getting closer to society. Consequently, the study of science communication necessarily involves studies of, for example, sociology, education, philosophy, health, political science, and biology (Bowater & Yeoman, 2013).
To develop a more comprehensive understanding of what science communication is and where it is oriented today, it is crucial to understand the evolving process of the field from its early appearance in the 19th century to today.

**Theoretical Frameworks and Foundations for the Models of Science Communication**

Several authors from Europe, the United States, and Latin America have explored the persistent issues of science communication, such as misinformation, inaccuracy in science reporting, the lack of participation of society, and the engagement of science and society, among others, that seem to be common and unsolved (Bowater & Yeoman, 2013; Bucci, 2008; Friedman, Dunwoody, & Rogers, 1999). Scholars agree that these issues are a consequence of the application of different theoretical frameworks that are the foundations of science communication models (Bowater & Yeoman, 2013; Bucci & Trench, 2008).

In this section, I review these models and theories to provide a discussion about the possible reasons for persistent gaps in science communication literature. I also discuss several common, prominent issues that exist in the practice of science communication activities. Finally, in this section I will review the models that have proposed to overcome science communication issues and to seek the public engagement of society.

**Western Theoretical Models: Diffusion of Innovations and Linear Models of Communication**

**Diffusion of Innovations Theory: Concept and Effects.** The diffusion of innovations theory emerged in the 1960s in the United States and has become the main framework for development research. As a theoretical model, the theory addresses the
stages that innovations go through during the processes of being adopted by people (Arroyave, 2006; Rogers, 2010). Different disciplines applied the diffusion of innovations theory in research, including sociology and political science. However, in communication research, the diffusion of innovations theory has informed studies in media scenarios, such as in newspapers and newsrooms (Abbot, Corbin, & Neigergall, 2000; Garrison, 2000); innovations in organizations (Crawford & Strohkich, 2002; James, Wotring, & Forrest, 1995); and adoption of new technologies by social groups (Dupagne, 1999; Dutton, Rogers, & Jun, 1987; Lin, 1998).

To provide a clear concept of the diffusion of innovations theory, it is essential to address four intellectual constructions of which it is composed. First, the diffusion of innovations theory responded to a set of development frames in the capitalist ideology better known by the following paradigms: (a) the dominant paradigm, (b) the linear model of communication, (c) the modernization theory, and (d) the myth of powerful effects (Arroyave, 2006).

In the diffusion approach, communication is a model for transmitting information only, not as a practice that stimulates dialogue and interchange among the actors involved in the communication process. In science communication research, diffusion of innovations has guided several studies in the United States, Europe, and Latin America (Bucci, 2008; Melkote, 2003; Valente & Rogers, 1995).

Despite the popularity of this theory in the United States and Europe, it is difficult to find studies that apply the theory in Latin America, because of the resistance of scholars in the region. The most common critique of the theory offered by Latin American scholars is that its theoretical framework served developmental agendas and
modernization purposes portraying nations of Latin America and Africa as “Third World/underdeveloped” (Arroyave, 2006, p. 267.). This portrayal, which is guided by Western-hegemonic agendas, worldviews, and values, has had profound adverse effects in the Latin American context. For example, the exploitation of natural resources benefitted Western economies, acculturation, and structural economic adjustments that led to poverty and inequality (Beltrán, 1976; Bordenave, 1976; Martin-Barbero, 1993). In the same vein, diffusion of innovations also guided development studies in Africa and Asia through programs in agriculture, family planning, public health, and nutrition that had both positive and negative effects and outcomes in their populations.

Everett Rogers, the author of the diffusion of innovations model, acknowledged that his model had certain limitations in its application in non-Western scenarios, and he made modifications to the classic model he first created in the 1960s. For this reason, Rogers (2010) added to the diffusion of innovations model a new convergence modeling, in which he suggested that (a) the communication process should be addressed in a new participatory framework and (b) the cultural characteristics of the people and the context should guide the communication process (Rogers, 2010).

**Diffusion of innovations and science communication theoretical linkages and issues.** By revisiting the theoretical foundations of diffusion of innovations, we must acknowledge that its communicational foundations address only linear and non-participatory frameworks. Consequently, there are frequent concerns that science communication, developed in many ways alongside that of the diffusion of innovations theory, does not open spaces for dialogue, participation, or public engagement (Bucchi & Trench, 2008). From this perspective, the main problem of diffusion theory is the lack of
a participatory process to develop the planning and execution of science communication that involves all of the actors in the process. Scientists, media reporters and media outlets, communication practitioners, and the target audiences of the research projects are not part of the process of planning and its activities: strategies, tactics, and the scientific content to communicate. Nor can audiences express their opinions, needs, or interests related to a specific research topic.

The most frequent practice among researchers/scientists who have a need or interest to present their research to society is to use communication and marketing divisions of the institutions where they work and therefore to remove themselves from the process of developing the discourse or communication support material. Consequently, the management of the information relies on communication practitioners, journalists who develop media content, and on communication pieces that might have inaccurate content (Bucchi, 2008; Friedman, Dunwoody, & Rogers, 1999) rather than on the scientists themselves.

**The transmission model of communication.** This model understands communication as something that is “transmitted” or “sent” to an audience over a distance (Leach, Yates, & Scanlon, 2008). This approach is predominant in the Western-hegemonic scholarship of science communication. The transmission model uses the linear process of communication as a theoretical foundation, which also sustains the diffusion of innovations model (Arroyave, 2006). The linear communication model, proposed by Shannon and Weaver (1949), considered the metaphoric transportation of a message between a sender and a receiver through a channel. Most of the science communication models that use the linear communication-model approach have the goal
of persuading the public to adopt science advancements, assuming that the public naturally consists of mere passive “receivers” (Bucchi & Trench, 2008).

![Model of communication proposed by Shannon and Weaver (1948).](image)

**Figure 1.** Model of communication proposed by Shannon and Weaver (1948).

However, in the scholarship of science communication, other essential models are used; these models have for decades been overlooked or dismissed by adherents of the transmission model and the diffusion model (Bucchi & Trench, 2008). These elements are crucial to truly understanding the overall process of science communication and the outcomes of the practices used to disseminate science content to society. Some of the concerns raised by science communication theorists, such as misinformation, inaccuracy in media reporting, misrepresentation, sensationalism, and distortion of science content (Bucci, 2008), have led to the lack of participation and unidirectional communication among scientists and society.

Another missing element from the diffusion and transmission models is the context where communication occurs and its cultural and ideological characteristics (Arroyave, 2006).

New explorations in science communication provide alternatives for developing participatory research that involves and connects all of the actors involved in the process (Bucchi, 2008). Other scholars also focus on how to evolve from dissemination frameworks to public engagement, taking a more nuanced approach to developing efforts.
for public understanding of science. However, still needed is the development of mechanisms and strategies that foster egalitarian participation of society and researchers in the processes of science (Holliman et al., 2009).

The deficit model. Another model that applies to science communication is the deficit model. This model and its theories hold that science content is too complicated for audiences to understand and that some effort should be made to bring science closer to the public’s understanding (Bucchi, 2008). This model also portrays audiences as “uninformed and in need of education” (Pearce et al., 2015, p. 164). Another assumption is that society is not interested in scientific content, resulting in society’s inability to understand complex content, as the deficit theory explains (Bucchi & Neresini, 2008). However, the linear models and theories are the object of critique of science communication scholars who promote dialogic models because they consider a dominant-paternalistic paradigm that does not promote dialogue and collective construction (Bucchi, 2008). The deficit model also uses a linear transmission of information from experts to the public. Therefore, the model builds its practices on the assumption that good transmission of information leads to a reduction in the “deficit” in the knowledge of audiences, which always leads to better support of science (Lewenstein & Brossard, 2005).

These models and theories undergirded the phases of deficit and PUS research movements in science communication research, which have contributed to the current issues in science communication as well as to the lack of participation among scientists and members of the general public.
Dialogic Communication Models as Theoretical Frameworks for Science Communication

Other communication models and frameworks focus on culture and participation. These models offer a different perspective about complex elements related to the communication process, such as in science communication scenarios.

The Ritual Communication Model. Some authors describe the ritual model as “archaic,” because its historical origins and practices can be traced to before the advent of linear communication models (Leach, Yates, & Scanlon, 2008). The ritual model proposes to define communication as a process of sharing information through participation in, association with, and fellowship within a human group. Through the ritual model, communication focuses on maintaining societal values in time in a sustainable manner, not by imparting information but through the representation of shared beliefs and ideas. Consequently, under the ritual communication model, the process of communication centers on creating and reinforcing people’s fellowship within a community interested in a specific topic (Carey, 2008).

Unlike the transmission model, the ritual model of communication adds new elements to the process of communication. Moreover, these elements work to bring about more-effective communication (Leach, Yates, & Scanlon, 2008). Carey (2008) named this framework the *theater of communication*. This denomination is used to explain how different elements interact and influence each other in the process of communication. Moreover, as a result of understanding the interaction of the elements, it is easier to suggest that the ritual model is an appropriate theoretical framework for analyzing communication components and for suggesting strategies to improve the effectiveness of
communication. To draw on the following terms under the ritual model and the theater of communication, an appropriate approach is Kenneth Burke’s (1969) Pentad. This framework, which is applied widely by rhetorical critics, is composed of the elements act, purpose, scene, agent, and agency, which can inform the process of analyzing science communication pieces and suggest strategies for improvement (Leach, Yates, & Scanlon, 2008).

**Participatory Communication**

Participatory communication allows people to reach collective solutions to their concerns and issues (Servaes, 1996). The crucial factors of participatory communication are the elements of access, participation, and self-management, a claim developed by UNESCO in 1977. Access refers to the use of media for public service, based on offering the opportunity of available content to the public to choose from a variety of relevant programs and to empower the public with ways to provide feedback and to transmit their reactions or demands. Participation implies a higher level of involvement by the public in communication and media. For example, an audience can become involved in the production process or in the planning of a television show. However, participation can also be the involvement of the public or consultation with an audience in the decision-making process about content. Finally, self-management is the most advanced way of participation because the public has power in the decision-making process of media. Moreover, the public is also involved in the process of policymaking in communication and planning (Servaes & Malikhao, 2012).
Science Communication in Research and Practice: Differences among Western and Dialogic Communication Models and Theories

As reviewed, the transmission model and the ritual model of communication take different approaches to understanding, planning, and executing communication. For this reason, as is also the case in science communication, there are significant differences when each of these models is applied. In this section, we review some differences and their effects.

The ritual model allows understanding science communication as something more than the process of transmission and diffusion of scientific information from a sender (scientist/research institution) to a receiver (target audiences/society/the lay public). An example is to understand in detail a possible scene of reading a research paper. In this case, it means not only the physical place but also the contextual setting where this action happens. If the act of reading a research paper occurs in the medical community that reads the British Medical Journal or an academic journal of interdisciplinary research, such as Nature, then the audiences of each journal must have a certain level of knowledge and expertise in the field. The knowledge of each audience will reflect the social roles and agency of the actors or agents involved in the act of communication. In other cases, it can happen in a family that reads a report in a newspaper and shares the information with relatives. In such a case, the act and the scene change because the news article is not written by an expert but by a journalist who reproduces the research data obtained during an interview with a scientist. Or, in another case, the source of the research data might be from another news source, such as Reuters (Leach, Yates, & Scanlon, 2008).
In the ritual model, the framework is flexible because it adapts to the multiple settings and contexts where the communicative act of science can have a place. Moreover, it allows for a better understanding of the audience’s perspectives and background context, which is a process that has a direct influence over how scientific information is understood (Carey, 1989).

Also, in science communication, the transmission model focuses on the sender, the message, and the receiver. Transmission suggests that the communication of science content might improve by centering the efforts of the planning and execution by focusing on the performance of the sender and the quality of content of the message. The expected outcome is that the receiver will have a clearer understanding of the science content (Carey, 2008). An element that this framework overlooks is that the role of mediation is kept as simple as possible as a mere mechanism of passing information to an audience but does not consider cultural differences among the actors involved as the mediators of the process, who might be people, institutions, or conduits, such as advertising or media outlets. The transmission model as a framework does not represent media activities and communication processes at work. This model represents and implies instrumentality, cause-and-effect relations, and one-directional flow of communication (McQuail, 2010).

Both models, ritual and transmission, use different frameworks to understand communication. As researchers Leach, Yates, and Scanlon (2008) suggested, it might be evident that combining both models might offer a new approach to understanding science communication and might offer possible avenues to explore its persistent issues in greater depth.
As for the actors of the communication process, it is also crucial to acknowledge that individuals as scientists need more training in communication skills so as to construct more-effective messages (Leach, Yates, & Scanlon, 2008).

The transactional model proposes that communication should be an interactive, two-way dialogue (Wood, 2003). Through this model, people communicate simultaneously with each other and through verbal and nonverbal communication, and both (sender and receiver from the linear model) are named communicators in an egalitarian framework where they share a context, experiences, and information over time (Bowater & Yeoman, 2013). Moreover, this model introduces the insights of learning theory, which proposes dialogue as a tool for learning through the examination of experiences through conversation (Dierking et al., 2003). In this approach, communicators learn from each other through multiple conduits of communication, activities “saying the same thing through many ways” (Bowater & Yeoman, 2013, p. 145).

In this way, the transactional model becomes a well-suited theoretical framework to guide the design process of science communication activities. Therefore, the two central insights that the transactional model proposes to communicate science to society are dialogue settings and the interactive learning experiences for the target audiences of a science project (Bowater & Yeoman, 2013). Moreover, the transactional model proposes that science communication is a process that to be effective needs to happen through several experiences, not through only a single exposure. For this reason, several tactics and communication learning experiences are necessary to sustain a message in audiences.
Examples of learning experiences include events and media activities (Dierking et al., 2003), such as:

- Reading books and magazines.
- TV and radio news reports or shows.
- Visiting museums/zoos or science centers.
- Websites and social media.
- Informal social spaces, such as conversations with peers or family members.

**Western Communication Models versus Dialogic Communication Models and Theories**

Several scholars acknowledge in their discussions about linear models (transmission model, diffusion of innovations theory, linear-communication model) and dialogue-based models (transactional model and the ritual model) that for achieving effectiveness in public engagement, science communication requires a change in theories that will sustain its practices. Specifically, science communication will need to change its application, practices, and research by shifting from the diffusion/linear communication models to dialogic communication models (Bucci, 2008; Leach, Yates, & Scanlon, 2008; Stilgoe & Wilsdon, 2008). Linear and diffusion frameworks applied to science communication seek mostly to inform society about a topic through a one-directional communication approach. Consequently, there is no place for interactions among scientists and the general public, nor is there an opportunity to establish a conversation between them. As a result, the linear/diffusion frameworks are not conducive for science communication for public engagement (Bucci & Trench, 2008).
On the other hand, the dialogic approach-based models propose a more favorable theoretical framework for developing science communication for public engagement. The first reason is because foundational communicational theories support two-way communication that allows feedback and an egalitarian approach among the scientists/researchers and their target audiences (Wood, 2003). The second reason is that dialogue-based models also offer a multi-conduit/tactic approach that is based on offering several experiences and activities (events, exhibitions, museums) and communication conduits (media and new media) that aim to establish a continuous process of learning experiences that support a better understanding of scientific research to their target audiences.

**Contemporary Models of Science Communication**

As scholars review the communication theories and models that sustained science communication research in previous decades, new research suggests that the elements that compose the models should be revisited and understood from a new perspective. To move from the dominant-paradigm approach models to a new dialogic and participatory approach implies reinterpreting terms such as “transmitter/source,” “signal,” “message,” and “receiver,” as well as “producers,” “texts,” “media,” and “consumers” (Leach, Yates, & Scanlon, 2008).

These elements emerge from the communicative act, which asserts that when people or institutions are *producers* of messages, they create objects such as letters, newspapers, photographs, television programs, and blog postings. Communication researchers understand the concept of objects/texts as interwoven ideas, social relationships, and the communication *conduits/mediums* in one holistic representation.
object. At the same time, receivers/audiences are understood as and named *consumers* of media, which are parts of larger units, such as communities or occupational groups, all of which are united by a common feature or activity.

**Figure 2.** A communicative act in context (Leach, Yates, & Scanlon, 2008).

**Science Communication for Public Engagement**

As noted earlier, in the phases/movements of science communication research, public engagement seeks to involve all of the actors involved in the process of communicating science, depending on the topic of a research project. These groups are scientists who are the authors of the inquiry (Jensen & Holliman, 2009) and the involved audiences and key stakeholders (i.e., children, parents, teachers, school cooks in the cafeteria services, health educators, in a project of child nutrition for healthy habits).

Nonetheless, some confusion remains about the process of creating practices from deficit models and developing research of science communication for public engagement.
Critical factors that demarcate a dramatic difference among deficit and public engagement frameworks are the goals that drive the science communication projects (Jensen & Holliman, 2009). In this manner, on the one hand, deficit-based projects will seek to increase scientific knowledge in a specific audience of society. On the other hand, public engagement should have foundations in establishing dialogue settings among scientists and society’s audiences and in motivating society’s interest to collaborate with scientists (Jensen & Holliman, 2009). Moreover, the goal of public engagement is to promote through dialogue mutual understanding between scientists, policymakers, and the public. A second step of the dialogue framework, as a priority to establish action, is to consult with members of the audiences directly affected, seeing and treating these audiences as attentive and active (Wynne, 2006).

**Issues of science communication for public engagement practices.** Developing activities of science communication for public engagement involves developing spaces of dialogue of different types. For example, some events are *Café Scientifique, scenario workshops, deliberative opinion polls, citizen juries, people’s panels*, and in the United States, *consensus conferences* (Russell, 2010). At first sight, these events appear to promote dialogue among scientists and society—although these panel events always followed the same structure where scientists exposed their research to people who were invited to ask questions and to participate. Davies (2009) examined these informal-space events at London’s Dana Centre, which belongs to the Science Museum. Davies found that these events had elements of dialogic models as well as deficit models. Moreover, this inquiry demonstrated that it is very difficult to achieve a fully participatory framework that promotes genuine dialogue.
Therefore, science communication for public engagement not only needs to attend to the development to dialogue spaces but moreover must seek the upstream engagement of audiences (Bowater & Yeoman, 2013). This new phase/movement of science communication research addresses the discussion with audiences as a first step before any scientific development or technology becomes a reality. Therefore, the central goal of upstream engagement will be to provide researchers with a reflective practice to discuss ethical issues, needs, and risks related to a topic of research (Whitmarsh et al., 2005).

**Strategies to promote upstream engagement for science communication.** In response to these issues, *nanodialogues* emerged as a case for addressing public values, concerns, aspirations, and the role of public engagement in influencing scientific research. These events offered a different format to operate the dialogue with people (Chilvers, 2006) based on access to specialists for people to ask questions on a specific topic and multiway dialogue (from scientists to people, people to scientists, people to people, and scientists to scientists).

Upstream engagement needs to develop a new framework for science communication that creates sustainable relationships between science and society. For this reason, dialogue should be not only a tool to communicate the results of a scientific inquiry. Instead, science communication should be the first step that orients researchers who aim to establish mid-term and long-term relationships with society’s audiences. First, scientists should approach their audiences and discuss their interests and needs related to a topic. This information should guide the approach that scientists use to design their research projects in balance with their research interests to develop a research
project that not only advances the creation of new knowledge but also encompasses the needs and concerns of society.

The present study aims to explore how similar research projects and their authors can reorient themselves to create a collaborative-participatory space to reimagine, re-create, and advance their research. For this purpose, in the following section, different qualitative and participatory research methods for science communication studies will be explored.

**Research methodologies for science communication for public engagement.**

Science communication research has applied several approaches, developing studies depending on their goals or the type of data the researchers aimed to find. On the one hand, quantitative studies explored methods such as textual analysis and statistical descriptions of data of discourse in different texts (Jensen & Holliman, 2009). An example of quantitative research studies in science communication is the exploration of the levels of interaction of children’s activity in museums or exhibits. Meisner and Osborne (2009) developed several criteria related to interaction and science learning theories in children for informal learning environments to measure video recordings of children attending to specific exhibits in London’s Science Museum. The study revealed that epistemic behavior of children prevailed as children developed questions about the functioning and their own roles as observers of the games.

Other studies, using mixed methods, used quantitative research for analyzing science framing in media. Thomas Listerman (2010) developed a project that explored how scientific debate was framed in opinion-leading newspapers in Germany, the UK, and the United States from 2000 to 2002 around biotechnology studies that media
covered. Quantitative data allowed Listerman to identify the most common frames related to media coverage of this specific topic. The most common were argument framing (use of theory and interpretative patterns in the news piece) and article framing (structure and explanatory models for scientific information). Simultaneously, qualitative data provided a more comprehensive approach to analyzing the attributes of the text, the use of pictures, diagrams, and the ways each media outlet addressed the same topics, depending on their audience of readers.

Qualitative studies in science communication also addressed studies of discourse analysis, metaphor analysis of media reporting, and communicational pieces of science communication initiatives. Qualitative studies were able to provide more-detailed explanations and descriptions of different phenomena and their causes (Jensen & Holliman, 2009). For example, Dunwoody (1999) conducted several studies that analyzed the issues that emerged among scientists and media journalists in the process of media reporting. She explored the difficulties that journalists faced in the process of covering, writing, and editing the news pieces, and how these led to misleading reporting about science in mass media.

In contemporary scholarship, as reviewed in the prior sections, science communication for public engagement is seeking to develop an approach that aims to establish more-sustainable relations among the academic/scientific community and society. Therefore, several scholars have suggested that to advance research in the field, there is a need to introduce participatory action research (PAR) methodologies (Bucci, 2008; Jensen & Holliman, 2009).

Designing science communication research through PAR and qualitative methodologies
Research studies in science communication for public engagement need to balance the construction of a comprehensive plan with the need to maintain a degree of flexibility. This framework allows scholars to manage new, emergent data that might evolve and to suggest new avenues that require further exploration (Jensen & Holliman, 2009). Moreover, participatory action research proposes an egalitarian research framework that provides power not only to the researcher but also to the participants (Chevalier & Buckles, 2013).

**Health Communication**

In the following section, I review theories that address health behavior change as these theories guide the present project.

**Social Cognitive Theory (SCT)**

In the field of health behavior change, this theory proposes an approach based on psychosocial influences as an integrative process composed mainly of the construct of *self-efficacy*, the personal belief in being able to exercise control over one’s health-oriented decisions and actions (Bandura, 2004). The perception of individuals about their capacity to persevere to improve their health is the primary influence over factors from the surrounding environment.

**SCT Constructs.** SCT’s constructs represent a dynamic relationship among behavioral factors, cognitive factors, and environmental influences (Bandura, 2004; Baranowski et al., 2002). Behavioral factors refer to motivation levels that influence the actions of an individual. Cognitive factors address the influence the thoughts of an individual. Environmental influences refer to factors such as culture, policy, strategies, and communication (Bandura, 2004). Dynamic interrelation among the factors is known
as reciprocal determinism; this refers to connection and interaction among factors that influence the three (Bandura, 2004) and describe the interaction between people’s health behaviors and their environments (McAlister, Perry, & Parcel, 2008).

Other constructs shape behavioral decisions. First, knowledge about health risks and benefits forms a precondition for behavior change. For example, if a person has little understanding of habits that affect one’s health, the person might not be motivated to change and adopt healthy habits, influencing their behavioral capacity. As a third construct, expected outcomes refer to the costs and benefits that impact the motivation of individuals (Bandura, 2004). The fourth construct is the goals that people set for themselves as a self-incentive to be motivated and to achieve a specific outcome by adopting behavior change. Finally, the fifth construct refers to motivators, the perceived facilitators, and barriers to performing behavioral, personal, or environmental change (Bandura, 2004).

Another construct of the SCT model is observational learning, which refers to how individuals learn to perform a new behavior through exposure to media and to peers’ modeling of a new behavior or activity (McAlister, Perry, & Parcel, 2008). Another aspect is emotional coping responses, which address how social support has beneficial effects in raising people’s positive beliefs in their self-efficacy to manage circumstances (Bandura, 2004).

Through such constructs, we can understand more about translating knowledge into useful strategies for health behavior change through the development of interventions. In the SCT model, it is critical to understand the likelihood of someone adopting a health-protective behavior based on self-efficacy. First, the person must
believe in future positive outcomes of the proposed health behavior. Second, the individual must have a sense of personal agency (self-efficacy) to perform the health behavior that is suggested (Fishbein & Yzer, 2008). Therefore, this model represents an interconnected system across its constructs that influences each element in different ways. The perspective of knowing the health risks and benefits a person can access creates a precondition for health behavior change, creating awareness. Such awareness will influence actions and perceptions about actions they enjoyed prior to discovering new approaches (Bandura, 2004). Another set of influences comes from the expectations people have about adopting a different behavior and how that brings about improvements in their lives. Such expectations are also influenced by the social perceptions of others surrounding the individual while performing a health behavior (Short, James, & Plotnikoff, 2013).

The SCT model provides an interconnected approach comprising the individual and their knowledge and environmental influences that intervene in the process of health behavior change. Additionally, SCT includes the outcomes people expect by investing their time and resources and how they project feeling in the future as a result of adopting behavior that requires personal effort and evidence supporting the benefits of adopting change (Bandura, 2004). Such behaviors include physical activity, associated expenses of enrolling in a sport or workout routines, and a healthy diet. Increased physical activity generates an expectancy of losing weight, improving agility, having more energy, giving up medication, or not having to face as severe or as many illnesses in the future.

In Webb and Sheeran’s (2006) meta-analysis of behavioral intention, SCT was the only model that addressed the construct of the individual’s intention in the process of
behavior change as a determinant, acting as a mediator of their beliefs, with other surrounding factors, such as an environment, along with personal criteria, that is important to each person. According to Bandura (2004), another core determinant influencing behavior is knowledge of health risks and existing benefits (see also Short, James, & Plotnikoff, 2013).

In the field of community-level theories, SCT is focused primarily on modifying the environment. This notion is based on providing social support, social networks, and interpersonal communication models based on reciprocal relations among the individuals and their surrounding contextual environments (Glanz et al., 2008).

**SCT outcome expectations.** The outcome expectations in SCT refer to perceived costs versus benefits of performing a behavior and to the goals that people set for themselves to guide their actions in the future and their expectations (Bandura, 2004). Finally, perceived facilitators and impediments to making behavior change come from personal or environmental factors, which allow SCT to be used as a guide to intervention design. Considering these variable factors provides a holistic approach that better informs the specific health behavior change (Demark-Wahnefried et al., 2006; Pinto & Ciccolo, 2011).

**Considerations for research of social cognitive theory.** There is a need for more research about each of the constructs that are part of the SCT model and about its utility. However, some advancements have been developed to address this knowledge gap through a qualitative approach. SCT’s constructs assessment focused on the effectiveness of elaborating interventions in cancer survivors and in physical activity (Short, James, & Plotnikoff, 2013). The authors used in-depth phone interviews guided
by the model’s constructs (demographic data, cancer history, and history of physical activity) in promoting healthy behavior through physical activity in oncological patients. The results demonstrated the positive effectiveness of SCT constructs in developing interventions through the efficient engagement of oncological patients in physical activity (see Figure 3). Outcomes or theory-based approaches to developing interventions using SCT should be investigated from a qualitative approach that focuses on the constructs that compose this theory (Short, James, & Plotnikoff, 2013).

**Figure 3.** SCT model constructs (Bandura, 2004; Fishbein & Yzer, 2003; Short, James, & Plotnikoff, 2013).

**Social Marketing Model**

This section reviews scholarship that addresses the social marketing model as it constitutes the theoretical framework for the ESTPH case study in the present project.

As a model of health behavior change, social marketing conceptualizes a program-planning process that applies commercial marketing concepts and techniques to promote voluntary behavior change (Grier & Bryant, 2005). The social marketing model
is usually applied to consumer communication effort; it is also used to influence policymakers who can address the broader social and environmental determinants of health (Donovan & Henley, 2003).

This model applies sophisticated commercial marketing techniques to address public health problems, such as sedentary lifestyles (Wong et al., 2004), and the prevention of unhealthy behaviors, such as alcohol and drug consumption (Grier & Bryant, 2005). This model has been used for multiple health promotion campaigns, such as promoting physical activity to teenagers (Wong et al., 2004) and persuading women to have a mammography exam (Shamsi et al., 2014). Moreover, social marketing has an enormous potential to affect other health problems between members of ethnic minority and majority groups (Williams & Kumanyika, 2002).

**The social marketing process.** Some elements of the social marketing model are shared with public health planning processes, although they are distinguished by the systematic emphasis that marketers place on the strategic integration of the elements in the marketing conceptual framework. These elements, according to Grier and Bryant (2005), include the following:

**The notion of exchange.** An example: marketing attempts to influence voluntary behavior by offering or reinforcing incentives and consequences in an environment that invites voluntary exchange. The exchange theory views consumers acting primarily out of self-interest as they seek to optimize value by doing what gives them the greatest benefits for the lowest cost. Different from traditional commercial transactions (where people buy a product or service for cash), in public health situations, there is an immediate payback to target audiences in return for their healthy behavior. Nonetheless,
the exchange theory reminds social marketers that they must consider several factors (Donovan & Henley, 2003). Those factors include:

- Offer benefits for which consumers often pay intangible costs, such as time and the psychic discomfort associated with changing behaviors.
- Recognize that consumers usually pay intangible costs, such as time and psychological discomfort related to evolving behaviors.
- Acknowledge that everyone involved in the exchange, including intermediaries, must receive valued benefits in return for their efforts.

**Audience segmentation.** This element suggests that marketing differentiates populations into subgroups or segments of people who share needs, wants, lifestyles, behaviors, and values that make them likely to respond similarly to public health interventions. Compared to other systematic planning processes, social marketing devotes greater attention and resources to segmentation research. This process typically divides populations into segments, based on the current behavior of the target audiences. Further, the program identifies one or more segments of the overall audience as target-priority groups to receive most of the program’s benefits and to develop marketing strategies to promote health behavior change toward new, proposed healthy behavior (Forthofer & Bryant, 2000).

**Competition.** In commercial marketing, competition refers to how products and companies compete among themselves to satisfy similar needs and wants through their promoting strategies. In social marketing, it relates to the behavioral options that compete as recommendations and services to a public; for example, bottle feeding versus breastfeeding (Hastings, 2007). In this matter, social marketers try to compare these competing
behaviors. Answers to these challenges enable social marketers to offer benefits that best distinguish healthy behaviors from the competition and to develop a sustainable competitive advantage that maximizes their proposals’ attractiveness to their audiences (Hastings, 2007). An assessment of competition also can be useful to determine which behaviors are the best to promote and which segments become the best target. As a result of this analysis, the competing behaviors provide criteria about whether to compete based on the effectiveness of a campaign for promoting health or the campaign that cannot offer better value than the competitor (Hastings & Donovan, 2002).

**The marketing mix.** This is a core concept adopted from the commercial sector, best known for its four Ps—product, price, place, and promotion. These elements are critical pieces of social marketing and are central to the planning and implementation of an integrated marketing strategy (Greene et al., 1999; Kotler et al., 2002).

These elements rely on the understanding of consumers to develop a carefully integrated strategy. This integration process means that each campaign promotion component has been planned systematically to support defined goals and that all of the planned activities must reinforce each other in a coherent way (Grier & Bryant, 2005).

**Challenges for social marketing.** Although this model offers an approach to the development of programs of health behavior change, it is subject to several challenges and misconceptions.

**Barriers to diffusion.** This refers to the fact that the field of public health has readily embraced marketing’s reliance on advertising and other promotional techniques and has begun to rely increasingly on consumer research to make evidence-based decisions (Grier & Bryant, 2005). Moreover, as noted, social marketing is often viewed as a method for
designing communication campaigns rather than for developing comprehensive interventions that integrate the marketing mix elements (Smith, 2002). In this matter, there also is diminished attention to other factors that play a key role in the effectiveness of a health promotion campaign. These nonpromotional elements of the marketing mix reflect confusion related to the adaptation of these concepts to social marketing situations because it is difficult or impossible to modify public health issues. Examples include creating incentives to eat more fruits and vegetables or to lower costs or to provide discounts so that adapting to this behavior becomes easier to perform. Another aspect that is a barrier to diffusion is the disproportionate attention given to promotional activities; this has created a misconception that social marketing relies mainly on advertising to achieve goals.

Another common mistake of social marketers has been that programs develop through a perspective of “blaming the victim,” focusing on individual behavior rather than on the underlying environmental and social causes of the problems it addresses (Donovan & Henley, 2003). For related reasons, social marketing is critiqued as a wrong-headed approach to developing public health campaigns. Nonetheless, other authors have argued that this approach centers on the audience and that this allows organizations to better explore their contextual needs and critical aspects in the acceptance of a behavior (Smith, 2002).

Formative research and evaluation. The application of social marketing principles to public health efforts would also benefit from improved research methodologies, such as mixed methods, creative audience segmentation, and improved evaluation studies (Grier & Bryant, 2005).
Theoretical underpinnings. As the literature and conceptual frameworks that support social marketing are borrowed from commercial marketing frameworks, an ongoing discussion has arisen about how to apply and adapt the concept of a product to the promotion of health behavior (Williams & Kumanyika, 2002). Social change and behavior change must base their needs on more than one theoretical stream. No single theory or discipline is likely to provide all of the guidance needed to direct social change.

Peer-to-Peer Health Education

The role of peers in promoting health behavior change allows for the development of different frameworks for health promotion. For example, peer support integrates peer relationships in the provision of healthcare (Dennis, 2003). Additionally, peer influence can be used to explore the influential role on an individual’s behavior that friends and family have over adopting or not a health behavior through social norms and culture (Maxwell, 2002). Peer-to-peer health education in health promotion strategies has become an increasingly popular strategy, especially for working with children and teenagers (Story et al., 2002).

Peer education is the process of receiving advice from a friend or peer who knows about a topic or has experienced change through performing a behavior (Frantz, 2005). For example, peer education interventions in schools have shown that they can create awareness about HIV/AIDS in high school students (Franz, 2006).

In health promotion for physical activity and healthy nutritional habits, there is evidence that peers can influence those who are at risk for chronic diseases, such as with dieting and physical activity participation (Finnerty et al., 2010). Therefore, a young audience peer group can have a significant influence on the way one behaves in the
process of adopting or not adopting a new healthy behavior. Moreover, peer-led education provides empowerment to young people and children because it offers them the opportunity to participate in activities that affect them and to access the information and services they need for improvement in their health (Franz, 2015). As a strategy, peer health education models are also compared to the practice of placing physicians or nurses in schools, the goal of which is to raise awareness of unhealthy and healthy behaviors regarding sexual health. Studies have found that peer leaders were more effective than physician-led interventions in enhancing students’ knowledge, attitudes, self-efficacy, and behavioral intentions in the audience of teenagers (Dunn et al., 1995).

Regarding activities for interventions for peer educators, programs that report higher effectiveness have used extracurricular activities, such as clubs of drama/theater, arts, and community outreach activities. Here, peer educators were encouraged to design interventions and to take leadership in specific health education programs, although most of the available research has addressed sexual health education and not physical activity or healthy nutritional habits (Hampton et al., 2005; Medley et al., 2009). However, the planning process of activities/interventions faces different barriers in developing countries that have culturally diverse scenarios. Crucial criteria sets are the cultural differences among the researchers, the peer educators and target audiences, the socio-economic barriers, and community aspects (Falk, Pettet, & Mpagi, 2016). Consequently, peer education activities should consider and develop formative research to understand how to create engaging activities for health promotion that attend to the specific characteristics of the target audiences grounded on their interests and needs. Moreover,
these activities should strive to maximize accessibility to and personal comfort of their target audiences.

**Criteria for peer-to-peer education model planning.** Behavior change peer models allow researchers to develop effective strategies that support the adoption of new health behaviors, educate people, and raise awareness about a specific health issue, such as incorporating physical activity and healthy nutritional habits for different audiences. For developing a peer education model for health behavior change, several guidelines can facilitate the design process.

Peer education requires practitioners to select a target audience and to recruit peer mentors, train peers, and design and plan health interventions. Because the present study concerns two research projects that developed strategies for children by using teenagers, this section discusses literature focused on peer education applied to educating children with teens as peer educators.

**Recruiting.** One recommended method for recruitment of peer leaders is the nomination of their classmates. The TEENS health program for promoting physical activity (Story et al., 2002) selected peer leaders in this mechanism. Teens were asked to nominate three boys and three girls they respected or admired and believed could help to teach a class about physical activity. Other criteria for recruitment were to invite target groups to participate as mentors based on their willingness and availability to volunteer. An important consideration was to give the volunteers some form of compensation for their time and labor. Paying an allowance and covering the costs of food and transportation for the intervention sessions are highly recommended as motivating factors (Frantz, 2015).
Available studies about the recruitment and selection of teens as peer educators of other teenagers or children agree that the best tactic is allowing teens who are former participants of the health program to volunteer and sign up by demonstrating their willingness and interest to mentor other people and to share their experiences (Falk, Pettet, & Mpagi, 2016). A supporting tactic in the process of selection of teen recruits is to develop a set of criteria among the research facilitators to evaluate the recruits who are the best-qualified candidates. The criteria for selecting peer leaders from the pool of recruited volunteers should use the values that the health program wants to promote. Therefore, the peer leaders should be individuals who reflect through their actions and behavior the ideal behavior that the health program encourages the target audience to adopt. As shown in a study (Frantz, 2015) of health program coordinators (HPC) in Uganda, developed by the United Nations, the candidate should have an interest in health topics, artistic ability, and the desire to teach and learn about preventive sexual healthcare; the candidate should also be outspoken in group interactions by demonstrating positive social skills (Frantz, 2015).

**Training.** A crucial factor for the success of any health promotion program is to provide health education to the team of peer educators that informs them about the issue they will be communicating and for which they will develop interventions. Researchers must design a curriculum that can be easily adapted to the peer educators for their accessibility. Critical factors, such as the schedule and location for the training session, must be agreed upon after consulting with the peer educator candidates (Frantz, 2015). Some studies have pointed out that developing a participatory approach for curriculum design increases the willingness of peer educators to participate. An example is to
encourage candidates to list topics they are interested in learning about, and then include this in the training program (Price & Knibbs, 2009).

**Design and planning of health interventions.** Here, the primary considerations are the characteristics that identify and define the target audience. Some factors to be borne in mind are the culture of the target audience and its socioeconomic level; others are the barriers that can emerge in unusual circumstances or scenarios (Frantz, 2015). Different barriers can emerge as part of the inequity of issues in developing countries or in culturally diverse populations.

**Epistemology**

As several scholars argue, science communication needs to develop its practices and research from a different perspective of theoretical foundations and communication models. Most existing science communication studies follow Western research communication epistemologies, which lead to persistent issues, such as misinformation, inaccuracy of science content, and lack of interest of audiences. However, newer research has found that the way that science communication studies most need to improve is in their exploration of public engagement in science. As Stilgoe and Wilsdon (2008) explained, the deficit model approach has guided prior studies in science communication through the notions of public understanding of science, in which researchers’ one-sided assumptions argued that people did not know enough about science to understand scientific topics. This approach did not encourage a cordial relationship between science and society, because it portrayed people as ignorant and science as unchanging (Wynne, 1995).
The Colonial Tradition: Historical Social Segregation and its Influence on the Relations Between Academia/Science and Society

The following section discusses the culture and social context of Latin America. In this regard, it is crucial to acknowledge the colonizing traditions that have affected research and knowledge production in North America and South America. In the U.S.-Western scenario, to develop a comprehensive approach that allows understanding its complex contextual reality, decolonial and participatory strategies are addressed from the perspective of indigenous scholars around the globe, including Native American and Australian scholars as well as those from Latin America, and specifically, from Ecuador and the Andean Region.

Colonial structures origins: privilege and power in the Americas (United States and Latin America). Mestizos currently represent the predominant racial group in Latin America (Mignolo, 2007). As a race, mestizos emerged after the Spanish colonization (Hurtado, 2007). Prior to their emergence, South American and Central America populations belonged to different indigenous civilizations (i.e., Cañaris, Incas, Aztecs, Mayans, Mapuches, Guaranís). Each had its own culture and social organization system (Valdano, 2014). With the arrival of Spaniards in 1492 in Latin America (Mignolo, 2007), new races appeared, such as Spaniard creoles (sons/daughters of Spaniards born in Latin America) and even in the present day, mestizos, individuals with a mixture of indigenous and Spaniard ancestries (Hurtado, 2007). Centuries later, the mestizos became allies to indigenous groups to fight for liberation from Spaniard colonizers. They became the new privileged social group of Latin American nations,
inheriting the ideological belief of superiority and privilege from their Spaniard ancestors, which led to the reproduction of an oppressive system that continued to exploit indigenous groups and minorities. People from South American nations found themselves in a segregated society divided by social classes and ethnicity, and this remains the case to the present day. Moreover, the mestizo privilege was reproduced in different sectors of Latin American society, such as government and academia, where minorities (indigenous and low-income groups) continue to be targets of discrimination and have little or no access to education, healthcare, or representation in politics (Walsh, 2009).

In the United States, colonial structures persist in different scenarios in society (politics, academia, interpersonal relations) and are reflected and reproduced through the intersectionalities of gender and race (Moreira & Diversi, 2011). In the U.S. system, the colonial structure persists through the supremacy of White males over other groups. At the same time, the Founding Fathers of this North American country established in 1776 wrote the U.S. Constitution to place themselves in a ruling position, which has contributed to this day to the reproduction of hatred of and discrimination against women and racial minorities (Grosfoguel, 2008).

**Western-colonial traditions in academia and knowledge production.** Colonial aspects inherited from Western influence, mainly through educational systems, were how to organize society and language through an underlying agenda with the goal of “whitening nations” (Hurtado, 2007). In Ecuador, the “whitening” agenda implied erasing cultural aspects of the indigenous culture. Some of these erased aspects were the indigenous epistemologies and ancestral knowledge from Cañaris and Incas (Walsh, 2009). Consequently, education also became an ideological project of whitening the
Ecuadorian population by privileging white mestizos over the social groups of indigenous and African Ecuadorian peoples to access higher education. In academia, white mestizos were preferred as faculty of Ecuadorian universities and thus became the only group whose members could conduct scientific research (Walsh, 2014).

In U.S. higher education and scientific research scenarios, colonial structures also persist. Specifically, minorities and women are excluded due to the prevailing privilege of White males. Moreira and Diversi (2011) described women and minority members as “the missing bodies” in contemporary U.S. academia. Moreover, in knowledge production and research, the colonial structures become evident in practices such as the self-granted power to speak on behalf of others under the guise of benign paternalism. This power is supported through expertise and academic credentials.

In North America and South America, colonization is reproduced in similar ways in academic structures where scientific research is created, i.e., through knowledge production in research, where power, agency, and decision making also benefit researchers, who are part of their society’s privileged spheres. Moreover, knowledge production privileges Western knowledge systems and their epistemologies (Mutua & Swadener, 2004). Consequently, indigenous groups, minorities, and other societal groups who are target audiences of research projects are ultimately reduced to objects of study. The outcomes of these studies are analyzed by using Western theories, models, and concepts that reduce to simplistic findings their issues, their causes, and their consequences (Smith, 1999). Moreover, these findings do not provide any benefit to society but instead portray the study participants as poor or ignorant (Tuck, 2009).
Decolonial methodologies can provide an alternative framework that promotes a more egalitarian approach among members of academia and society at large. Moreover, as a research movement, decolonizing proposes to reverse the equation by making Western systems of knowledge, including the voices and participation of society and researchers, the objects of critique and inquiry (Denzin & Lincoln, 2008).

**Alternatives that Inform the Process of Overcoming Social and Cultural Tensions among Scientists and Society in Research Settings**

As reviewed above, academic structures have strong inherited colonial structures that lead to inequality. Therefore, academia and society require the exploration of ways that can contribute to understanding the responsibility of engaging with society’s needs and interests. For this purpose, a first step to include in the research process is the understanding of cultural identity and traditional knowledge (Jojola, 2008). In this manner, indigenous epistemologies support the belief that dialogue is a tool for reaching consensus. Dialogue among different social groups (i.e., researchers and society’s audiences) must be egalitarian and provide equal opportunities to share ideas, goals, needs, and analysis of an issue.

A specific phenomenon occurs in the Latin American context, where systemically mestizos and indigenous peoples are victims of discrimination and oppress each other (Freire, 2000). Indigenous planning frameworks provide guidelines for understanding the importance of an inclusive approach in a multiethnic-diverse context. Additionally, there is a need to incorporate traditional knowledge and cultural identity as counterparts to modern planning systems. Specifically, a participatory-planning approach contributes to address the local needs and interests as the primary component for
developing knowledge and for proposing practical alternatives for action. Indigenous planning, different from the Western approach to planning, represents an ideological movement (Jojola, 2008). The principles of indigenous planning that have been recovered by indigenous scholars from other parts of the world represent opportunities for rethinking a planning system that can integrate social actors of society, grassroots movements, academia, citizens, indigenous groups, and public authorities. Principles of indigenous planning of direct relevance to the present project include the following:

**People thrive in community.** This acknowledges that the struggle to build a sense of community is vital for reclaiming and rebuilding social fabric through identity (Robin, 1995). This principle is based on shifting from Western-hegemonic views and their individualistic paradigm toward, instead, strengthening a sense of community through the work of sharing information openly and through collaborative work with processes of dialogue.

**Putting our lives together.** This refers to addressing the claims of epistemologies that can revitalize the conceptualization of community. Social scientists are called to address these issues and to work collaboratively with indigenous communities and mestizo groups to unmask inequality and injustice through transformative processes (Lucero, 2003). This principle can raise awareness of the sense of community that is resilient in indigenous communities, encouraging their members to learn how their social systems organize and collaborate.

There are experiences of how community organizing led to powerful transformations in the context of Ecuador. In this country, the efforts of indigenous groups and organizations influenced policy reforms in education and new constitutional
laws in 2008 by promoting the development of research based on ancestral knowledge. Decolonial strategies advanced in Ecuador, creating spaces to revalue and reconstruct cultural identity. These spaces were the starting point to develop more understanding about an intercultural nation to enable the transition and transformation to overcome and emancipate from Western hegemonic frameworks for creating knowledge (Walsh, 2009).

**Ordinary people have all the answers.** This principle hinges on the trust that society holds power and knowledge that allow people to solve their own problems (Robin, 1995). The understanding of cultural ways and worldviews of indigenous groups allows them not only to better understand their ethics, protocols, and methods of knowing and existing but also serves as a guide to develop planning not only in built space but in the process of constructing solutions.

**Oppression is a force that devastates people.** This principle helps to reveal how different phenomenon lead to social suffering of the oppressed as well as to the spaces of resistance (Robin, 1995). As stated, one of the negative features inherited from colonization is social stratification, which leads to discrimination and oppression of indigenous groups. This, in turn, leads to oppression by members of higher social strata who wield influence and power by mismanaging their privilege. It is essential to understand the most frequent problems of civil society and social groups in their attempt to advocate for their rights as well as to understand other contextual problems, such as dominant-unequal policies, economic models, and ideologies.

Altogether, these principles provide a framework that argues for the need to provide an egalitarian space for dialogue among scientists/researchers and society. A key aspect is understanding that regardless of the educational differences and expertise that
the two groups have, they can learn from and be informed by each other through dialogue. Moreover, these principles provide guidelines for creating a collaborative space among members of academia and the general public.

**The Ecuadorian Decolonizing Research Approach in Academic Practices and Scenarios**

Decolonizing approaches in Ecuador developed through the indigenous Andean philosophy of Sumak-Kawsay, which is the holistic practice of good-living practices. Sumak-Kawsay is a holistic system that promotes the harmonious practices of individuals with each other, with nature, and with the divinity. Sumak-Kawsay claims that all of the elements present in the world are interrelated and affect one another. From the perspective of Sumak-Kawsay, one action has multiple effects that have a positive or negative impact on individuals and their surrounding social and environmental contexts (Walsh, 2014).

Applied to decolonial research, Sumak-Kawsay as a philosophical movement incorporates aspects of culture and worldview, with the purpose of creating an approach to understanding social issues and to finding solutions for them (Kesse, 1996). Ecuadorian scholars Juan Salazar and Catherine Walsh wrote in *Sobre pedagogías y siembras ancestrales,* “About pedagogies and ancestral sowings,” that it is important to consider two concepts to understand and integrate the elements to understand and develop actions for reaching new alternatives (2017, p. 295, 296). These concepts are *decolonial screams* and *decolonial cracks.*

*Decolonial screams* refer to the voices of the historically unheard people that embody the pain and suffering injustices (e.g. indigenous and marginalized groups) and
as that collective raises its voice with dignity, to reclaim their rights to reconstruct their
culture and ancestral knowledge in order to develop new alternatives for the present and
the future. These screaming voices mobilize their contemporary counterparts to recognize
the dispossession of their rights and, mobilized, to struggle against power imbalances. In
these struggles, tensions and confrontation occur and consequently lead to rupture and
gaps in the system. Decolonial cracks occur as a result of the tensions with those in
power and lead to disruptions and gaps that become evident by society in the power
systems; these systems are not conducive to social well-being; they need to change and
give space to the development of new alternatives. These alternatives are grounded in
local knowledge and culture that can lead to new sustainable solutions that do not harm
people (Walsh, 2017).

**Decolonial Principles that Inform the Present Study**

New science communication research suggests that it is necessary to move future
research in the field into a new dialogic framework (Stilgoe & Wilsdon, 2008), one that
uses a more nuanced epistemological approach to address the pressing issues of bringing
science closer to society. For this reason, the decolonial approach is applied to the present
project as I seek to design research from a community/society standpoint about how a
phenomenon is examined, understood, and affects people, taking into account local
knowledge, needs, interests, and issues that need to be solved (Smith, 2012; Walsh,
2014).

Among researchers who have been trained within the Western framework, there is
a tendency to seek evidence, numbers, methods, and theoretical frameworks that enable
them to build arguments through data-based interpretations of a phenomenon. However,
in the name of objectivity, researchers can fall into the trap of forgetting how to embrace issues with humanity. Researchers must not forget the contextual reality, where behind social issues people are suffering and need to move into action to transform their reality (Porter, 2010). The next section of this chapter reviews the principles that informed the ethical procedures and ontology that guided the present project’s development in two scenarios, Latin America and the United States. Although the present project’s two case studies took place in these different locations, they share a commonality: the presence of culturally and socially diverse groups, demarcated by oppression by privileged groups.

**Decolonial guidelines used in the present study.** Decolonial epistemologies suggest several principles that can inform how a researcher should proceed, through the following guidelines. These sets of criteria also informed how the researchers of this project conducted the overall inquiry. The guidelines were *service of love* as part of *love as a radical practice concept* that provide us relational politics guidelines to approach the ethics to practice and manage relations with others (Hooks, 1994; Nussbaum, 1990).

**Service to others.** This principle explains that to begin understanding people collectively, as “we” instead of the “otherizing” tradition of “them,” the best approach is to engage in thinking that we are in service to each other (Porter, 2010). In the context of this project, researchers and social groups are equals who construct and help each other to build knowledge and actions to improve and learn together.

**Compassion.** Compassion is a practice of self-awareness about the impact that actions might have in the world (Porter, 2010).

**Insight.** This is a concept that comprehends a group’s claims and dilemmas that can appear in a planning process based on the context. Here, useful reflections can occur
to foresee the possible difficulties in the process of research and to develop actions to consider strategies oriented to facilitate the emerging issues (Porter, 2010).

The principles of decolonial epistemologies can help to determine the procedures for developing dialogical encounters and can explain how culture and shared concerns about social issues can foster a sustainable relationship in immediate, medium, and long-term projects among different social groups (Smith, 1999). These principles can bring ethical considerations to bear on integrating cultural and racially diverse groups such as mestizos and indigenous groups in Latin America into the process of research (Walsh, 2017). The United States, as a culturally diverse country, could similarly transform the practices in academia and consider these decolonial principles (Porter, 2010). Moreover, these principles can be used as guidelines to create tangible practices based on spaces to open dialogue among people of different social backgrounds as researchers and the public.

Another emergent paradigmatic shift concerns the ways in which social movements in Latin America have changed from taking power through violence, as has been the case with armed movements, to a new approach of organizing models that are based on integrating and organizing into one’s everyday life so people can participate. These models are based on radical participatory practices rather than on representational democracy, better known as a revolutionary vanguard model (Smith, 2016). This model reconceptualizes “safe space” as a political movement that flows from the logic of privilege regarding gender, race, settler, and class to a different egalitarian framework for participation. This approach, however, does not recognize issues such as heteropatriarchy, White supremacy, settler colonialism, and capitalist ideologies, which
are manifested not only among privileged researchers (White or people of color) (Smith, 2013).

**Positionality of the Researcher and Self-Reflective Practices**

A decolonizing reflection for developing research involves taking a holistic approach to different social problems/concerns. Specifically, decolonial research will interrogate and contrast the existing scholarship that analyzes the phenomenon with the knowledge and experiences of people who live and are affected by these in real-life contexts. This strategic practice will allow developing critical reflections about the disparities created by dominant Western scholarship (Mohanty, 1991) and the efforts that must be put forward to find alternatives and solutions to social concerns. Additionally, it is necessary to avoid perpetuating colonizing and oppressive traditions of otherizing people by excluding them in the process of research, to move into a real participatory research framework that attends interests, goals, and real needs of indigenous and mestizo groups.

**Acknowledging the positionality and self-reflexivity practices of the researcher.** This section develops the approach of acknowledging researchers’ privilege through practicing self-reflexivity (Smith, 2013). This practice is necessary to develop a clear statement of the researcher and provides a transparent approach to understanding who the researcher is in terms of the researcher’s identity and beliefs, as well as her identifications, such as those concerning race, gender, culture, and ideology. In other words, this is a complementary reflective exercise to understand the perspective and the “researcher’s lens” when the claims emerge (Anzaldúa, 2007).
The identity of the mestiza is a product of the transference of cultural and spiritual values from one group to another. It means to be monolingual/bilingual or multilingual or tri-cultural. Moreover, the mestiza undergoes an inner struggle embodied in herself, perceiving a version of the reality that one’s culture communicates (Anzaldúa, 2007). One such scenario is the internal struggle that comes from being simultaneously an oppressor and an oppressed individual (Freire, 2010). Here, a question emerges: How can the mestiza embrace her identity? Several authors affirm that self-reflexivity is a positive practice to understand the impact of our actions as researchers (Breen, 2007).

As Andrea Smith (2013) explained in *Unsettling the Privilege of Self-Reflexivity*, it is important to note that the self-reflective practices have been described as a purely Western practice to deal with the confessions of researchers who bear the guilt of privilege but do not lead to dismantling oppressive structures that reproduce power. Moreover, and frequently, self-reflective practices had become a confession that would grant absolution and forgiveness or would earn temporary permission and absolution for any possible abuse of power in the research process (Smith, 2013). For this reason, the present project is driven by a decolonial epistemic approach and should be aligned with proposing a participatory approach that dismantles the systems that reproduce and reinforce power and oppression (Walsh, 2017).

Another common mistake in self-reflective practices is to adapt and negotiate the identity of the researcher for the researcher’s convenience. In this way, the goal becomes not to end oppression but to become as oppressed as possible in order to receive acceptance, as if competing in an “oppression Olympics” (Smith, 2016, p. 276). Such practices provide temporary access to develop research from a privileged position but do
not lead to political transformation (Smith, 2013). But in order to develop a truthful decolonial approach, it is crucial to not only acknowledge the power positions and privilege of the researcher but also to develop meaningful work to orient and provide new guidelines that represent a counterpart to oppressive structures.
CHAPTER 3
METHODOLOGY

In this chapter, I discuss the methodologies used for this study. I used qualitative (Marshall & Rossman, 2014) and participatory action research methodologies (Chevalier & Buckles, 2013) for achieving the research goals proposed in Chapter 1.

First, I explain the contextual aspects of this study regarding the qualitative data that was addressed/explored and subsequently analyzed. As a second step, I introduce the research questions for this project. Third, I provide a discussion of the methodologies chosen for this inquiry. Fourth, I discuss the processes of recruitment, compensation, and ethical considerations that guided the overall study. Finally, to close this chapter, I explore the data collection tools used and the data analysis procedures, placing those tools and procedures in conversation with the research questions.

Timeline for the Study

This study began in May 2018 and was completed in February 2019. The overall study planning included the approval of the dissertation prospectus; UNM’s IRB approval; the data collection process for both ACTIVITAL and ESTPH; and writing the manuscripts of the dissertation, as shown in the timetable below (See Table 1).
Table 1. Timeline of the study for 2018 and 2019.

Contextual Background

To recap, this study explored from an interdisciplinary approach the process of science communication for public engagement. The study identified the barriers and issues that emerged in planning and executing science communication of two research programs that already existed, and each program aimed to involve target audiences of children (ESTPH) and teenagers (ACTIVITAL). The study focused on research projects related to health behavior change for learning and for adopting healthy lifestyles (nutrition and physical health). The project was grounded in two case studies that allowed me to explore and compare how science communication can be developed in culturally diverse scenarios in the United States and Ecuador.

It is crucial to mention that the participants recruited for this project were groups of high school and college students who in both cases already knew about each of the programs. In both cases, they were named student collaborators, not human subjects or respondents, in accordance with the epistemological guidelines this study used (see page 71, *Epistemological Foundation for this Study*).

In the case of ESTPH, the students of Health Leadership High School (HLHS) were part of a specific pilot study developed by the University of New Mexico’s
Prevention Research Center and the Project Teacher of HLHS in the spring of 2018. The HLHS ninth and tenth graders were trained as health educators for elementary school children at Cien Aguas Elementary School in Albuquerque as part of their school curriculum.

In the case of ACTIVITAL, the student collaborators were former participants of the program when they were high school students, and during the current study, they were college freshmen and sophomores in Cuenca, Ecuador. They were exposed to the program messages in the past as target audiences and followed the program activities. Moreover, they contributed their opinions from their lived experiences about how ACTIVITAL can be communicated in a more engaging manner to other teenagers and to their parents.

As an interdisciplinary study, this project combined theories and methods from two scholarly disciplines—(a) communication and (b) community and regional planning—in its investigation of science communication for public outreach. The project addressed the need to explore more in depth the issues that are evident in prior studies of science communication for public engagement. These are (a) the lack of approachable language to present science content to the public (Dunwoody, 2014) and (b) the need to create more strategies to encourage the engagement of society with science communication (Stilgoe & Wilsdon, 2008).

Additionally, these two cases took place in different cultural and contextual scenarios. Both research projects concern health behavior change for healthy eating and physical activity. Using this approach, I was able to determine if the issues reflected in existing science communication literature applied similarly or differently for researchers
in the United States and Ecuador, to develop public engagement initiatives related to their research projects.

The two research sites, both located in the Americas are (a) Eat Smart to Play Hard (ESTPH), conducted by the Prevention Research Center in the Health Sciences Department at UNM; and (b) the multidisciplinary research group ACTIVITAL (see Appendixes for the case studies) at the University of Cuenca in Ecuador. These two projects were selected as case studies to develop a full description of the issues and difficulties that the audiences and the researchers found concerning health behavior change for promoting healthy lifestyles. Moreover, both projects share several commonalities. These projects, in previous phases, implemented health behavior change for children aged 8 to 11. Additionally, at the time of the current study, both projects were in a second phase and had as their goal the development of strategies to engage teenagers and/or young adults as health educators for children. For this purpose, teenagers (ESTPH) and teens/young adults (ACTIVITAL) were expected to adopt the suggested behavior of each program to be role models for children.

**Research Questions**

For this study, the research questions were the following:

RQ1: *How can researchers/scientists of health behavior studies develop better science communication strategies for public engagement, from the perspective of teenage/young-adult audiences?*

RQ2: *How can teen audience engagement with science/health communication be improved?*
Discussion of Methodologies

This study used a combined qualitative and participatory action research approach. By adopting this methodological strategy, the study aimed to ensure a collaborative setting that allowed constructing knowledge through dialogue as a practice to overcome traditional structures of academic research (which is commonly the center of power for decision making); the research agenda; and the interests of the researcher/scientist, which are not typically focused on the ideas and desires of research participants (Smith, 2013; Tuck, 2009). Additionally, this methodological approach enabled me to manage power relations in the process of research without excessively imposing my own interests as a researcher, or the interests of the researchers of ESTPH and ACTIVITAL, on the participants. For this reason, participants were referred to as “student collaborators,” because they were not subjects of study but rather were equal collaborators who contributed with their ideas, knowledge, and lived experiences (see the epistemology section below). The development of a collaborative setting allowed me to challenge traditional monopolies of knowledge creation driven by the power and interests of researchers over participants (Gaventa & Cornwall, 2006). These scenarios are common in universities where less frequently there are initiatives based on how to respond to a society’s issues using participatory action research and building relationships or alliances with social stakeholders to develop and conduct collaborative research (Greenwood & Levin, 2005).

Epistemological Foundation for this Study

Specifically, the present study combined decolonial scholarship as epistemological guidelines, participatory action research, and qualitative research as
research methodologies; and dialogic communication models and theories applied to the exploration of science communication in culturally diverse scenarios.

First, as an epistemic foundation, decolonial scholarship was used to discuss the issues that exist in the academic context of knowledge production and how the dialogue between science and society and society’s participation is the missing actor in the process. The following section explores the causes and consequences that the lack of society’s participation with scientific/academic spheres currently have. Understanding these aspects also enabled me to create a set of ethical procedures for both scenarios in the United States and Ecuador.

**Decolonial research methodologies conceptual framework.** To develop decolonial research means designing and conducting research from the community/society standpoint, about how a specific phenomenon or a set of issues is seen principally from their perspective (Denzin, Lincoln, & Smith, 2008; Smith, 1999). For this purpose, decolonial research methodologies focus principally on providing a voice to people in the overall research process. In contrast with western research frameworks and methodologies where a study’s participants are “human subjects” or “objects of study,” decolonial methodologies suggest that people and researchers must participate in research in an egalitarian framework (Smith, 1999).

Moreover, the process of decolonial research suggests that local knowledge, needs, interests, and issues of people must be included as part of the research process (Smith, 2012; Walsh, 2017). One of the most critical steps in decolonial research is to attend to indigenous scholars, students, and activists who engage in the struggle to find their academic voice by developing tools, ideas, and resources that assist the development
of peoples and communities (Smith, 2012). Decolonial research methodologies work hand in hand with participatory action research (PAR) and/or community-based participatory research (CPBR) methods—both of which I define below—to (a) ensure an egalitarian framework among researchers and participants and (b) promote the participation of people in the overall research process (research design, data collection, and analysis) (Denzin, Lincoln, & Smith, 2008).

**Decolonial research issues and misinterpretations.** Frequently, decolonial research is confused with rejecting the modernity that colonialism brought and claiming the superiority of the precolonial past (Walsh, 2014). However, decolonial scholars argue that decolonizing means to commit to building a self-determined future for indigenous groups and oppressed communities for achieving justice and liberation (Smith, 2016). Therefore, decolonizing means to establish an inclusive and egalitarian framework that provides voice to all of the stakeholders involved in the research process. Thus, researchers and audiences are seen as collaborators or co-researchers (Kovach, 2010).

Decolonial epistemologies (Kovach, 2010; Picq, Guanolema, & Guarantambel, 2017; Smith, 2013; Walsh, 2017) provide foundational principles for developing a participatory and collaborative research approach and ethical procedure considerations. These authors, and others, provide several considerations for counteracting the traditional procedures of academic research, including the co-construction of research protocols with the co-participants (Kovach, 2010) and the development of guidelines for shared knowledge among indigenous and social groups and academia (Herr & Anderson, 2014; Kesby, 2000). These considerations will be developed in more depth further on as part of the discussion of ethical considerations (see page 84).
A qualitative and participatory research approach enabled me to use this study to construct knowledge, shifting from the traditional framework of research, in which the power to determine the research agenda and to create knowledge typically relies solely on the researcher, to a more egalitarian action-research approach, which configured the inquiry scenario differently. Here, the framework shifts from (a) understanding research participants as subjects of research under the analysis of researchers to (b) a scenario in which the researcher and the participants are research collaborators who construct knowledge collectively (Chevalier & Buckles, 2013).

**Qualitative Research Methodologies**

This study used an explorative interdisciplinary approach that combined two different streams of social sciences (communication and community and regional planning). Qualitative research provided a comprehensive framework appropriate to this interdisciplinary study because the project (a) evidenced the need to use multiple methods that were interactive and humanistic, (b) explored and interpreted the focus on the context where the phenomena occurred, and (c) sought to identify emerging events/factors/themes rather than working with prefigured data (Marshall & Rossman, 2014). Case studies, specifically, were the core of the project, because the cases allowed me to explore how and why a phenomenon works (Yin, 2017) while also allowing for the development of a more extensive and “in-depth” description of a topic, favoring the interaction between each case and its context (Flyvbjerg, 2001). As a qualitative methodological strategy, the case study method (Yin, 2017) allowed me to understand, from the perspective of the programs’ audiences, how science communication can be developed to achieve public engagement.
**The case study approach.** The design applied to this study was a multiple-case study design composed of context, case, and the embedded units of analysis (Yin, 2017). The multiple-case study design is regarded as a more robust inquiry approach (Herriott & Firestone, 1983); specifically, a multiple-case design approach is preferable over choosing a single-case study design because the results of the latter might be not generalizable (Yin, 2017). Multiple-case studies offered greater analytic benefits; having two or more cases offered the opportunity to develop comparisons that were more substantial, and consequently, outcomes of greater meaning.

The first research question—How can researchers/scientists of health behavior studies develop better science communication strategies for public engagement, from the perspective of teenage/young-adult audiences?—addressed how strategies of science communication for public engagement can be developed. For the purpose of the case study approach, this constitutes the first unit of analysis, and it was addressed by recapping the experiences, opinions, and ideas of the student collaborators of the ACTIVITAL program and of ESPTH, as firsthand informers of their own experiences and of their experiences with children participants of the program. Here, the emerging issues and their insights about how to solve these issues informed how scientific research could be communicated to become more engaging to the audiences of the ESTPH and ACTIVITAL programs.

The second research question—How can teen audience engagement with science/health communication be improved—addressed how collaboration among society and scientists can be feasible; thus, the exploration centered on how scientists/researchers can work to create engagement with their audiences. As I conducted the study, it was
important for me to keep in mind that the two groups of each case study were different from each other and that each group itself was composed of a diverse set of young people. That is, within each of the groups and between the two groups, there were differences in the student collaborators’ interests, needs, and expectations, and, as I expected, in their understanding of and recommendations concerning the development of collaborative-participatory research.

Therefore, the research design of the present study, which employed multiple-case studies, was the following. The context for this research project focused on science communication for public engagement in culturally diverse cities in Cuenca, Ecuador, and Albuquerque, United States. The case studies were ACTIVITAL and ESTPH research groups working with teenagers and young adults who explored how to communicate their research findings with the goal of creating more engagement with the programs each research group proposed in order to promote the adoption of healthy behaviors (healthy nutrition and physical activity). The embedded units of analysis were the following: (a) science communication for public engagement, which addressed and explored how science should be communicated by researchers to their projects’ audiences to achieve greater public engagement; and (b) participatory planning, which explored how to construct collaboration among academia and society around, but also beyond, science communication (See Figure 4).
**Figure 4.** Multiple-case study with embedded units of analysis (Yin, 2017) applied to this study.

**Participatory Action Research Framework**

Action research and PAR trace their foundations to two distinct but interrelated traditions, Kurt Lewin’s action-research (1946) and Paulo Freire’s approach to co-learning in his book *The Pedagogy of the Oppressed* (2000). Taking a psychological approach, Lewin referred to action research as a cyclical process for solving problems through the steps of full participation of people in planning, action, and research, or PAR (Minkler, 2004). This contribution of Lewin to CBPR and PAR is better known as “emancipator research” (Hacker, 2013). CBPR centers on the process of inquiry on the values, needs, and desires of a community. In this manner, the participation and involvement of community members in the research stages are crucial. In CBPR, researchers and community members serve as co-researchers working together to define
the problem, develop a logic model or conceptual frameworks, design the research questions, decide and adapt the methods for data collection, document the interventions, analyze data, and use the information to make an argument (Hacker, 2013).

Freire, a Latin American educator, developed another foundation of participatory research methods, through his concept of co-learning (Freire, 2000). Co-learning proposes a role for the researcher as a facilitator of producing knowledge but also argues that research not only can emerge from academia but also from the interests of society working in a framework of a community, where all the participants are co-researchers and contribute with their knowledge (Hacker, 2013). Accordingly, the present study was conducted through qualitative methodologies and PAR.

In this study, action-reflection cycles (McNiff, 2014), which are a PAR procedure for conducting research, served as guidelines to conduct the discussion in each session. This methodological approach was a process that allowed the facilitator and student collaborators to serve as co-facilitators to focus on identifying topics and issues and collecting and analyzing the data (McNiff, 2014). This approach also made it possible to process the data and develop suitable actions through a collaborative and dialogic endeavor that involved the student collaborators as active research collaborators.

The overall research process was conducted through phases in four sessions. It is important to clarify that the assistants of each session were student collaborators and two researchers of each of the health programs (See Figure 5):

Phase 1: Identify the issues and barriers that emerge for communicating science. Here, the discussion centered on identifying the difficulties and barriers to communication of a research project from the perspective of its audience, who in this
project were the student collaborators. Specifically, as a first step, the study looked at what audiences think about how science for health studies is currently communicated in the cases of ACTIVITAL and ESTPH, such as was it interesting, boring, or too technical? These aspects were explored in the first focus group session.

*Phase 2: Describe the issues, barriers, characteristics, and causes of these.* After we identified the primary issues and barriers, we moved toward building some description of each of the issues that the student collaborators found in ESTPH and ACTIVITAL and which caused or led to the difficulties found in each case study. This exploration was developed in the first group session.

*Phase 3: Develop and execute alternatives to address these issues and barriers.* The third step was to discuss with the student collaborators how to solve these issues or difficulties through developing specific actions. Another exploration was to find the best-suited communication conduit to re-design the activities or tactics of ESTPH and ACTIVITAL. For example, the issue of technical language was solved by writing shorter messages about the program’s nuclear claims. Alternatively, an activity that was considered as not interesting, fun, or useful was addressed by designing a new activity that was more attractive. This exploration was developed in the third session.

*Phase 4: Revisit the results of the activities/tactics and evaluate the effects of the implemented tactics.* After the student collaborators developed their suggestions and analysis, all of the researchers of each corresponding research group were invited to the sessions (ACTIVITAL in Cuenca, ESTPH in Albuquerque) to learn more about the new suggested strategies proposed by the student collaborators. The purpose of this phase was
to reflect, evaluate, and envision new alternatives to communicate ACTIVITAL and ESTPH. This process was conducted in the fourth session.

*Phase 5: Determine actions for public engagement and for building collaboration and participation among scientists/researchers with the public.* After the student collaborators and the researchers of ESTPH and ACTIVITAL discussed the projects and their goals and also acknowledged the new emerging topics that represented each groups’ interests, it was crucial to address the discussion outcomes and to propose alternatives to work together in the future, guided by the needs and concerns of student collaborators. Through this approach, the project aimed to be genuinely participatory and egalitarian. Moreover, the interests of researchers and student collaborators were equally important as nonextractive of information that benefits only the researchers and leaves behind the participants, as in traditional research frameworks (Tuck, 2009). Instead, the study sought to find convergent points where researchers and their audiences could become collaborators for the future and develop projects and actions for mutual benefit. This discussion took place in the fourth session for the closure of the data collection and analysis phase.
Figure 5. The action-reflection cycle process (McNiff, 2014) applied to the study.

Through this process, the student researchers shared agency with the researchers of the programs, and together they worked in an egalitarian fashion to create knowledge about persisting issues in science communication. As noted earlier, by using dialogue as a tool to communicate and to build understanding, the facilitator and the student collaborators dismantled the emerging or existent issues and proposed further actions to address them through in-depth descriptions.

Recruitment of the Student Collaborators

In the recruitment process of student collaborators in Cuenca and Albuquerque, it was necessary to acknowledge these considerations, the constituencies of social groups, the interests of the target population in the topic of research (Minkler, 2004), trust building (Chevalier & Buckles, 2013), specific recruitment procedures for approaching the student collaborators, and compensation for participation (Weiss, 1995).

Regarding the constituencies of the social groups, it was crucial to approach the existing organizational leadership and to follow legal and policy procedures; doing so
helped me to better understand the interest of the teen population in Albuquerque and the young adults in Cuenca.

**Group 1: Teenagers of Health Leadership High School in Albuquerque, New Mexico.** For the ESTPH case study, in Albuquerque, HLHS was approached through UNM’s Preventive Research Center about participating in this study. At the time, these students were currently working with ESTPH as health educators of children aged 8 to 11 at Cien Aguas Elementary School.

I held conversations with the teachers of HLHS who were involved with the ESTPH research team. A letter of intent was submitted to and approved by the HLHS principal and the teacher in charge of the students, allowing me to work with a group of ninth and tenth graders as student collaborators for this project. Participants in this group received an informed consent and assent form detailing the data collection and other research procedures for the focus group sessions. This document was signed by a parent or legal custodian of each participant and also by the student collaborator, because the students were younger than 21. Participants were asked to join voluntarily, and they could also choose to stop attending if they desired. The sessions took place in a classroom of HLHS, in the presence of the teacher of the health education class, during August and September 2018.

**Group 2: Former participants of ACTIVITAL in 10 high schools in Cuenca, Ecuador.** In the case of ACTIVITAL, in Cuenca, the initial intent was to contact the coordinators of their faculty-student boards or councils to request the participation of the students. Nonetheless, due to issues of funding of the research group, the initiative of a public outreach program with former participants of the program was postponed until the
academic year 2019-2020. At first, this study was articulated with the public outreach program of ACTIVITAL to begin in January 2019. For this reason, it was agreed with the researchers of ACTIVITAL to change the recruitment process of student collaborators by using the pool of the database of former participants. The ACTIVITAL research group provided a database of contacts of the high school participants during 2009 to 2012. However, it is important to mention that at the time of the current study, the student collaborators of ACTIVITAL were college freshmen and sophomores, aged 19 to 21, who had been participants in the program when they were in high school. In this case, the authorization and approval of the IRB of the Ministry of Education of Ecuador was no longer necessary because the guidelines in Ecuador for research with human subjects require review only if the research used underage participants.

The recruitment process used the database contacts of former participants from 2009-2012 and sent emails to invite them to participate as student collaborators. In this case, informed consent and a contact phone number were required from all of the student collaborators. The students were alumni of the following high schools where ACTIVITAL was implemented: Miguel Merchán, Antonio Ávila, Salesianas, Catalinas, Fe y Alegría, Carlos Arízaga, Manuel J. Calle, and Colegio Latinoamericano.

The venue for the sessions was determined by consulting the participants about which location, dates, and times were most convenient. They agreed that the main campus of the University of Cuenca was the best place, due to its proximity to all points of the city. For this reason, a classroom at the university was selected as the location for all four sessions. All sessions were conducted in Spanish because it was the native language of the student collaborators.
Ethical Considerations for Research

In this section, I address the general ethical considerations that guided the overall study. Specifically, I discuss the procedural practices followed in all phases of research through the guidelines of decolonial epistemologies, and my positionality as a researcher.

Trust-building with the student collaborators for creating a safe space for research. Before addressing the student collaborator groups, the following procedures describe how I as the researcher of this study addressed the participants. The following notions of trust-building allowed me to understand that trust is something that is earned as the result of a process of building a relationship (Hacker, 2013). A first step was the practice of using cultural humility as a guide for addressing the cultural beliefs of the researcher and for countering power imbalances (Tervalon & Murray-Garcia, 1998). Consequently, in practice, I researched the cultural aspects of each group of the participants of the programs through formative research studies and the cultural characteristics of the student collaborators during the overall research process. Second, it was important to negotiate the research agenda with the participants in a way that also benefitted them. Third, I demonstrated willingness to share power in the practices involved in the research process, including decision making and developing/identifying a collaborative setting for working with a community (Hacker, 2013). In the context of this study, the second and third guidelines supported the process of building trust with the student collaborators for designing and executing a research project in a transparent setting through the following practices.

- The student collaborators chose the locations for conducting the research sessions in places that were safe and comfortable for them.
The student collaborators and the researchers of each case study constructed the final ethical procedures and policies to proceed in the research sessions. However, the guidelines established over the prior sections were the starting-point considerations to design this study. In the first session, one of the initial points was a discussion about creating consensus about the ethical procedures to guide the sessions and the management of the outcomes of the inquiry. This is described further later in this chapter.

At all times, the student collaborators were invited to co-facilitate the research sessions, formulate additional questions, and they led the co-design process of new science communication strategies for each case study.

Additionally, another useful practice to encourage a reflective process on the part of the researchers involved in this project was necessary, in order to clarify the reasons and interests that drove the study. It was crucial also to create a balance among my interests as a researcher, the interests of the researchers of ESTPH and ACTIVITAL, and the needs and interests of the student collaborators of each case study involved in this study. Research traditionally reflects more of the position of the researcher as the initiator of a project and the person who develops an analysis (Stoecker, 1999). In the participatory action research realm, however, consensus must be reached from the beginning through transparent dialogue between the collaborators and the researcher (Breen, 2007). The design of the present study, then, was constructed as a result of previous discussions about the interests, needs, and issues of the student collaborators of the programs and of the research teams of each case study. Consequently, this study recognized not only the gaps in science communication and public engagement along
with the needs/interests of researchers to improve the communication of their programs but also the needs and interests of the student collaborators.

One constant consideration for me as a researcher and author of this study was to be cognizant of the power dynamics that come into play in cross-cultural scenarios. Specifically, I conducted two case studies in which I did not belong to the same ethnicity or culture of the student collaborators. For this purpose, I developed several self-reflective practices to ensure transparency and to reduce bias in the research process that is explained in detail later in this chapter.

**Dialogue as a methodological tool for participatory action research.** In action research, the contribution of Street Science—which is a framework for decision making that combines professional and local community knowledge to seek solutions for solving issues that affect local communities (Corburn, 2003)—highlights where power lies in the production of knowledge and how valuing local knowledge allows the researchers and collaborator researchers to face “real life” problems and seek solutions (Corburn, 2005). In the same manner, PAR seeks to shift from a traditional structure, where power lies only in the researcher, to a research framework in which the participants are empowered through their own experiences, knowledge, interests, and desires to address a specific issue that affects or concerns them (Smith, 2017; Tuck, 2009).

The present project combined the expertise of researchers and the experiences of student collaborators based on their respective experiences and training to develop new solutions for addressing social concerns. From the outcomes of this collaboration, it was possible to propose alternatives for social change regarding how healthy habits that are the results of an inquiry project can be communicated for improving the engagement
specific to audience groups. Moreover, the study considered how, in the future, student collaborators and the researchers of each case study could find common ground for future collaborations.

**Compensation for student collaborators and the research teams of ESTPH and ACTIVITAL.** It is important to compensate the participants of a research project for the time they dedicate to being part of an inquiry process (Weiss, 1995). Thus, in the sessions, the student collaborators were compensated with healthy food and refreshments and were paid for each session they attended. The total compensation that each participant received was $40 — $25 in cash and $15 worth of healthy food and refreshments. Researchers on both research teams (ACTIVITAL and ESTPH) were compensated with a science communication workshop that included the development of a strategic campaign plan for their projects, with the result of the findings of this study, at no cost to those teams. The resources for this study were financed through the funding of UNM’s Latin American & Iberian Institute Ph.D. Fellowship Grant.

**Ethical procedures for conducting research and managing the data.** This study was reviewed and authorized by UNM’s Institutional Review Board prior to the beginning of the data collection phases. The ethical procedures followed for data collection, for managing the data, and the student collaborators’ information were the following, the focus group sessions were audio-recorded and documented through the photographic registry of the sessions’ outcomes. For example, the only pictures taken captured the participatory diagramming displays (concentric rings, diagrams) or the sketch maps; faces of the participants were not filmed during the activities. This procedure was selected because the ESTPH student collaborators were underage, and
protecting their identities was essential. In the case of ACTIVITAL, the same procedure was followed to protect the individuals’ identities, even though they were young adults with a legal right to provide their consent. This procedure provided a more comfortable setting without video recording, which frequently intimidates and conditions the behavior of research participants (Weiss, 1995).

Moreover, the student collaborators were not asked to provide their names on any paperwork other than on the informed consent forms and on the attendance sheets for each focus group session. Informed consent/assent forms, the registry of session attendance, and the registry of the compensations given to each of the co-researcher participants were stored separately on paper and were filed in folders labeled “Albuquerque” and “Cuenca,” respectively. Both folders were kept in a locked file cabinet, and the keys were under the control of the researcher of this study, from the time they were collected and until May 2022, when the folders and their contents will be destroyed. At all times, these documents were stored separately. This procedure was an additional practice as evidence for the participants’ consent to take part in the study and to serve as proof that they received compensation at the end of the study for each session they attended.

As noted above, to ensure the privacy of the student collaborators, each of them created a nickname during the first focus group session, and that nickname was used in each of the four sessions that took place. Their nickname was the only identifier in the process of research for data collection and in the transcripts for data analysis. This procedure ensured the protection of the identities of the student collaborators. All of the data collected (participatory diagrams, maps, and zines) will be kept until May 2022 on a
hard drive for possible publishing of research articles. After May 2022, data will be destroyed. If a research article ultimately is published, the names of the student collaborators will be recognized as “ESTPH student collaborators team” or “ACTIVITAL student collaborators team” as the co-owners of the data. If a collaborative article is written for a journal, the names of the collaborating researchers of each program would be recognized as co-authors.

**Practices for ensuring transparency and reducing bias in the research process.**

There are useful practices to adhere to in the process of participatory research for a better outsider-insider positioning of the researcher. The outsider-insider positioning refers to a research standpoint that represents a different positionality for the researcher that corresponds to a contrasting or a different reality concerning the researcher’s culture, race, geographic location, and agency or belonging to a human group. However, it also refers to shared aspects that the researcher belongs to, knows about, and has agency with. This represents a dual positionality of insider/outsider (Breen, 2007).

In this project, in the Ecuadorian scenario, my agency and power were greater than they were in the United States. Therefore, my identity and, consequentially, my positionality, were dual and shifted from one place to the other in my condition as a mestiza researcher (Anzaldúa, 2007). For this reason, the following procedures were developed during the data collection process.

- Employed multiple sources of data and multiple methods of data collection. This strategy allowed for triangulation and confirmation of facts that were key for a project (Maykut & Morehouse, 1994; Patton, 2002).
• Carried an audit trail, such as a journal, in which the researcher documented the daily tasks and memos (Etherington, 2004; Maykut & Morehouse, 1994; Nagy & Viney, 1994; Strauss & Corbin, 1998).

• Double-checked interpretations developed as a researcher with informants to ensure accuracy (Maykut & Morehouse, 1994). For this purpose, inviting several informants to participate in short second interviews helped to clarify interpretations.

• Provided a detailed description of both the setting and the informants involved in the study so that readers could assess the credibility and transferability of findings (Breen, 2007).

As a researcher, I strove to anticipate any barriers that could emerge, starting by learning more about the local culture of the teenagers in Albuquerque and college students in Cuenca. By embracing these practices in conducting my research, I aimed to develop a respectful approach to any possible sensitive topics and to determine the best strategies for eliciting student collaborators’ opinions and ideas. To this end, formative research was necessary to understand the perspectives of student collaborators, their communication habits (including learning about the media they most frequently consumed as audience members), and their experiences with health/nutrition-related programs. This information was addressed by the research teams of ACTIVITAL and ESTPH and by reviewing existent literature through available studies about Cuenca and Albuquerque populations regarding physical health studies.
Data Collection Processes and Their Relationship with the Research Questions

To present the data-collection processes used for this project, this section recaps the study’s research questions and comments on their value and their relation to the case studies. In Chapters 4 and 5, the research questions discuss the results and analysis for each research question.

This section comprises all of the data collection tools, procedures, criteria for analysis used for each of the four sessions, and the overarching research question.

### Table 2. Summary of the data collection processes, tools, and procedures of the study.

<table>
<thead>
<tr>
<th>RESEARCH QUESTION 1</th>
<th>SESSION</th>
<th>DATA COLLECTION TOOLS USED</th>
<th>CRITERIA OF ANALYSIS</th>
<th>ANALYTICAL LENS STRUCTURE</th>
<th>THINK ABOUT QUESTIONS</th>
<th>PROMPT QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Participatory Diagramming</td>
<td>Assessment of communication materials and activities, existing issues of ESTPH.</td>
<td>Two-Step Flow Theory</td>
<td>What will be good opinion leaders for ESTPH/ACTIVEITAL? Scientists, other kids, teenagers like you, as influencers? Why do you think these individuals will be reasonable opinion leaders?</td>
<td>1.1. What do you think about the activities that ACTIVEITAL/ESTPH has developed to communicate their program? How well do you think these activities are working?</td>
<td>1.2. Which activities of ACTIVEITAL/ESTPH do you think are most effective? Why?</td>
</tr>
<tr>
<td>2</td>
<td>Participatory Diagramming, Asset Mapping</td>
<td>Opinion leaders for ESTPH, evaluation of activities of the program and mapping spaces for physical activity &amp; family engagement.</td>
<td>Framing Theory</td>
<td>If framing affects how people feel or think and act, let’s picture different scenarios you believe will be more useful to communicate ESTPH/ACTIVEITAL. Our “think about” last session is how ESTPH/ACTIVEITAL can be focused on the public to be more engaging?</td>
<td>2.1. What do you think about the program?</td>
<td>2.2. Which places are available for children and parents to do physical activity and play in the city?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RESEARCH QUESTION 2</th>
<th>SESSION</th>
<th>DATA COLLECTION TOOLS USED</th>
<th>CRITERIA OF ANALYSIS</th>
<th>ANALYTICAL LENS STRUCTURE</th>
<th>THINK ABOUT QUESTIONS</th>
<th>PROMPT QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Zonas.</td>
<td>Communicational framing for ESTPH, designing new activities and communicational conduits.</td>
<td>Mendelian Theory</td>
<td>Which media conduits are the best to promote their programs to create more engagement?</td>
<td>2.3. Where can (or where do) teenagers find information about healthy habits?</td>
<td>3.2. What would you add or suggest to ESTPH/ACTIVEITAL current program?</td>
</tr>
<tr>
<td>4</td>
<td>Participatory Diagramming</td>
<td>Exploring the proposed strategies of ten student-collaborators and opportunities of collaboration with the ESTPH research team.</td>
<td>Discussion of the overall findings of the think about questions</td>
<td></td>
<td>DISCUSSION OF OPTIONS FOR FUTURE COLLABORATION</td>
<td>Student collaborators and researchers of ESTPH and ACTIVEITAL discuss about options for future collaboration among researchers and society under their target audiences.</td>
</tr>
</tbody>
</table>

This question addressed how...
to develop science communication in a way that effectively attracts the attention of the target audiences to communicate how to have healthy habits for nutrition and physical activity. In this study, this approach was developed from the perspective of the student collaborators of the two case studies. At the same time, these findings informed the process of elaboration of a set of criteria for designing and implementing science communication initiatives for public engagement. These criteria contributed by providing guidelines to inform the work of scientists/academic researchers in science communication initiatives for public engagement.

To elicit the insights of student collaborators, focus groups were conducted. The sessions were designed as participatory group discussions to address explanations, centering the attention on building more knowledge about the participants’ experiences (Kamberelis & Dimitriadis, 2008). A total of four sessions, each lasting 45 minutes to one hour, took place in which the perceptions, interests, and ideas of the student collaborators were explored regarding how healthy habits for nutrition and physical activity that emerge from scientific research can be communicated efficiently. Also, the discussion centered on the exploration of how to attract audience attention to promote audience engagement. All of the focus group sessions used participatory data collection tools for a collaborative exploration. The data collection tools were the following per each session.

*First session.* As a first activity, in this session, the student collaborators were asked to create a self-identifier (nickname) for themselves in the overall research process; this nickname had to be the same from the first to the last session, and it was also used in
the transcripts of the sessions as the only identifier for each of the student collaborators. This procedure ensured the anonymity of their identities.

The second activity was to discuss the ethical procedures and rules that guided the sessions. Here, the ethical procedures, specified later in this chapter, were discussed with the student collaborators (i.e., personal identifiers and safety for managing data, informed consent, compensation, assistance, communication in the overall research process, expected outcomes, what to do in case of conflict). These rules were shared with all of the student collaborators and everyone else involved in the research process. All of the involved parties committed to respecting and following these guidelines and policies.

The participatory diagramming tool for data collection in PAR research allowed for the facilitation of the first discussion about assessing the communicational pieces of each case study (see Table 2). As a data collection tool, PAR diagramming enables researchers to rank priorities, recognizing topics and themes that emerge from the responses of the participants. In its different formats (grid diagramming or a concentric ring), this data collection method allows researchers to guide and establish priorities and then to organize ideas to make sense of the insights that emerge (Kesby, 2000). In the data collection process of this study, PAR diagramming was used to organize and select the emergent themes for discussion and to connect causes and consequences with the alternatives proposed as solutions for emergent problems and with issues that required improvement.

Participatory diagramming was applied to collect data for recognizing the perceptions of teens about how science communication was done at that time and how it could be developed to create better engagement and to explore what works and what does
not. In this session, emergent topics were identified as the primary priority issues; subsequently these issues were addressed in the following sessions’ discussion. This practice allowed me as the facilitator researcher to identify and organize the student collaborators’ perceptions and interests. This data collection method was a guide to establishing priorities and organizing ideas for making sense about the possible strategies, conduits, and messages for science communication for health promotion of both case studies.

The student collaborators were asked the same questions in both case studies, depending on the program in which they participated. The student collaborators of Cuenca responded only to ACTIVITAL, and the student collaborators in Albuquerque at HLHS responded only to ESTPH.

The guiding prompts for this session were:

- *What do you think about the activities that ACTIVITAL/ESTPH have developed to communicate their program? How well do you think they are working?*

- *Which activities of ACTIVITAL/ESTPH do you think are most effective? Why?*

In the last section of this session, building upon the emerging information generated during the session, the student collaborators were asked to determine collectively through their experiences which activities they believed were engaging for the ESTPH and ACTIVITAL programs. Additionally, the student collaborators discussed which activities they thought needed to be changed to retool the program in order to be more engaging in the future for future implementation.

To prepare the student collaborators for the data analysis, I as the facilitator researcher explained the two-step flow communication theory and the role played in that
theory by opinion leaders. The purpose was to alert the student collaborators to key issues in the current literature of science communication and about the actions taken by opinion leaders on science topics. The goal of explaining this theory to the student collaborators was to consider possible alternatives to determine who might be appropriate opinion leaders for ACTIVITAL and ESTPH, respectively.

Second session. In this session, participatory data collection methods were used to develop a discussion with the student collaborators and researchers of each case study about how to improve and create more in-depth engagement and interest of audiences in the programs.

To collect the data, participatory diagramming (Kesby, 2000) was also used as tool to help to determine the subsequent tactics to be co-designed by the researcher of this project and by the student collaborators. The purpose was to explore the insights and ideas the student collaborators had for science communication for public engagement to be effective and interesting to each program’s audiences (see Table 2).

In this session, it was expected that the student collaborators of ESTPH and ACTIVITAL could determine possible communication conduits, messages, and activities for promoting each of the programs. Some of the answers suggested how to produce message content (e.g., create tips and recipes and physical activity alternatives that are fun) and the use of role models as opinion leaders as a peer-to-peer tactic or as activities that truly promote healthy lifestyles involving the children and teenagers’ families.

The first prompt question for the discussion of the second session was:
• If you could design an activity for communicating ACTIVITAL/ESTPH to teenagers like you, what would you do/suggest? Think about something you would like to see or do and other activities that teens like you might enjoy and engage in.

The suggested strategies were added to the participatory diagram of the first session as possible alternatives and solutions.

To identify the best conduits and available resources in each context for communicating the ACTIVITAL and ESTPH programs, I used asset mapping as a data collection tool. Asset mapping is a suitable data collection method for locating centers/places/conduits that represent any resource center for people. This tool is useful for PAR and CBPR in collaborative settings of inquiry. Research participants can be organized and trained for data collection and interview techniques that enable them to locate resources of a different type (e.g., experts, museums, places where specific practices occur in a city) and to develop sketch maps with their communities or peers (Chapin & Threlkeld, 2001).

For this project, asset mapping was used to allocate the resources and conduits that were useful to find reliable information about healthy habits and venues for physical activity. The second and third prompt questions to ask the teenagers in this session were:

- Where can (or where do) teenagers find information about healthy habits?
- Which venues are available for children and parents to do physical activity and play in this city?

The student collaborators in Cuenca and Albuquerque received training on how to use and conduct asset mapping for data collection for locating sources of information and how to develop sketch maps with their peers. Sketch maps are tools that allow
participants to collaboratively build more knowledge about a location, to elaborate notions of space perception, and to determine what respondents consider valuable sources of information for various purposes. A sketch map, as a template map, can facilitate the data collection or ask respondents to draw their maps and develop symbology for representing specific spaces/sources/resources (Chapin & Threlkeld, 2001).

Also, the student collaborators were asked to draw places in the city that they considered resources and information assets about healthy habits. For this purpose, in the second-session tools of Google Maps and Google Tour Builder were used to organize all of the sketch maps developed by the participants to visualize and analyze collectively the emerging data.

**Third session.** Once the student collaborators identified the suggested science communication tactics, activities, messages, and conduits to be used, the third session focused on exploring outcomes in-depth and bringing them together into an articulated strategy (see Table 2).

For this purpose, we used the technique of Zines, which emerged in the United States in the 1960s as self-published magazines (hence the abbreviation “Zines”) of counter-cultural movements to disseminate ideas and values, by addressing topics of social interest such as music, human rights, and social movements (Duncombe, 2014). Some authors use Zines for advocacy and activism, to elevate the voices of people and to raise awareness among others (Guzzetti & Gamboa, 2004). However, this study used Zines for creatively exploring the ideas suggested by student collaborators. In the third session of the study, the student collaborators created a short Zine (five pages or so in length) in which they addressed the specific topics they considered important for ESTPH/
ACTIVITAL, guided by prompt questions. The Zine tool was designed for making student collaborators draw, write, and create activities, examples of messages, events, and contests to develop engaging communication related to the research programs. All of the materials were provided to the participants by the facilitator.

The prompt questions used to guide the Zine-making process were the following:

- What activities will you develop to create engagement with your audience around issues of healthy eating/activities?
- What would you add/change to ESTPH/ACTIVITAL?

Also, in the third session, the student collaborators received information about framing theory in communication and how it is related to the design of media/campaign messages. The primary purpose of introducing this theory was to explore how ESTPH and ACTIVITAL frame their primary claims for engaging the public. Further, as with the other theories introduced in the sessions, this procedure allowed us to create a collaborative analytical lens to organize the emerging data and to discuss how to retool both research programs’ scientific communication to achieve public engagement.

To conclude the third session, the concept and constructs of medium theory were presented to the student collaborators. The goal of this discussion centered on the core aspect of this theory, which addresses media conduits and their specific characteristic features (Meyrowitz, 2009). Here the discussion centered on finding which media conduit according to its characteristics was more useful to achieve public engagement of the audiences of ESTPH and ACTIVITAL.

**Research Question 2: How can teen audience engagement with science/health communication be improved?** This question aimed to contribute to science
communication for public engagement scholarship by exploring how scientific research can be not only presented to society as a dissemination strategy to “nonexperts” on a topic but also by going further and moving into a dialogic framework (Stilgoe & Wilsdon, 2008). For this purpose, the second research question explored how to build what Stilgoe and Wilsdon called “encounter points” among scientists/researchers and their target audiences.

This exploration was also developed through a qualitative and PAR approach, using the insights provided by teenagers for creating criteria and guidelines to develop science communication for public engagement. For this purpose, in the same focus groups of student collaborators, the discussion was organized and facilitated by the teenagers for dialoguing with the researchers of ACTIVITAL and ESTPH.

**Fourth session.** In the fourth session, the student collaborators led and organized the session with the support of the facilitator researcher. The student collaborators presented their ideas, topics of interest, and the roles they would be interested in taking on to develop further collaborative work with the research teams of each university.

An additional goal of this final session was to analyze all of the findings from the other three sessions. For this purpose, the participatory diagramming tool (Kesby, 2000) was used to establish a list of shared interests and an inventory of people, possible stakeholders, and participants’ and researchers’ skills and interests that could be useful for further collaborative initiatives (see Table 2).

**Data Analysis**

After the data collection phase, the data were transcribed and translated from Spanish to English (in the case of the data set of ACTIVITAL) and were organized
according to each unit of analysis corresponding to the research questions. This procedure allowed me to code data according to emerging categories and broader themes, using open coding (Marshall & Rossman, 2014). The broader themes were organized and described, and then these broader themes were compared with scholarship of science communication and health communication in order to provide several patterns to answer each of the research questions of this study (Yin, 2012).

Because the current study focused on the analysis of two case studies, the analysis also used the organizational-level logic model developed by Yin (2012). This analytical procedure identified the specific research sites involving the results of each of the case studies within larger organizations, its stakeholders, and the existent influences that led to the issues evidenced in the results of the study. In this procedure, matrices are used to describe the flow of relations of the different stakeholders, the influences of institutions, and other crucial factors that lead to certain causes and consequences that affect science communication practices. Through this procedure, I as a researcher, the student collaborators and the researchers of each case study were together able to determine the processes that were influencing the practices of science communication and public engagement. Additionally, the organizational-level model enabled me as a researcher to identify and understand the issues and difficulties that emerged and as consequences of which factors. This analytical procedure gave me a more in-depth understanding of the issues and of possible avenues that could be subsequently explored so as to propose alternatives to the persisting issues in science communication research and practice.

**Applying Media Theories to the Analytical Framework.** As noted earlier, the findings of the science communication section and its units of analysis were also
collaboratively examined through the lens of the media theories. For this procedure, two-step flow, framing, and medium theory composed the theoretical lenses to interpret the emerging data.

**Two-step flow theory.** The two-step flow theory helped to analyze the roles and actions of opinion leaders in science communication. This theory is especially useful for addressing the recurring problem of the accuracy of science content when conveyed by journalists or any other individual who acts as an opinion leader in regard to scientific content (Dunwoody, 2004). It is possible for scientific researchers to intervene in the process of scientific communication not only as the authors of their own research but more powerfully as opinion leaders with accurate information. The two-step flow theory contends that content is transmitted through the interactions of interpersonal communication between opinion leaders and their followers (Katz, 1957). With science communication, when the opinion leader is someone other than the original author/researcher, there is a higher risk that the opinion leader might shape—or misshape—the findings, possibly communicating inaccurate information to the public (Nisbet & Kotcher, 2009).

Therefore, if scientists are more involved in the process of science communication, as opinion leaders, then the issue of inaccurate science content might be solved. As Katz (1957) demonstrated in his Elmira Study, a high level of expertise in a discipline raises the possibility of attracting and maintaining the attention of audiences. Consequently, there are significant opportunities to create engagement and understanding from a direct dialogue between researchers and their audiences. However, the findings of the present study were revised in the Latin American context and were updated for the
21st century, as the original theory was developed in a western context in the 1950s and 1960s. Specifically, two-step flow as part of the analytical lens allowed me to explore who should be the opinion leaders for each case study to create engaging communication for science and accurate information for audiences.

**Framing.** In science communication, framing provides a structure to understand how the discourse related to science topics should be constructed to motivate that audience engagement (Entman, 1993, Listerman, 2010). Communication frames are defined as the exercise of selecting aspects of a perceived reality and making them more salient in a communicative text (Entman, 1993). In this matter, for example, frames can define a problem, the causes to interpret it, and can provide moral evaluation and treatment recommendation (Gamson, 1992). Consequently, in this study, the framing theory allowed me to analyze and suggest several guidelines and considerations to choose a frame for the scientific content of ESTPH and ACTIVITAL and to propose a suitable schema to draft messages for each program.

**Medium theory.** To date, little research in science communication has explored the features and characteristics of various media conduits and how to more effectively reach general audiences. For example, the insights of the medium theory could be applied to determine if print media are more suitable than audiovisual media for communicating scientific findings about nutrition and physical activity. Similarly, the different structural characteristics of platforms such as Facebook, Instagram, Twitter, and YouTube might suggest different ways to communicate science content, depending upon which social network is used (Collins, Shiffman, & Rock, 2016).
For the purposes of this study, the medium theory provided a useful theoretical framework to reflect on how and which communication conduits, analyzed in terms of their “biases” (that is, their characteristics and features), might or might not be effective to communicate science content for each case study (Meyrowitz, 2009).

Scientists in various fields have been experimenting for some time with different media, including social media—but without necessarily considering the “biases” of the various media themselves. For example, climate change scientists are taking new initiatives on platforms such as Twitter and Facebook to create a dialogue with society (Pearce et al., 2015). Blogs also provide spaces for rich sources of data, interaction, and spontaneity for content creation. This also has opened the opportunity to engage with new developments in science and policy and to develop interventions to foster discussion, contestation, and alternative networks (Pearce et al., 2015). This study focused on the characteristics of each medium as communication conduits that can contribute to scientific communication for public engagement.
This chapter contains the findings, analysis and discussion, implications, and suggestions of the Eat Smart to Play Hard (ESTPH) case study. The findings section presents the results of the data collection process. The analysis and discussion sections develop the description of the broader themes that answer the research questions of the study. Finally, the implications and suggestions recap several criteria for the ESTPH case study and the U.S. scenario, in terms of how science communication for public engagement could be approached in the future.

Chapter 5 uses the same structure when discussing the ACTIVITAL case study. In Chapter 6, I discussed and then compared and contrasted the findings from the two case studies and provide several guidelines and criteria for developing science communication initiatives for public engagement.

Findings

This chapter’s section reviewed the results of the ESTPH case study data collection. For this purpose, it is organized by responding to each of the research questions according to the emerging data of each case study, the ESTPH program, in Albuquerque, N.M.

According to the research design explained in Chapter 3, Research Question 1 of this study is covered by the emerging findings of the first and second sessions. Research Question 2 responds through the data findings of the third and fourth sessions (see Table 3).
Table 3. Research questions and corresponding data collection sessions.

In both case studies, the four sessions of data collection were conducted with the participation of the student collaborators. In each session, the concepts of the communication theories two-step flow, framing, and medium theory were discussed for structuring the analytical lens for the emerging findings. Student collaborators received literature and summaries to inform them about the criteria and constructs of each communication theory in each session. Additionally, each of the participants carried a “think about question” that corresponded to each of the theories to be reviewed at the start of the following session. At the beginning of each session, all of the student collaborators provided their points of view, and the discussion was built upon their comments and reflections (see Table 4). This practice allowed for a participatory analytical lens that enabled this study to count collective revisions of the emerging data with the participants of this study and to follow the framework of participatory action research (PAR).
<table>
<thead>
<tr>
<th>THEORIES/SCHOLARSHIP</th>
<th>SESSIONS FOR DATA COLLECTION</th>
<th>OBJECT OF ANALYSIS</th>
<th>THINK ABOUT QUESTIONS FOR STUDENT COLLABORATORS PER SESSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-step Flow (Katz, 1957)</td>
<td>First session</td>
<td>Ideal opinion leaders/spokespersons of each program</td>
<td>Who will be good opinion leaders for ESTPH/ACTIVITAL? Scientists, other kids, teenagers like you, as influencers? And why do you think they will be reasonable opinion leaders?</td>
</tr>
<tr>
<td>Framing (Emman, 1993)</td>
<td>Second session</td>
<td>Suggested language tone and message frame</td>
<td>If framing affects how people feel or think and act, let’s picture different scenarios you believe will be more useful to communicate ESTPH/ACTIVITAL. Our “think about” for next session is how ESTPH/ACTIVITAL can be focused on the public to be more engaging?</td>
</tr>
<tr>
<td>Medium Theory (Collins, Sniffman, &amp; Rock, 2010; Mayrowitz, 2009; Pearce et al., 2015)</td>
<td>Third session</td>
<td>Most appropriate conduits to promote audience's engagement.</td>
<td>Which media conduits are the best to promote their programs to create more engagement?</td>
</tr>
<tr>
<td>Science Communication for Public Engagement, Decidual Theories, Organizational Logic Model</td>
<td>Fourth session</td>
<td>Analysis to build engagement and collaboration of audiences with the ESTPH program.</td>
<td>Student collaborators and researchers reflect on retooling the program to address existent issues and improve audience engagement.</td>
</tr>
</tbody>
</table>

Table 4. Analytical lens structure for the case studies.

Also in this section, relevant aspects of the findings were analyzed with the student collaborators by using communication theories that address the issues of each case study.

Data Findings of ESTPH in Dialogue with the Research Questions

Prior to answer the research questions for this study, it is essential to clarify that the answers provided were developed by teen peer health educators, who are teenagers enrolled as students in Health Leadership High School (HLHS) in Albuquerque, and received training about how to develop health education for the ESTPH program. Moreover, as teen health educators, they are required to participate and follow the ESTPH program by cooking the meals and taking part in the suggested physical
activities. This group provided firsthand responses about their experiences as health educators of the ESTPH for children who are third graders and fifth graders at Cien Aguas Elementary School, also located in Albuquerque.

**Research Question 1: How Can Researchers/Scientists of Health Behavior Studies Develop Better Science Communication Strategies for Public Engagement, from the Perspective of teenage/young-adult audiences?**

To answer the first research question, two participatory sessions were planned. Each had prompt questions that opened the dialogue and facilitated the discussion through participatory data collection tools.

**First session: Assessment of communicational activities, materials, and existing issues.** During the initial session, the student collaborators created nicknames for themselves to participate in the sessions. The nicknames had the purpose of protecting the participants’ identity in the research process. The student collaborators and the facilitator used the following nicknames to refer to each other during the sessions. Lollipop, Young Sinatra, Lil Grapey, Bob, Anilu, Janis Joplin, Amanda, and Juanita.

As the second activity in the first session, student collaborators created a set of rules for the sessions in case of eventualities, how to manage conflicting points of view, punctuality, communication conduits and rules that promoted respect, and a safe space for the conducting the research. All participants committed and consented to follow these rules for the research process. Moreover, all of the participants respected each of the rules in the overall research process.

The rules for conducting the study were discussed in order to provide a safe space that respected different points of view, to determine in advance how to resolve emerging
issues, and to provide a voice to all of the involved participants. The rules were following (see Figure 6):

- You are free to give your opinion with respect here always. This rule defended the egalitarian opportunity of student collaborators to contribute to the research process with personal experiences, ideas, and analysis.

- Ask for help if you feel sick. All participants agreed to raise their hand and ask for assistance from the facilitator in case of any discomfort or sickness. In case of need, the nurse of HLHS would be notified by the facilitator to provide help.

- Different points of view will be debated with respect. This principle guided how conflicting views or opinions would be addressed. All student collaborators agreed that a debate with respect was the best practice. In the four sessions, all participants respected each other’s opinions, with harmonious participation.

- We will communicate outside the sessions through email only. Email was chosen as the communication conduit for contact outside the sessions among the student collaborators and the facilitator.

- You can miss only two sessions; otherwise, you can’t come back to work as a collaborator. This rule was developed by student collaborators to reinforce their commitment to the project through their continuous assistance. Additionally, the student collaborators would receive the compensation by the end of each session they attended.

- Each session will have a research co-facilitator. Student collaborators were asked to develop a rule that allowed them to learn about participatory research tools. For this purpose, they decided that each of them would select which tool (i.e., PAR
diagramming, asset mapping, Zines) they wanted to learn more about. The student collaborator who was interested volunteered at the start of each research session to co-facilitate the session along with the student collaborator in order to learn about the tool and to learn how to facilitate and apply each of the participatory data collection tools.

**Figure 6.** Rules for the Science for All teamwork created with the student collaborators.

In the first session, the student collaborators and the facilitator discussed the two planned prompt questions. The following section reviews each prompt question and the emergent responses.

**Prompt Question 1.1. What do you think about the activities that ESTPH has developed to communicate their program? How well do you think these activities are**
working? For the exploration of this question, a participatory diagramming tool was used to organize the emergent data. As explained in Chapter 3, participatory diagramming was applied to this section of the study to enable the exploration of the existing issues, their consequences, and possible alternatives to each issue regarding the communicational materials of ESTPH. Moreover, this data collection tool made it possible to show that the problems were connected to several possible causes and allowed me as a researcher to reflect on which possible solutions and activities could be created for solving them.

In general, regarding the branding and the visual communication materials of the program by observing and reviewing the design and name of the program, the student collaborators’ first answer was that ESTPH was appropriate and attractive to children in elementary schools.

*Communicational pieces of ESTPH program. The Champion’s Passport to Fun!* is a six-week booklet of recipes, games, meals, and suggestions for physical activities (see Figure 7). The purpose of this communicational piece is to teach children how to balance their eating and to develop physical activity habits as part of adhering to the program. The student collaborators deemed the passport to be visually attractive and in their words, “eye-catching.”

A bookmark was included with the passport. This communicational piece had the function of separating the pages of the passport and reminding the participants about the key steps of the program, which suggested the daily habits of portions intake of fruits, vegetables and water in each meal, and at least 30 minutes of physical activity.
Another communicational piece was the set of weekly newsletters titled *Eat Smart to Play Hard @ Home*. These newsletters provided recipes and suggestions for parents and children to help them comply at home with the program. Newsletters were developed by the social marketing team of ESTPH for each of the six weeks of the program. They were distributed by the teachers.

The student collaborators believed that the format of the passports and the weekly newsletters had too much text and information for children. They said the newsletters seldom were passed along to the parents, sometimes because the children never removed them from their backpacks (see Figure 8).
A frequent issue noted by the student collaborators (who also were peer health educators of the program) and that repeatedly appeared in the three other sessions was that children cheated about following the tips and instructions in the passport. The ESTPH program offered weekly prizes--e.g., jump rope, water bottle, backpack, refrigerator magnet, medals, hacky sack ball--to participants who accomplished the proposed goals of each of the six weeks of the program. It became apparent that the children did not want to miss the weekly prizes rewarded by their school teachers. For this reason, some of the children sometimes lied about doing the weekly activities, incorrectly entering information in the passport registry. Sometimes, parents also were involved in recording erroneous information in the registry in order to help their children win the weekly prizes.

Student collaborators mentioned that some children confessed they did this, but they still liked the program. When student collaborators asked them about the reasons they lied, the children cited several. A main reason was that the level of family support
was low. Although the participants went home motivated to follow the ESTPH program, their parents did not have the time or willingness to cook the recipes with them. Some reasons for that were (a) the recipes contained organic vegetables that were expensive for the household budget, (b) the parents or their other family members got home after their work tired and had little energy or time to play with them, and (c) some of the physical activities suggested were group games. Still, the children’s parents signed the passport, even though they did not cook or eat the meals or participate in other program activities. Student collaborators constantly reported that their parents told them that eating healthy was an expensive commitment.

Student collaborators also said that most of the ESTPH children participants have pets. Moreover, they considered their dogs and cats as their main companion and “best buddies” and that they loved playing with them. The student collaborators, identified with children regarding their pets and the relationship with them. Moreover, they said that parents gave pets to their children as a companion and as a replacement for the time they could not dedicate to the children. For this reason, pets were considered a key character that should be present in the ESTPH program promotion pieces because the pets were key characters that can enhance the children’s identification with the program by providing a reflection of the children’s reality. This is explained in detail later in this chapter.

In a final note to the first prompt question, the student collaborators found that the ESTPH content was fun for children but it needed to be updated, taking into consideration some of the contextual barriers that existed with the program’s expected behaviors and actual contemporary family life.
Prompt Question 1.2. Which activities of ESTPH do you think are most effective? Why? The activities that student educators believed that the children enjoyed the most were the games and physical activities of the passport. Specifically, they observed that the children liked the crosswords, the hula-hoop game, and the dancing games. Moreover, these activities were also the ones the student collaborators themselves enjoyed the most, as they also followed the program in the passport.

During the four sessions, the student collaborators also said the ESTPH program needed to develop a closer relationship and deeper engagement with children, parents, and teachers. For this purpose, there should be activities or strategies oriented to addressing the issues and difficulties, perceived or real, that parents face or when performing the proposed health behaviors of the ESTPH program.

The PAR diagramming process was chosen as a tool to organize the responses of the student collaborators. Moreover, it allowed me to organize and link the issues with their causes as well as to possible solutions that might work to address the emerging difficulties. Specifically, the PAR diagramming tool allowed me to identify positive aspects of and emerging issues in the ESTPH communication strategies with their target group of children at elementary schools as well as to identify ideas for addressing and solving those issues from the perspective of health educators (see Figure 9).
Figure 9. Participatory diagramming of ESTPH elaborated with the student collaborators.

Second Session: Opinion leaders for ESTPH, evaluation of activities of the program, and mapping spaces for physical activity and family engagement. Other exploratory questions for ESTPH in the second session addressed the prizes the student collaborators received as health educators who also followed the program. The questions in this session also addressed the student collaborators’ perceptions of the reactions by the children when they received the ESTPH prizes and how the children used them (see Figure 10). The prompt question for the PAR diagramming, used in a ranking format, was:

Prompt Question 2.1. What do you think about the prizes? For this purpose, the research team of student collaborators analyzed the current materials, and the results were ranked from 1 (disliked) to 5 (really liked).
Figure 10. Participatory diagramming for ranking prizes of ESTPH in the second session.

Summary of solutions for ESTPH issues suggested by student collaborators in the first and second sessions. For organizing the strategies suggested by the student collaborators, this section is divided into two groups. First, I discuss communicational suggestions, and second, suggestions for activities. This discussion was driven by the following prompt question.

- If you could design an activity for communicating ACTIVITAL/ESTPH to teenagers like you, what would you do/suggest? Think about something you would like to see or do and other activities that teens like you might enjoy and engage in.

Communicational suggestions. This section addresses the use of the campaign materials and the content in the informational pieces.

The ESTPH Brand. The logo, name, and colors are appropriate, “eye-catching,” and fun. Student collaborators suggested to keep the current branding because it reinforces the identity of the program.
Passport registry. Student collaborators said that pictures of the food and the recipes should be more produced to be more appealing. A tasty-looking dish would be more likely to be cooked at home and remembered by the children, they said.

One suggestion for addressing the issue of “cheating” by children (sometimes with the support of their parents) was to develop a contest through social media that was related to family activities. The children participants of ESTPH had no social media accounts themselves. However, Facebook and Instagram, social media platforms that the children’s parents used, were mentioned as conduits that could be useful to reinforce the ESTPH program with parents by sending them tips with more frequency. The content of the posts should be fun and motivating to support the parents’ knowledge about the ESTPH program. One specific idea suggested by student collaborators was to use features such as Facebook Live and/or Instagram TV to host a weekly Q&A session where parents and kids could dialogue with the ESTPH researchers about their concerns and provide ideas about healthy habits.

Newsletters. These communicational pieces have a letter-size format in full color, but newsletters got lost frequently because kids sometimes did not give them to the parents because they forgot to do so or lost them among their school notices. For this reason, student collaborators suggested that the newsletter format should be different. Some suggestions were to include a coloring section on the back of the sheet to create motivation for not losing the newsletter but to use a different shape for the document itself, such as a circle, the shape of a vegetable, or a dish. But in all cases, food-related objects were found to be appealing to the ESTPH concept. Another suggestion was to develop a digital format so that the newsletter could be sent via email to parents.
Whatever new format could be developed, student collaborators said, the letter should include more images and less text.

**Prizes.** Student collaborators suggested new utilitarian prizes. New options mentioned were notebooks, sports balls, school supplies such as mechanical pencils, gift cards, and even day passes to rock-climbing gyms or other places where they could take part in physical activity with their families.

**Suggestions for activities.** As the student collaborators noted, children frequently said that the ESTPH program proposed mostly group- or family-oriented physical activities. However, sometimes the children did not have a way to replace the group activity with an individual alternative when no one at home was available to play with them. To address this problem, teenagers suggested thinking about activity options as group/family weekend activities but also adding daily “solo workouts” or dancing routines the children could do at home. Several ideas for individual-solo activities included pet yoga and other games to play with pets in the children’s backyards. Group-game activities suggested by student collaborators included basketball, long-ball, flag ball, and soccer.

Student collaborators also offered suggestions concerning the recipes. It was important that the recipes consider allergies and alternative ingredients for children with lactose intolerance or allergies to nuts, for example. Although the program included cooking activities, the issue was that there was not clear evidence to motivate children and their parents to cook and to not cheat about it. Again, student collaborators recommended that these activities be supported through social media. For example, an online contest through social media oriented to parents also could support the expansion
of the program. Moreover, it could help to engage parents by offering a communication conduit that provided information about how to support healthy nutritional habits and physical activities of their children. Another aspect discussed was that social media could enable parents to establish a direct interaction with the ESTPH program where they could ask questions and share information with their network.

In Session 2, we explored more about who can be the opinion leaders of the program, as the topic came up during discussions in Session 1. Also, as in the end of the first session student collaborators and I discussed the two-step flow theory’s concepts and constructs. Student collaborators thought about the following question for the next session, which was:

Think about Question 1: Who will be good opinion leaders for ESTPH? Scientists, other kids, teenagers like you, an influencer? And why do you think they will be a reasonable opinion leader? First, student collaborators said the best option should be mainly teen opinion leaders. In their criteria, younger children look for a role model to follow as they grow up, and that was a crucial factor that was repeated several times. One aspect cited here was that to improve the knowledge of the teen opinion leaders about the program, it would be best if future peer educators were former participants of the ESTPH program or people who had followed the program successfully and made changes in their life by incorporating healthy eating and physical activity in their daily habits. These experiences also would provide them with enough experience to support younger children to learn and practice ESTPH in their lives. Teenagers suggested that as health educators, they believed the opinion leaders should be role models for children. Crucial characteristics that opinion leaders should have are: a strong character and positive values
and behavior—being humble, friendly, have good humor, entertaining, creative, respectful, and be a good student. Another element was that all opinion leaders should be young men and young women and that they should promote gender equality.

Second, student collaborators also considered that children should also be opinion leaders of the ESTPH program. This suggestion appeared in Sessions 2 and 3. The main argument was that the new participants of the ESTPH program needed to see, feel, and learn that other children like them achieved the goals that the program suggested. Other criteria pointed out by the student collaborators was that these children should be selected through a contest and be the faces of the program for the next academic year. Student collaborators believed that having children as the opinion leaders would make ESTPH more relatable to girls and boys of elementary school age. Personal characteristics that children opinion leaders must have, in the opinions of the student collaborators of this project, were “someone everyone gets along with”; “that is fun to be around”; and show personal values such as kindness, respect toward others and creativity.

The third opinion leader group was composed of scientists. As in the second and third sessions, student collaborators said they should be incorporated into the opinion-leaders/spokespeople group to communicate the value of the program. Student collaborators believed that having scientists (male and female) also could reinforce the health information about food and physical activity from the voice of an expert. Student collaborators also said that when they went to Cien Aguas Elementary and they tried to teach the children, they felt like they could get their attention most readily when they played with them. Although when they tried to talk to them about food and physical activity, the children often did not listen. For this reason, student collaborators believed
that having a male and female scientist who conducted experiments about food and physical activity would be interesting for children to learn about the importance of healthy habits.

Student collaborators also pointed out that seeing scientists working in health-community programs motivated them to think about their own future. As health educators, they felt supported by an expert (the researchers/scientists) who also was approachable and “chill” and made them think they would like to be like them in the future. From the perspective of the student collaborators of HLHS, UNM’s ESTPH researchers also were role models to them. In this session, and frequently in other sessions, they repeated the names of the members of the ESTPH team. They also profiled the researchers in Session 3 as examples of how a scientist as an opinion leader for this program should be. More on this is discussed later in this chapter, on pages 128 and 129.

Also in the second session, it was essential to determine places for physical activity in Albuquerque or places where families could be approached to for the communicational activities of the ESTPH program effectively more effectively. For this purpose, the primary goal was to locate places where children and parents could find health information on nutrition and physical activity in Albuquerque. For this purpose, asset mapping was applied as a data collection tool with the following prompt question for the student collaborators.

**Prompt Question 2.2. Which places are available for children and parents to do physical activity and play in the city?** For answering this question, student collaborators developed drawings about places they saw as options for children and families to take part in physical activity in Albuquerque. After making their drawings, the student
collaborators were trained to develop a map locating the sites to analyze all of the answers and to overlap them with their drawings.

The most frequent answers were community centers, parks, and dog parks. Some student-collaborators said their parents usually took them to fast food venues such as McDonald’s and Burger King, because these venues had playgrounds for customers (see Figure 11). One surprising fact was that there were more than two times as many of that kind of venue compared to the number of public spaces, such as parks and community centers. Therefore, those commercial venues were more accessible to parents than parks. Another factor cited was that some parks also were becoming unsafe for children and families. That risk was relevant and might require further exploration.

Figure 11. Asset map of spaces for children’s physical activity and health information resource centers developed with the student collaborators.
Prompt Question 2.3. Where can (or where do) teenagers find information about healthy habits? In Session 2, we also developed from the planned prompt questions a second asset map focused on locating possible places that could represent resource centers about healthy eating habits for children. Student researchers located the University of New Mexico Hospital’s Children’s Hospital, Lovelace Hospital, Presbyterian Hospital, and local medical clinics. The main reason was that pediatricians are considered reliable sources of information about healthy habits for children.

Research Question 2: How Can Teen Audience Engagement with Science/Health Communication be Improved?

This research question was answered through the data collection of the third and fourth sessions. It focused on exploring how the engagement of audiences could be improved and supported. Because the student collaborators were involved with the ESTPH program as health-educators, it was also essential to explore from their perspective how they could be better communicators of a health program by exploring aspects that motivated their interest and consequently their engagement to the ESTPH program (see Figure 11).

Third session: communicational framing for ESTPH, designing new activities and communicational conduits. Student collaborators also reviewed the framing theory concepts. By this activity, they were asked to think about the messages of ESTPH and how the messages were structured. The student collaborators also were asked to describe the tone of future messages and texts and how the program could be described to develop deeper engagement of children.
The children also said the current texts of the passport, bookmark, and newsletters were clear and understandable.

For the activities and new ideas, the student collaborators proposed (a) to introduce characters/opinion leaders who brought a personal tone to the program and (b) the peer-health education with teenagers should also have those values/characteristics, and in this way, the program’s messages and texts would have the same frame. Additionally, student-collaborators suggested that the texts should use colloquial language to provide closeness and familiarity to the target audiences. Student collaborators suggested that the new framing strategy for ESTPH should be based on showing healthy habits as “fun, happy, and healthy” activities that lead to positive results in the health of children.

The new activities suggested by the student collaborators should follow the same message framing strategy stated above. For this purpose, by introducing the characters (scientists, teens, children, and the pet) the messages of each of them should be “close as talking to a friend, with a language that is understanding and approachable.” This suggestion was delivered by Lollipop, a 13-year-old student collaborator, which was supported by the rest of the participants. Other relevant values that should guide the message framing mentioned by the student collaborators were that the opinion leaders/characters should always be respectful, happy, fun, and confident. Moreover, these values would have to be reflected in the messages and texts they communicated with the target audiences.

*Communication conduits.* During the third session, the student collaborators reviewed the medium theory. Several ideas also emerged for communicating the program.
through different activities. These ideas were developed during the four sessions. However, these communication initiatives required the consideration of which conduits of communication could support the engagement of children as the primary audience as well as the influential audience of parents.

**Social media for parent and family engagement.** One aspect mentioned was that the student collaborators in their role as teen health educators agreed is that children frequently mention that their parents did not place much importance on the activities proposed to do at home with ESTPH. As mentioned, parents helped their children to cheat in the passport registry to win the prizes that the program offered. For that reason, student collaborators believed that social media as Facebook and Instagram could be a conduit exclusively dedicated to parents to provide the information and tips about nutrition.

In this regard, teenagers linked the issue of cheating about the activities and recipes to a possible solution: develop an online contest based on family or parent/children videos or selfies as they cook and go about daily activities, and use the hashtags #ESTPHworkout and #ESTPHcooking (see Figure 12). An argument arose during a discussion that parents could reinforce their image as “good parents” through their social network of family and friends. That might precipitate a viral effect with other parents engaging in a healthy lifestyle for their children and their families. The ESTPH program could raffle a gift card for grocery shopping and/or a family activity, such as rock climbing, hiking, or swimming, as prizes.
As result of the third session, the student collaborators developed a Zine, which as mentioned in Chapter 3, is a self-publication method that was used in this study to organize all of the emerging data from prior sessions to outline the suggested strategies for the ESTPH program. As guidelines, the Zine was developed by the following prompt questions.

Prompt Question 3.1. What activities will you develop to create engagement with your audience around healthy habits (eating and physical activity)?

Prompt Question 3.2. What would you add or suggest to ESTPH’s current programs?

The discussion and collaborative Zine-making process revealed the following strategies.
Opinion leaders for ESTPH. As in prior sessions, student collaborators frequently said they believed ESTPH needed to develop a closer approach to the target audiences of children. For this purpose, student collaborators suggested that several opinion leaders must be incorporated to reinforce the claims of the ESTPH program. Because the program targeted fourth and fifth graders, it was essential not only to develop a narrative for them but also for their support system of parents/legal guardians and teachers. Moreover, student collaborators said they thought that an ideal team would be made up of scientists, teens, children, and a pet (i.e., a dog). As noted earlier, these characters must be present in the activities for the children, and this information must be included in the communicational campaign materials. Participants agreed that this would be a key character to enhance children’s engagement, because it was linked to positive emotions, such as fun and tenderness and love. Moreover, a pet catches the children’s audience attention (see Figure 13).

An idea that teenagers suggested for providing more engagement was to develop a comic or a story where all of the opinion leaders played a role related to the goals of ESTPH. This narrative should be present in the communicational pieces and social media conduits. Student collaborators said they believed that the opinion leaders should be grouped as a team for the comic as well as for real events that could occur as activities or events to promote ESTPH in schools and in social media spaces. For this purpose, the characters could be named as “The Eat Smart to Play Hard Squad.”
Focusing on each group of ESTPH opinion leaders, guidelines were spelled out by the student-collaborators. They were:

**Scientists.** Researchers of the ESTPH program should be part of the communication of ESTPH by using games and experiments to explain the science behind food and physical activities. Their influence as opinion leaders would be based on their knowledge and expertise in health studies. These activities should be done as a first intervention oriented to children prior to the intervention of teen health educators beginning their peer-mentoring interventions.

**Teen health educators.** This group of opinion leaders should focus on the fun of physical activity and healthy eating. Their purpose would be to design games and provide support by talking with the children about how to incorporate healthy habits in their life. The role of teenagers would be to educate children through games and activities that would be enjoyable and support the claims of ESTPH. Moreover, the selected teens for this role should be role models for the children by promoting a healthy lifestyle.

**Children.** Children made up the group that also served as opinion leaders; they would be former participants of the program who were successful in following ESTPH
and made changes in their life. They would tell their stories to other children about how they and their families learned and made improvements in their health.

*Pet.* It was decided that a pet could play a valuable role in The ESTPH Squad. In all four sessions, dogs and cats were always part of the conversation of the student collaborators. Most of the children had a pet at home, and the children often played with their pet. The pets were described as an “unconditional companion,” that is always there for the children and is generous with their love. The pet could be in the company of the children during the campaign as well as serve as a playmate during physical activity. The children could play throw and catch with their dog, walk their dog, and do pet yoga.

**Fourth session: Exploring the proposed strategies of teen student collaborators and opportunities of collaboration with the ESTPH research team.** In the fourth and final session, the student collaborators and the research team of ESTPH met to review and discuss the findings related to the experiences of teenagers in their role as health educators of ESTPH. Student collaborators presented in sections the findings to the researchers and posted discussion questions about how to start a collaboration among peer-health educators and the ESTPH researchers to develop solutions for the areas of improvement of the program (see Figure 14). Through the fourth session, the main outcome was the exploration of the opportunities for audience engagement related to the communication of ESTPH program. The following sections explore the possible avenues to improve the scientific communication of this program.
Student collaborators pointed out several aspects they believed should be reorganized for the participation of teens as health educators. Some of the criteria mentioned were the following: (a) review the selection criteria for teen health educators of ESTPH and (b) plan interventions and health lessons for children with the ESTPH program.

Selection criteria. Student collaborators of this study repeatedly noted that in their specific case, as students of HLHS, they did not have the chance to choose if they wanted or not to be involved as health educators. They said that some of them and even some of their classmates did not like playing with younger children. Of the eight participants, four said they had no initial interest in being involved with younger children but that they had to take the class as a requirement of their academic program in HLHS. The other four said they were interested in getting involved with the ESTPH program so they could learn healthy habits about nutrition and physical activity and have the opportunity to gain experience as educators of younger children.
Moreover, student collaborators said they believed the program would be better if it were open to sign-up to find health educators as opinion leader volunteers who match several characteristics cited above. Also, they said they believed that having more training with UNM’s ESTPH team and with the teacher, instead of only with their teacher, would provide them with more information about health. All of the student collaborators agreed that the teens should represent a role model to follow and to motivate and inspire children. A crucial factor, the student collaborators believed, was that the teen opinion leaders should be volunteers that show interest in ESTPH so that they would be more likely to reinforce the program’s claims.

In Session 4, the student collaborators and the ESTPH research team discussed and voted on the best criteria for the selection of opinion leaders. For this purpose, the website Poll Everywhere.com was used to reach a consensus. The options that emerged from the discussion (see Figure 15):

- Devise a contest to find the teen and children opinion leaders among the participants of the ESTPH program from elementary schools and high schools in New Mexico. Only interested teens and children will sign up to be selected.
- Opinion leaders should be nominated by their classmates, teachers, and friends.
- The best performing participants as followers and educators should be the opinion leaders.

All 10 participants of the fourth session (student collaborators and ESTPH researchers) voted that a contest should be held to select the opinion leaders among children and teenagers. Out of the participants of the contest a male and a female should
be selected for the category of teens (selected out of the pool of teen health educators), and children (selected from the best performing who sign up for the contest).

**Figure 15.** Results of votes among researchers and student collaborators in Session 4.

Near the conclusion of the session, after the overall discussion, the ESTPH researchers and student collaborators were asked to text also through Poll Everywhere, the words that came to mind when they thought about the core values of the ESTPH program. For the results, the most frequently used words were written in larger letters in a word cloud, and smaller letters were the less frequently mentioned words by the participants in Session 4 (see Figure 16).
Figure 16. Word cloud of core values perceived by participants of Session 4.

Unexpected Findings

This section details the findings that emerged in the data collection process and evidence phenomenon and events that were not expected or that explained contextual situations. Even though those findings were not related directly to the research questions, they were reported because they could be considered factors that affected the process of science communication for public engagement.

Limitations of ESTPH for developing science communication for public engagement. This project was developed by approaching the ESTPH research group as its project as community oriented in the area of health education related to nutrition and physical activity; during initial conversations, there was openness and interest from the research group to participate in this study, but several barriers emerged in the process.

Funding. The program is funded by the U.S. Department of Agriculture’s Supplemental Nutrition Assistance Program Education (SNAP-ED). Some parameters represented limitations for further activities. For example, compensation could not exceed $5 per prize for children and parents. A second factor was that the program should not critique fast food through pictures, texts, or comparisons.
Scientists’ motivation and willingness: Although this study was possible through the support and openness of the research group, some aspects represented barriers among the teen health educators and the researchers of the ESTPH. In the fourth session, even though scientists manifested their interest to work and collaborate with the researchers, some members of the ESTPH team did not participate at all in the discussion. Moreover, most of the participation of the researchers occurred through questions directed to student-collaborators without providing them feedback, and just listening to their responses.

Further, because of the response in the last session, a meeting among the student researchers of this study and the ESTPH research team was scheduled. Here, the results and suggestions developed with the student collaborators were presented. Again, there was no feedback from half of the researchers, and only three in a group of six ESTPH members offered feedback. Positive comments related to the possibility of developing a peer-model for improving the communication and the results of the program through teenagers. However, there was criticism to the methodology of this study. The participatory methodology of this project was questioned, claiming that the data did not emerge from the target audience of children but from the teen peer educators of the program speaking about their experiences. I must note, though, that the project was presented as a qualitative-PAR study to the research team in detail of procedures and scope prior to data collection.

Moreover, the ESTPH research team demonstrated its interest to explore peer-health models as an initiative with HLHS with a prior commitment to this study; the school agreed to collaborate on the project, a move initiated by the researchers of ESTPH
with this institution. However, there was criticism of the method, specifically, that the suggestions provided by student researchers did not represent the real interests that the fourth and fifth graders might have or like. This was surprising, because the student collaborators developed the role of health educators and were in contact with the target audience of elementary school children and had several experiences and dialogues with them about healthy eating and facilitating activities with them involving ESTPH.

A second criticism that emerged during the meeting was that the opinions of the teen student researchers were questioned harshly as possible lies or unreliable data. This argument developed through the comment that the student collaborators made recognizing that they lied about following the passport. The researchers also acknowledged that they knew about the issue of cheating on the passport registries, and that confirmed prior evaluations the research group made before regarding the effectiveness of the passport as a communicational tool of ESTPH. This represented an issue for the collaboration among the researchers and the student collaborators because although there was initial interest to work together among teen health-educators/student-collaborators of this project, there was not an apparent willingness to embrace these suggestions. Moreover, this situation raised a question about the genuine willingness researchers to participate and develop initiatives for public engagement related to science communication for public engagement of this research project.

In this regard, several aspects are discussed in the data analysis and conclusions by using available scholarship of scientists’ performance, attitudes, and perceptions toward science communication practices for reaching public engagement.
Discussion and Analysis

In this section of Chapter 4, the findings of the case study of ESTPH in UNM’s Prevention Research Center were analyzed and discussed with the two research questions of this study. The discussion was structured by the coded data findings that were categorized and built broader themes. These themes reunited explanations, implications, and criteria that could contribute to suggesting guidelines for further research and practice of scientific communication for public engagement in the specific case of health behavior change for children. Moreover, these constituted the answers for the two research questions of this study.

The literature of science communication for public engagement revised for this study in Chapter 2 match with two suggested avenues for future research. A first avenue would create spaces for interaction and dialogue among science and society as a first step for establishing sustainable relationships that lead in partnerships (Bowater & Yeoman, 2013). The second avenue suggests a new methodological design for future studies that leads to dialogue. In this regard, several scholars agreed that participatory action research methods are a suitable inquiry approach to facilitate an egalitarian framework among science and society for mutual collaboration (Stilgoe & Wilsdon, 2014).

The research design of this study addresses these suggested avenues proposed by the scholars cited in this study. Moreover, in the case study of the findings of ESTPH, the data findings respond efficiently to each of the research questions and consequently to each of the units of analysis (see page 77, Figure 4.); they also contribute to several implications and criteria that influence the planning and execution of science communication in the United States.
Discussion of Research Questions and Findings

The first research question--How can researchers/scientists of health behavior studies develop better science communication strategies for public engagement, from the perspective of teenage audiences? --considered aspects of evaluating the current effectiveness of the communicational strategies of ESTPH (addressing the communicational pieces and activities). In the prior section of this chapter (see pages 111, and 112), student collaborators developed detailed guidelines that addressed how the communicational strategies of ESTPH could be improved in terms of science communication for public engagement.

However, to implement these suggestions, other influential factors had to be considered before developing a new strategy of science communication for public engagement adapted to ESTPH. For this purpose, the discussion describes the contextual considerations for public engagement for health promotion.

The second research question--How can teen audience engagement with science/health communication be improved? --explored how scientists and student collaborators interacted in a collaborative space discussing how public engagement could be fostered in the ESTPH case study. This section of the discussion centered around the broader theme of the barriers identified for public engagement.

In this section of Chapter 4, for developing the analysis of the findings, the discussion was structured by contrasting the categories and the overarching themes that emerged in this study with available scholarship of science communication for public engagement and health communication models. Altogether, the discussion and analysis
outcomes provided considerations to develop scientific communication for health behavior change programs in culturally diverse scenarios in the United States.

**Creating Better Science Communication Strategies for Public Engagement for ESTPH**

This section elaborates on the answer for Research Question 1 through the major theme of the contextual considerations for public engagement for health promotion adapted to the case study of ESTPH. This section is composed of the following subthemes: (a) understanding family dynamics and the implementation of the ESTPH program, (b) the household budgets versus proposed health behavior of the program, and (c) spaces for children and family physical activity and the perceptions of safety and convenience.

**Figure 17.** Contextual considerations and the subthemes that compose the discussion.

The contextual considerations for public engagement for health promotion.

As mentioned, the student collaborators of this study were students of Health Leadership
High School in Albuquerque. The participants elaborated on several suggestions based on their experiences as health educators of the ESTPH program for children in third and fifth grade at Cien Aguas Elementary School. The discussion was enriched by several aspects that described why a deeper understanding of the context of the target audiences faced by following the ESTPH program and which aspects represented challenges that the program had to consider for improving the public engagement of the target audience and influential stakeholders as parents (see Figure 17).

*Understanding of family dynamics and the implementation of the ESTPH program.* The communicational material and research for the ESTPH program was developed by following the social marketing model guidelines. This framework suggested pre-testing and a consulting to the target audiences all of the activities and promotion materials prior to implementing the program (Lefebre & Flora, 1988). This methodological guideline was followed by the ESTPH research team, as it conducted focus groups to develop formative research and to test the promotional strategies of the overall program prior to implementing the program each school year.

This study revealed that there were other contextual issues regarding the environment of the target audience in relation to the ESTPH program activities that influenced the participation of children in the program. The student collaborators, as health educators, noted significant aspects of the family dynamics of the children that required attention. This section revisits these aspects in relation to the ESTPH program and the suggested solutions proposed by the student collaborators.

Several characteristics of family dynamics in the households of the target audience of ESTPH (see pages 112, 113) met the implementation of the program and
how these crucial factors affected the program’s implementation. The first factor refers to the household budgets versus proposed meals of the program, regarding the difficulty of families to afford the suggested foods. A second factor was the unavailability of parents and/or family members to involve versus the proposed physical activity for children. Finally, the third factor refers to the spaces for children and family physical activity: perceptions of safety and convenience. These aspects described several elements that needed further exploration and could provide guidelines to update the ESTPH program. This study describes these aspects considering that this data set can be used to inform the design of science communication practices that target children and their parents as agents of influence. Moreover, these aspects represent opportunities for creating major engagement tactics that address their interests, concerns, and valuable resources that can be offered through the existing program.

Unavailability of parents and/or family members to get involved with the proposed physical activity for children. Because the program proposes participation in physical activities, most of which are group games, student collaborators said the children frequently said that often no one was at home to take part in these activities with them, especially on weekdays. The student collaborators suggested alternatives for children to do alone daily, such as dancing games and activities with their pets. The student collaborators did agree that families needed to be involved in the program to support the children. For this reason, student collaborators suggested that the group activity/games be maintained as weekly activities in the program for involving the children’s family members. Such activities were suggested for weekends and that they should involve some part of nutritional/cooking activities and physical activity.
Household budgets versus the proposed health behavior of the ESTPH program. A specific issue that emerged from the sessions with the student collaborators was the use of the Passport to fun! of ESTPH. The main concern discussed was how participants cheat constantly in the registry, with the help of their parents. With the Eat Smart to Play Hard @Home Newsletters, which provides tips for parents to support their children’s progress of the program, the children sometimes would forget to give the newsletters to their parents, and sometimes, the newsletters were lost between the school and the children’s home.

As for cheating, the student collaborators collected feedback from the children. Two of the most common reasons: (a) parents believed that the ingredients for some of the healthy-food recipes stressed the household budget for groceries, and (b) parents and other family members did not have time or energy to take part in physical activities with their children or to review the information of the newsletters.

Student collaborators said they believed the newsletters should have a different format or that even a different conduit of communication should be used to reach the parents. Suggestions included using Facebook and Instagram to provide daily information. The content of the newsletters could be focused on health and cooking tips of the programs, the student collaborators said.

The family dynamics of the children who were the target audience and the proposed behaviors of the ESTPH program included several mismatches. These issues should be considered to refine and retool the ESTPH for major engagement of children and their parents. As social marketing literature suggests, the component of price in social marketing refers to the balance of the new health behavior benefits versus the costs
or efforts for the participant (Wong et al., 2004). For example, in the ESTPH program, parents had to buy vegetables and fruits, instead of less nutritional fast foods or processed foods. Another challenge was the investment of time that parents and children had to make to incorporate activities such as cooking and physical activity. These factors represented commitments to change or at least modify the lifestyles of entire families, sometimes changing their daily routines to fit these activities into their schedules.

*Spaces for children and family physical activity: Perceptions of safety and convenience.* This study also explored the component of spaces for physical activity, because it constituted a critical factor that allowed an understanding of the lifestyle of participants in relation to the proposed health behavior of the ESTPH program. Additionally, student collaborators located sources of information about healthy behaviors for parents and children. These aspects were explored by conducting the participatory tool of asset mapping. Student collaborators located spaces in Albuquerque where children and families usually go for physical activity. The most common places were community centers, parks, dog parks, and amusement parks but also included fast food venues that had playgrounds for children.

The research found that the number of fast food venues with playgrounds was nearly double the number of public spaces such as parks, dog parks, and community centers. The fast food venues had a geographical advantage over public spaces for physical activity, which made them more convenient for parents and children. Therefore, fast food venues were more available from any point in Albuquerque than parks or community centers. A relationship among the environmental factors that represent a major influence for overweight children. A study conducted in the United States that
analyzed data of the National Survey of Children’s Health of 2007 found that children who have access to safe public spaces, such as parks and playgrounds, are less likely to become overweight or obese. Other crucial and influential factors to a child’s health are the socioeconomic level of a child’s family and the safety of the neighborhood in which they live. Research has also found that children of low-income families who live in unsafe neighborhoods are more likely to become overweight or are already obese/overweight (Fan & Yin, 2013).

Even though the scholarship cited above refers to studies that used quantitative research methods that addressed the relation of children’s health and their access to public spaces, and this study focused on science communication for public engagement, there is significant data that should not be overlooked.

This study explored available sources of health information and places for physical activity for developing formative research about existent resources for children and their families, specifically, physical activity spaces and information resources about healthy habits. The existing literature of quantitative studies and the qualitative findings of this study are related. As described through the participatory analysis with student collaborators and researchers, public parks are perceived as unsafe spaces for children in Albuquerque. Therefore, parents have opted for other venues that are perceived as safer for their children—-and even though those places are fast food restaurants that have playgrounds perceived to be safer, the children are more exposed to fast food. Other research that used spatial-statistic methodologies, developed in Chicago in the United States, concluded that fast-food restaurants often cluster within walking distance of schools, which is yet another major exposure to an environment of poor quality food
(Austin et al., 2005). As for health promotion programs in the United States, further studies about the exposure to unhealthy foods in schools and homes could provide more understanding about the nutritional habits of children and how to develop strategies that address children’s environment.

There are different findings and counterarguments regarding the analysis of how the availability of parks, perceptions of safety in public spaces, and fast food restaurants is related to childhood obesity in the United States. A study in 2004 concluded that no relationship existed in the United States linking the likelihood of children being overweight to the proximity of parks or the proximity of fast food restaurants. This cross-sectional study developed by Hillary Burdette and Robert Whitaker (2004), in Cincinnati, Ohio, hypothesized that children of low-income families that live farther from playgrounds and closer to fast food restaurants and in unsafe neighborhoods were more likely to be overweight. The study found no association among the three variables, and concluded that among the population of low-income children, being overweight was not associated with the proximity to fast food restaurants or playgrounds or with unsafe areas.

Newer studies, developed in southeastern United States, found different findings by analyzing the availability of parks was related to children’s BMI measures across different racial groups. The study developed in 2017 found a strong relation among the availability of parks and childhood obesity. Moreover, children of racial minorities (African Americans and Latinos) from low-income families had less availability and access to parks and playgrounds when compared to White children (Hughey et al., 2017). This study also demonstrated how the perceptions of children’s families were related to
the accessibility and safety of public spaces as evidence of social and racial segregation in the urban space.

Student collaborators of the ESTPH case study also said that safety was one of the main factors that also influenced parents to choose fast food venues with playgrounds. The main reason was that parks were perceived as unsafe because of the presence of homeless people of illegal drug buyers and sellers. For this reason, parents opted for spaces, such as playgrounds in fast food restaurants or even in shopping malls, because the parents perceived such spaces to be safer and more convenient to their home. In the case of ESTPH, further formative research applied to New Mexico, combining environmental factors (closeness to playgrounds versus fast food venues) and overweight children, can provide more-detailed understanding about the perception of places’ safety and convenience for physical activity and children’s playtime.

**Improving Audience Engagement with Science/Health Communication**

This section explores the broader theme developed through the analysis of the data of this study, which respond to Research Question 2. This theme refers to the barriers for practicing science communication for public engagement that need to be understood and explored to improve audience engagement of the ESTPH program by incorporating science communication.

**Barriers for the Practices of Science Communication for Public Engagement.**

This section discusses the issues that emerged as findings of this study. These issues refer to institutional structures and practices that represent barriers to science communication for public engagement, specifically, the case study of ESTPH in Albuquerque.
As this study was informed by decolonial epistemologies, it sought to provide voice mainly to the experiences of student collaborators as health educators of children and therefore, firsthand informants of the ESTPH participants’ experiences. Additionally, the research design of the study allowed me to create a participatory setting where student collaborators met with researchers to discuss plans to provide a holistic discussion about the ESTPH program.

This section discusses several subthemes, such as the perceived barriers for engagement from the perspective of student collaborators, and the institutional barriers that are major difficulties in the collaboration among academia and society. This discussion section contributed to a greater understanding of the persisting systemic issues among academia and society in the context of science communication for public engagement in the United States. Moreover, this discussion enabled this study to develop several suggestions that can serve as guidelines for developing tactics that researchers must consider before implementing science communication for public engagement in the United States for health behavior change (see Figure 18).
Figure 18. Barriers to the practices of science communication for public engagement and the subthemes that composed the discussion.

**Perspective of student collaborators: perceived barriers for science communication for public engagement.** Several aspects that the student collaborators addressed pointed out that the researchers’ contributions to the ESTPH program were effective in teaching children about healthy dietary habits and physical activity from their perspective as health educators.

The student collaborators believed that the program needed to create a closer and direct dialogue with parents and teachers as major influential audiences over children. For this purpose, the student collaborators said that bringing scientists closer to parents and children and also to them as health educators can provide more understanding about the real needs and complexities families face. Moreover, student collaborators said they believed that scientists are perceived as experts with authority and knowledge from whom people can learn. This vision matches studies of two-step flow theory studies, such
as the Elmira Study (Katz, 1957), which suggested that people with certain levels of education could act as opinion leaders of others. For example, in the case of this study, the ESTPH researchers through their credentials and research can provide their suggestions about healthy practices to children and their families. The researchers also were well received and were seen as sources of interesting and engaging information. This suggestion of student collaborators matches this two-step theory assertion as well as newer studies that found evidence of how scientists can introduce themselves to science communication for public engagement. This will be addressed further in the suggestions and implications section of this chapter.

From the perspective of student collaborators, public engagement will need not only to create a direct dialogue activity. It also will need to build trust to establish a relationship among scientists and target audiences. A dialogue space can be the first step to demonstrate truthful interest of researchers in children’s health improvement. A second step will be to create a collaborative research project or intervention that reunites the needs and interests of parents, children, teachers, and researchers; this step should be part of the early design process. This notion also matches available scholarship of science communication that addresses the concept of upstream engagement (Irwin, 2008). As noted in Chapter 2, this concept seeks to find common scenarios among scientific topics and quotidian life scenarios.

Moreover, and this coincides with the theme of student collaborators suggesting that science communication should be a part in the design of research projects, for reaching engagement, dialogue should always be incorporated with target audiences. The main purpose of dialogue should be to include the target audience’s ideas and concerns in
the process to create truthful public engagement. If public engagement is considered as a first step prior to designing and executing a research project through an open dialogue with society, more information can be supplied to the research design process of a research project (Bowater & Yeoman, 2013). Previous studies have found that dialogue strategies reported positive outcomes to creating deeper engagement among scientists and target audiences of society related to research projects. The major issue that these dialogue initiatives reported was public retention (Chilvers, 2005).

An example of science and society dialogues can be found in the United Kingdom. It’s the Biotechnology and Biological Sciences Research Council (BBSRC), which receives support from the British government’s Department for Business, Innovation and Skills Sciencewise. Twelve workshops were held in 2009, with guests invited to discuss synthetic biology. Even though the organizing agencies offered financial compensation to attendees, their participation was limited. One of the shortcomings of the event was that the attendees did not have the opportunity to give their opinion and contribute to the construction of the research agendas, which contributed to their lack of interest (Brake & Weitkamp, 2010). Another shortcoming was that the few citizens who participated in the dialogue events were not representative of the society; the attendees also were largely more informed that the society audiences about the research project targets. For example, university students were not part of the guests of the event (Nisbet & Scheufele, 2009).

If society is seen merely as a target audience that scientists aim to reach, then people will perceive that their voices will not be heard. Moreover, people will know that their interests, ideas, and concerns could be used merely as consultation inputs and not as
collaboration. Consequently, people’s willingness to become involved in dialogue initiatives would not be sustainable in time and collaboration. This is the reason that consultation frameworks for science communication might not be a positive or productive scenario to foster an environment of public engagement that can promote genuine interest and mutual benefit of researchers and target audiences.

As is evidence in this there are several areas of overlap among the findings and reflections of the participants of this study and the suggestions of science communication scholarship about how to foster public engagement. Although in the practice of implementing public engagement strategies in universities, it is difficult given the systemic issues in which academic systems work and the influences of institutions involved in research processes. The following section details how these issues affect scientists and the practice of science communication for public engagement in the United States.

Institutional influences and barriers for science communication for public engagement. As the second broader theme addresses existing barriers among scientists and society, there are other crucial factors related to the institutions and processes that universities and research in the United States follow. As an analytical tool, the organizational-level logic model (Yin, 2012) was used to create relations and to map how the institutional influences of funding agencies affect academic research, universities, researchers, and scientists’ work routines.

This section addresses two subthemes that explain the nature of the institutional influences and barriers for science communication for public engagement, specifically with ESTPH. These are the research processes and dependence on funding agencies and
the researchers/scientists’ work routines and institutional standards of the academic systems. Altogether, both themes provide criteria that describe the scenario of academic structures in the United States and how systemic processes for research projects represent a challenge to implement science communication for public engagement initiatives.

This discussion emerged from unexpected findings that were a counterpart of the ESTPH researchers and that explain the reasons why implementing the suggestions and ideas of student collaborators was challenging and difficult.

*The research processes and dependence on funding agencies.* Research projects in the United States, as in other countries, are frequently launched by universities or research institutions. They are designed and executed through grants provided by funding agencies, which could be institutions of the government, nonprofit organizations, or private organizations.

A research project frequently is developed by researchers or scientists at universities who are tenure-track professors who already have earned tenure and/or are associate scientists of research divisions of universities (see sections A and “Researchers” in Figure 19). Researchers unite in teams based on areas of expertise and academic interests, and they search for funding for their projects. Once a research team finds a funding source that offers grants for research in their area of work, they design a research project around the parameters of the funding source and then write a grant proposal. The grants frequently cover the salary of the research team (partially or in its totality) and for the resources necessary for the study. This includes all materials, compensation, and resources of any type the researchers provide to participants of their studies.
When a research project is funded, research teams also pay a portion of the grant funds to the institution or university at which they are employed. These fees usually cover operational costs, such as office space, lab use, and work spaces; and an administrative structure for the operation of the project and payment of salaries and funding for working benefit, such as health insurance. When a research project does not attract funding or when an existing project is not funded for a second time, there are several consequences (see Researchers’ section in Figure 19.).

- Researchers who do not hold a tenure-track position or who are not tenured as professors face major employment instability. Associate scientists can lose their job if they are not part of another research team within a university.
- Fewer opportunities are available to disseminate the results of an existing project. A project that does not receive funding renewals after it is implemented has less of a chance of survival and less of a chance that researchers will write research papers or be invited to attend conferences. Moreover, public engagement and outreach activities are even less likely to take place.
- A project can be suspended temporarily or indefinitely, and that can affect the social benefits that the project provides to society.

Resource dependence that U.S. universities have from funding agencies affects the way researchers act in the institutional environment. Scientists/researchers need to ensure their stability; to do so, their behavior and actions must focus on the development of research by navigating the requirements and limitations that funding agencies impose to provide funding. This behavior ensures the stability and flow of resources necessary to keep their academic/research work positions safe and their research projects funded to
operate. Moreover, researchers must continue publishing academic papers that are required by universities for their promotion and that are necessary to measure productivity of their work (Tolbert, 1985). Public outreach, community engagement projects, or science communication projects/initiatives developed in research universities are considered to be the service that faculty and researchers must fulfill among their academic duties (see Science Communication for Public Engagement section in Figure 19). Still, those activities do not count as much as research, publishing, and teaching among the promotion criteria for professor/researchers in universities. Consequently, there is little motivation for faculty and scientists of universities to involve themselves in public engagement projects.

The research system at U.S. universities represents a challenging and competitive scenario for professors and scientists as well as for science communication and public engagement, which is still considered a relatively new academic practice that is necessary to bring science closer to society. Another barrier in the U.S. is that few researchers have received training in science communication, which means that most of researchers do not know how to design a strategy that promotes engagement of society. Consequently, this task has been frequently delegated to the offices of communication and marketing divisions of universities (Govoni et al., 2010).

Researchers of the ESTPH team mention said they worked hard every year to maintain funding and that they have managed to win renewals of their grants to keep the program alive since the program was launched in 2014. To do so, it was necessary to follow and navigate the guidelines provided by their funding agency. Following the guidelines has been managed creatively by the research team by developing promotion
messages and pieces that focus on healthy food options, fun games for physical activities, and family time.

**Institutional standards of universities and research institutes.** Research is one of the main and most valuable practices of U.S. universities. At the institutional level, universities are ranked for their competitiveness in receiving funding for research, and those figures are compared to those of other universities. At the individual level, research is the most valuable skill and capacity among graduate students and of tenure-track and tenured professors. The number of published research papers, awarded research grants, and projects successfully approved and funded is one of the most valuable attributes that researchers can have in their professional and academic backgrounds. Moreover, it is important to mention that those elements are crucial factors reviewed during searches for new faculty and for promotions by university committees (see sections A and B in relation with the section of researchers in Figure 19).

The competitive nature of U.S. academia leaves few spaces and little time for researchers to engage with the public. The expectations of universities, funders, colleagues, and scientific associations that direct scientific dissemination through conferences and academic journals do not provide space and funding opportunities for public engagement (Stilgoe and Wilsdon, 2014). Studies developed in the United Kingdom have explored scientists’ willingness and interest of public engagement determined that they would like to spend more time with their target audiences of society, but the academic system and the duties imposed on them to maintain their jobs was a barrier for this to happen (Royal Society, 2006).
Studies in the United States have demonstrated that the attitude of scientists toward public engagement is varied. A report by the National Science Foundation, “Science and Technology: Public Attitudes and Understanding,” stated that only 42% of scientists were interested or ever were motivated to take part in public engagement activities related to their projects. The survey found that that 76% of the researchers said they not have enough time, 28% did not want to take part in such activities, and that 17% do not care at all about science communication (NSF, 2004). Over the past decade, several studies have found that scientists and professors in the United States were becoming more interested in exploring ways to become more engaged with society—even though they faced multiple barriers and even threats to their careers. This was evidence that the academic environment in the United States and in other parts of the world has changed over the past three decades (see subsection of Interested Researchers/faculty in Figure 19). Newer studies pointed that there is a call for scientists to engage the public more fully in their research (Lane, 1997). Scientists can be change agents by becoming more engaged with their communities by conducting research about the real needs of their communities and inviting people to collaborate with them. This practice becomes also a way to contribute to the common good through exercising their civic duty (Greenwood & Riordan, 2001; Nelson & Vulcetich, 2009). This shift in the roles of scientists in academia and society has become a major risk for scientists, because these efforts could jeopardize their job stability and their scientific reputation in the current political scenario in the United States.

Social movements advocating for science communication in the United States.

The March of Science is an example that there is a significant number of U.S. scientists
who are interested in advocating for science and how it should be more involved with society by engaging research as a source of information and analysis in policymaking processes (Ross et al., 2018). It is important to acknowledge that as a movement, the March for Science has emerged primarily as an advocacy claim of the scientific community rejecting the budget cuts that the Trump administration executed to federal science agencies that provide research funding (Mooney, 2017).

Another restraint more specifically related to this study is that a segment of the U.S. scientific community, also involved with the March for Science, has rejected governmental policies that limit how scientists can disseminate their research to the public. New policies since 2016 prohibit scientists and professors at universities from presenting the results of the findings of their studies to society at large (Lin, 2018). This suppression restricts constitutional rights of scientists as citizens to speak and present their knowledge. Consequently, scientists in the United States are not protected by law if they develop any kind of scientific communication; this issue leads to self-censorship and suppression if the research discipline addresses political or economic power groups (Rainey & Rainey, 2017). Therefore, in the current scenario in the United States, science communication becomes a risky practice for researchers that threatens their work stability as well as their role in society. Still, the scientific community is organizing to advocate and defend their right to be engaged with society.

Further exploration about the motivations of researchers to engage in pro-science movements could clarify the reasons and perceptions of scientists to be involved or not in public engagement initiatives and to defend their work and seek support from society in general. Specifically, one could explore how federal budget cuts jeopardize research and
academic work and therefore act as a factor that can lead to different future scenarios. Thus, there is now an opportunity to change the paradigm and relationship among academia and society, but will scientists become even more closed to the alternative of public engagement in the United States?

As cited in Chapter 1, oppressive policies in the United States have compelled scientists to react and turn to society for seeking support to defend their jobs and their social role as researchers. That said, multiple complexities and barriers for science communication for public engagement are not the only existing restrictive policy. Another crucial barrier is that few researchers had received training in science communication to acquire skills that would help them to engage with society (Barrie, Hughes, Smith, & Thomson, 2009; Dietz, 2013).

**Figure 19.** Organizational-level logic model (Yin, 2012) adapted to the institutional barriers of ESTPH case study (UNM in the United States).
Suggestions and Implications

This section summarizes how the emerging themes from the discussion and analysis section of the data findings of ESTPH can be addressed with suggestions and implications. These suggestions and implications were developed by reviewing studies of science communication for public engagement and media theories applied to this field, and health communication models that can serve as a guide for solving or addressing the difficulties found in this case study.

Understanding Family Dynamics of Target Audiences: Formative Research through an Ethnographic Approach for Creating Truthful Engagement of Audiences

As revised in Chapter 2, science communication for public engagement literature suggests that dialogue frameworks are the best-suited initiatives for events or any tactic for enhancing society’s interest and participation. To plan engagement strategies, it is necessary to investigate and create a comprehensive understanding of a target audience’s characteristics (culture, socio-economic level, beliefs) to not fall into practices of deficit, diffusion, or transmission models in informal-dialogue spaces or tactics (Davies, 2009).

In this regard, further formative research of ESTPH that is designed with an ethnographical-qualitative approach could also provide a greater understanding of family daily routines and how to adapt the program according to household needs and difficulties. In this regard, a formative study would provide information about which type of support, and valuable resources will be more attractive and necessary to the families--and consequently would create a suitable environment for the target population of children to adopt healthier habits of diet and physical activity.
A Comprehensive Framework for Health Behavior Change: The SCT Model and the Exploration of Environmental and Cognitive Influences to Complement the Social Marketing Model

Regarding health behavior models that can contribute to changes in the ESTPH program, the Social Cognitive Theory model can be a useful framework. Because this model is based on socio-cognitive aspects that can reinforce behavior change, it comprises the dynamic relationship among behavioral, personal, and environmental influences. Moreover, the SCT model also offers ways to translate knowledge into effective strategies (Bandura, 2004; Baranowski et al., 2002).

As the ESTPH case study findings showed, one of its issues is the size of a household budget for healthy groceries. Considering that, the program could develop an activity that involves children and their parents. Indeed, parents are a key stakeholder that plays a major influence in the engagement of children. Moreover, it is the parents who manage the household finances, grocery shopping and cooking meals or prepare snacks and lunch for the children. Therefore, ESTPH can motivate parents, by providing them not only information but resources that are valuable to them.

School pantry and vegetable gardens in schools. Ideas discussed with student collaborators included the creation of a school pantry and to plant gardens at community centers and schools. The pantry could be supplied with donations of the community and local grocery stores, and it could be located at each school, where the ESTPH participants could receive healthy food, free of charge, for the families. The gardens could reunite parents and children to create a space to plant vegetables and fruits in their homes and/or schools. The produce would be shared among the program’s participants at school, and
the crops could be tended by groups of students from the schools. The ESTPH program could partner with a seed bank in New Mexico to provide seeds to the participants to plant at home gardens.

According to existing literature, making healthy food more accessible to participants through this type of initiative could be successful in promoting a deeper engagement of the ESTPH followers (children and their parents). Available studies demonstrate that home food availability, parental diet, and familial eating habits seem to play an important role in the diet quality of children. A study of urban Hispanic children in the United States based on developing interventions that target the family education on healthful dietary habits and available foods as resources they can access can have a positive impact on children’s diet quality (Santiago-Torres et al., 2014). Therefore, the content of the ESTPH program could be complemented by resources valuable to families in terms of their household budgets and also could expose children and their families to healthier diet options.

In conversations with the ESTPH researchers, school pantries and gardens were considered interesting and viable options. Several limitations emerged, however, regarding the guidelines that the ESTPH funding agency requires. A primary limitation is the criterion that the funding agency demands that prizes/rewards must be only for children and must not exceed $5 in value per participant. Therefore, providing groceries through children to their parents would adhere to funding agency guidelines and also would serve as a valuable resource.

After knowing the results of this study, in specific how parents faced difficulties in buying healthy groceries, the ESTPH research team implemented a promotional booth for
the program in a school event in October 2018 to supply fresh fruits and vegetables to parents and children. The researchers said that parents acknowledged this activity as a positive measure by providing positive comments and thanking the ESTPH program.

**Self-efficacy and peer health education as opportunities for engagement.**

Several studies address the self-efficacy of children in health behavior change. With ESTPH, focusing on self-efficacy of children to maintain healthy habits could also be reinforced through activities involving peer-led health education. Previous studies have shown that children’s self-efficacy can be enhanced through teaching new skills and habits through observation (Rosenthal & Bandura, 1978). However, a critical aspect to enhance self-efficacy through peer-led modeling must consider that the peer educators must possess the necessary capabilities and lived experience linked to a positive attitude and environment to enhance self-efficacy (Schunk & Hanson, 1985). Newer studies about the relation of self-efficacy and peer-led health education models for children could inform a retooling of the ESTPH program. Peer-led model studies demonstrate that observational learning thorough peers has a major influence on children who are at risk for chronic disease to motivate children to include physical activity and healthy diets in their routines (Frantz, 2015).

An opportunity to motivate the engagement of children with the ESTPH program content could be promoted through the recruitment of new peer health educators who are former participants of the ESTPH program. Because the program was launched in 2014, it will have a sizable number of former participants who could become peer health educators and serve as models for younger children who could share experiences with current participants. Moreover, they could become the “faces” of the ESTPH program to
communicate not only to children but also to their families information about healthy habits in diet and physical activity.

As for science communication practices, the audiences that should be considered for planning and executing practices for increasing the effectiveness of public engagement are science practitioners, mediators, target audiences, and peer-to-peer groups (Burns, O’Connor, & Stocklmayer, 2003).

An important highlight of the family dynamics was that student collaborators identified as a common factor among the children who follow the ESTPH program is the role of pets in their families. Student collaborators said that children often talked about their cats and dogs, and how much they loved their pets. Most of the children spent time playing with their pet after school. The pets were not only a mascot but a companion that provided to them by parents and gave them unconditional affection when their parents were not available. The value of a pet in a household speaks to the availability of time that parents have for their children. Having a pet is also evidence of how parents of the target audiences find different strategies to supply companionship and affection to their children. This element needs further exploration to define the reasons for the unavailability of time for family in daily routines.

Social Media as Conduits for Science Communication Engagement

Science communication practices and research provide several considerations about which conduits are more suitable for building audience engagement. As mentioned in prior sections through the suggestions elaborated by student collaborators, social media can constitute an opportunity to engage parents and families with healthy habits.
However, social media can also support the work of research by enhancing and increasing the scientific impact of their work.

A study informed by the foundations of the two-step flow theory suggests social media as a conduit for direct communication between scientists and society (Liang et al., 2014). This study demonstrates that nano-scientists who used Twitter to communicate findings of their research to broader audiences of society supported positively the promotion of their work and gained the attention of media outlets. Moreover, including social media strategies had a positive effect on the scientific impact of their work inside their own academic networks (i.e., increasing citation of their academic papers and contacts for further collaboration with other scientists).

Additionally, other studies suggest that social media constitutes an efficient communication conduit for scientists who seek public engagement of lay publics of society. The main reason is that the feature characteristics of this communication conduit provide versatile tools to create events and discussion forums and to share information (Nisbet & Kotcher, 2009). Currently, the ESTPH program does not offer a direct tactic/conduit for communication among scientists and children, or their families. In terms of science communication for public engagement, a possible tactic would be to use social media (as suggested earlier in this chapter) to talk about the children’s and their family concerns and interests about health and how they could incorporate healthy habits. This space could allow scientists to facilitate direct discussions with families and foster spaces for parents and children engagement with the ESTPH program.
CHAPTER 5

Case Study 2: ACTIVITAL

VLIR-UC Food Nutrition and Health, University of Cuenca, Ecuador

As noted in Chapter 4, this case study follows the same structure of presenting the findings, analysis, and discussion of the ACTIVITAL case study. The first section of findings presents the emerging results of the data collection section. The following second section focuses on the analysis and discussion of the broader themes found in the study with the research questions. For closing the chapter, the implications and suggestions present several criteria for consideration of the ACTIVITAL case study related to science communication for public engagement as guidelines to improve the communication strategies of the program.

Findings

This section reviews the emerging data from the data collection of the ACTIVITAL participatory focus group sessions developed with former participants of the program. It is important to note that the participants of ACTIVITAL who were recruited for this study were college freshmen and sophomores, as the program was developed in 2012 for the students last time in local high schools in Cuenca.

Following the research design described in Chapter 3, Research Question 1 was covered in the first and second sessions, and Research Question 2 was covered during the third and fourth sessions. Each session also included the introduction of the concepts of one communication theory of the analytical lens (see page 106, Table 4) as a set of flexible guidelines for consideration and discussion of student collaborators. This procedure allowed the organization of the emerging ideas and reflections of the
participants developed through a participatory action research (PAR) framework into
tangible suggestions and arguments for the case study in the framework of science
communication for public engagement.

**Data findings of ACTIVITAL in Dialogue with Research Questions**

Prior to describing the findings, it is crucial to note that the participants of the
ACTIVITAL case study were former participants of the program. That is different from
the participants in the ESTPH case study, who were teen health educators. Consequently,
the data reflected in this section of the research study responds to the lived experiences of
the student collaborators when they were in high school approximately five to six years
ago. All of the data collection sessions were conducted in January 2019.

It is also important to note that the ACTIVITAL program was implemented by the
distribution of the booklets in 10 high schools of Cuenca, and providing health education
workshops of nutrition and physical activity, recipes and cooking, and games the program
team took part in in each high school. For more details of the program, see Appendix B.

**Research Question 1: How can researchers/scientists of health behavior studies
develop better science communication strategies for public engagement, from the
perspective of teenage/young-adult audiences?**

To answer this question, the first and second sessions were conducted using
participatory data collection tools guided by prompt questions to open the facilitation of
each session.

**First session: Assessment of communicational activities, materials, and
existing issues.** The first research procedure with the student collaborators asked them to
create a nickname for themselves and to make a tag to they would wear in each session.
The purpose of using a nickname, as noted in Chapter 3, was to ensure confidentiality of the participants and to eliminate any link to their identity in the research process and data. The student collaborators also were asked to refer to each other only by their nicknames, which were Churos, Chino, Lucy, Linda, Estrella, Merli, and Peter.

As a second activity, the student collaborators devised rules for carrying out the research process and how to proceed with communication, possible eventualities, a discussion of differing views, and how to address delicate information that could emerge. The final rule set was the following:

- **How to proceed when we disagree with each other.** Each participant presented their reasons to think differently, always with respect. All of the student collaborators agree to not interrupt or use disrespectful terms to each other at any time.

- **When we can’t attend the sessions.** Student collaborators asked for the option to respond remotely to any session they might not have been able to attend. For this reason, the prompt questions were uploaded through Google Classroom so that their opinions or answers could be taken as part of the data. The missing participants would receive the prompt questions through a link through their email to access the session, the same day the session took place.

  All student-collaborators also agreed to attend at least one of four sessions so that they could be considered participants and collect their compensation by the end of each session.

- **Communication will happen always through text messages and email.** Student collaborators suggested that the best way to receive reminders and to contact them
was through text messages. If anyone needed to receive more information, an email would be the best conduit, they decided.

- **Ask for help if you feel sick.** In case of any discomfort, the student collaborators were asked to raise their hand to seek assistance from the facilitator. If a student collaborator needed medical assistance, the Student Health Center at the University of Cuenca would be contacted.

After setting the rules for participation, the student collaborators also made a poster that was sent to every participant through text message and email (see Figure 20).

<table>
<thead>
<tr>
<th>SCIENCE FOR ALL</th>
<th>RULES FOR OUR TEAMWORK</th>
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<tr>
<td></td>
<td>We will respect the opposite points of view. And we will discuss our opinion with arguments.</td>
</tr>
<tr>
<td></td>
<td>We will have to attend all the sessions. If we cannot attend, we will ask for remote access to participate in the session.</td>
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<td></td>
<td>We will communicate only by text messages and email.</td>
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<td>In case of feeling sick, we will ask for assistance to the facilitator.</td>
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<td></td>
<td>We will always receive our compensation at the end of each session.</td>
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*Figure 20.* “Rules for our teamwork” developed by the student collaborators of the ACTIVITAL case study.
Prompt question 1.1. What do you think about the activities that ACTIVITAL has developed to communicate their program? How well do you think these activities are working? This question opened the first session with the participatory diagramming tool. The selected format was a grid to organize issues, positive strategies developed by the program, and suggestions. This tool allowed the student collaborators to conduct a productive facilitation by considering all of the emergent ideas and opinions that the student collaborators had that were related to the ACTIVITAL case study (see Figure 21).

**Figure 21.** Participatory diagram elaborated by the student collaborators of ACTIVITAL.

The first response of all of the collaborator students was that they remember that ACTIVITAL taught them about nutrition and physical activity, which are the two core constructs of the program. Given that this program was implemented five to six years ago in their high schools, this was a positive aspect, as they recalled the two main goals of the program.
The activities they recalled most readily were the outdoor activities and games and the workshops about nutrition. Moreover, student collaborators agreed that they think it was an effective strategy to combine a workshop and a game or an activity. This framework helped them to learn about eating healthy and how to adopt healthy habits for physical activity.

After this first set of responses, the handbook of ACTIVITAL (see Appendix B) of the case study for more information) was shown to the student collaborators so they could review it, analyze its content, and recall other activities of the program. One of the activities they remembered as positive was the nutritional pyramid game, which was a diagram with the food groups, and they had to locate correctly each food by cutting and pasting the food image in the correct section. However, the students said they believed this activity was quite complex for their age because they were confused frequently trying to identify the correct food portions and combinations. For example: If they had already eaten a fruit and then combined a meal with a protein portion with a carbohydrate such as bread, they had doubts about how much fruit and what kind of fruit would have less sugar (a citrus or berries) to not unbalance the intake of sugars that later become carbohydrates.
Figure 22. ACTIVITAL’s Nutrition and Physical Activity Guide Booklet for students.

Even though the pyramid activity was difficult, the student collaborators acknowledged that they learned to vary their foods and to balance their meals in the long term. Yet they suggested that this activity could be redesigned as a game through an app or a website, which would make it more interactive and fun also might help to correct wrong ideas for future participants.

As for the booklet serving as a communicational piece (Figure 22), student collaborators believed it was a functional piece, with a clear design and content, and helped to keep them engaged with the nutritional information they learned through the workshops and the games/activities the ACTIVITAL team took part in during their high school years.

Another activity that student collaborators described as effective was The Healthy Day, or in Spanish, El Día Saludable. This was a healthy breakfast day where the students brought a healthy breakfast food to share with their classmates. This activity was recalled as fun and positive. Yet the students believed it could have been enhanced as a cook-off
day so they could learn about portions and healthy recipes that are easily prepared at home.

Another activity the student collaborators remembered as positive was the visits of athletes who talked about how a healthy lifestyle (balanced nutrition and physical activity) helped them to reach milestones in their careers. The student collaborators agreed that having a successful figure as a guest speaker who supported the program in their schools was motivating and encouraged them to follow the program.

A less effective element of the ACTIVITAL program, the student collaborators said, was the self-evaluation test, which was in the booklet *Nutrition and Physical Activity Guide*. The students did not mention the test initially, but when it was shown in the guide to them, they said it was confusing and not very interactive. This activity could have been done online, they said, and still would have provided tips about how to improve their habits.

Ultimately, the student collaborators said most of the strategies were effective. But if the ACTIVITAL program was to be implemented again in high schools, the activities should be redesigned and the communication conduits should be more interactive, more fun, more easily learned, and it should use dynamic strategies to capture the high schoolers’ attention.

*Prompt question 1.2. Which activities of ACTIVITAL do you think are most effective? Why?* Student collaborators considered the games and the interactive spaces for learning to be the best features of ACTIVITAL. For example, all of the student collaborators learned habits that they still use daily or frequently. For example, they eat fruits and vegetables every day or make time for physical activity.
The structure of teaching and combining this activity with a game or outdoor activity was very effective, they said, because they had a combination of scientific information about nutrition and physical activity, and later, there was time for having fun using the same concepts they had learned. The student collaborators said this strategy base should be maintained in the future as a major guideline and framework to design new activities or redesign existing activities.

**Second Session: Opinion leaders for ACTIVITAL and mapping assets for health information and activities.** Student collaborators said it is necessary that opinion leaders for the ACTIVITAL program create a more personal and interactive approach for the communication strategies of the program. After discussing some of the constructs of the two-step flow theory, there were crucial factors to consider for ACTIVITAL.

The presence of an expert in nutrition as an opinion leader to present information about the program would be a new key element that student collaborators thought was crucial. This person does not need to be necessarily a scientist or a researcher but should have charisma, should be approachable, should have a positive attitude and be open to talk to high schoolers with good humor and an upbeat personality. Moreover, this person should look healthy and be a good example of the discourse that will be communicated.

Another group of opinion leaders that would be interesting to include, the student collaborators said, would be former ACTIVITAL participants. The student collaborators said they thought that having someone who speaks from their own experience would create a closeness and establish trust with the teenagers. Moreover, this person would foster a more interpersonal approach to communicating with the target audience.
Prompt Question 2.1. What do you think about the prizes? This question was discussed only during the ACTIVITAL data collection, because the program did not offer prizes for the participation of high school students. The program was focused exclusively on providing health education about nutrition and physical activity and games. The student collaborators said they believed that the new games and activities needed prizes to motivate participants and to reinforce the goals of the ACTIVITAL program. The suggestion was that healthy meals and snacks would be the best prizes.

Summary of solutions and suggestions for the issues of ACTIVITAL suggested by the student collaborators

After reviewing the results and guidelines provided by student collaborators in the first session, the discussion focused on suggesting ideas for new activities. The prompt question that guided the first section of the second session was:

- If you could design an activity for communicating ACTIVITAL/ESTPH to teenagers like you, what would you do/suggest? Think about something you would like to see or do and other activities that teens like you might enjoy and engage in.

As result two main suggestions emerged: activities to promote the ACTIVITAL program through interactive games and new conduits for communication. The activities to promote interactive games would summarize activity suggestions, detailing what type of events would be key to promote ACTIVITAL. The new conduits for communication would present new channels focused on offering interactive experiences for the teen audience of the program.
Both suggestions would complement and reinforce the need to create a more interactive approach for communicating the program. As for ACTIVITAL, the student collaborators said that in the current scenario, it would be important to integrate technology and games in order to engage teenagers and their families. It also would be important, they said, to motivate teenagers to be active in their spare time.

**Suggestions for interactive activities.** Student collaborators discussed different options for proposing fun and interactive activities that focused on providing teenagers different opportunities to learn about how to adopt a healthy lifestyle.

**Outdoor activities.** Student collaborators also said they believed that ACTIVITAL needed to create events that are interactive and fun so that the goal of the program could be fulfilled. For this purpose, there were several suggestions about activities oriented for high schoolers and their families. For this purpose, in the second session, asset mapping was done to locate the best venues for outdoor events and to locate other venues that could be information resources for physical activity.

**Prompt Question 2.2. Which places in the city are available for teens and parents to do physical activity and play?** Student collaborators said that parks might be the best places to engage teenagers and their parents. The favorite parks (see red sites in Figure 23) for families were Parque de La Madre and El Paraíso Parks, especially on weekends. In those parks, families in groups of three to five people could play soccer, volleyball, ride bicycles, jog, or run. Cuencanians typically enjoy meeting up with friends to socialize on Saturdays and Sundays in these spaces. For that reason, the following activity was proposed by student collaborators.
Fin de semana ACTIVITAL. The best way to approach families, according to the suggestions of the student collaborators, would be to make family events one weekend per month. Such events could be organized as booths that offer ACTIVITAL information, an intervention for assessing the physical health of parents and teenagers with the researchers of the program, and free workout routines, such as dancing lessons or yoga in the park. The student collaborators suggested that these spaces could be useful to engage parents and family groups with the ACTIVITAL program by offering interactive activities that are accessible and fun.

Other spaces mapped as key sites to engage teen participants were local high schools (see yellow sites in Figure 23). The student collaborators mapped out several local high schools where games and health snacks could be offered to the teenagers. Suggestions for addressing teenagers were to create team games related to healthy food and to physical activity. Ideas included small soccer and basketball games, yoga lessons, and trivia about balanced nutrition. A key aspect mentioned was to offer games that teenagers could choose and get healthy snacks along with information about the ACTIVITAL program and invitations for their parents to follow ACTIVITAL on YouTube.
Figure 23. Asset map created by the student collaborators of ACTIVITAL, locating sites for family physical activity and key sites to promote the program.

Other spaces where teenagers gather in their spare time and that could be centers for distributing information are the two local malls, Millenium Plaza and Mall del Río (see green sites in Figure 23). The student collaborators said these places could be useful to promote online access to the ACTIVITAL app by placing QR codes and the links to access the game. Some nontraditional advertising could be placed in elevators, bathrooms, and at entry points to the mall, for example, with floor advertising that has an eye-catching design.

Prompt Question 2.3. Where can (or where do) teenagers find information about healthy habits? Hospitals and health centers in Cuenca were also considered as venues that could be used as information centers for the program (see white sites in Figure 23). The student collaborators said that having permanent information about the program at
hospitals would be important, i.e., a booklet of information and posters with links for the social media profiles of the program on Facebook and Instagram.

**Communicational suggestions.** As mentioned, the student collaborators agreed that it was important to consider new technology that allows people to interact through the internet, social media, and on mobile devices. Moreover, in the case of ACTIVITAL, it was important to reflect about how to use these communication conduits to promote a healthy lifestyle through nutrition and physical activity. For this purpose, internet-based conduits and social media aim to engage parents and to concentrate the program’s information on different platforms that are integrated.

The last section of communicational suggestions also provides several insights for developing a communicational tone for the program’s messages.

**Internet-based conduits and social media.** The ACTIVITAL app is considered an online activity and strategy that summarizes the core goals of ACTIVITAL, which are physical activity and healthy nutrition. Also, it is important to the program to the need to improve with a more interactive approach that is fun and enjoyable for teenagers. The app should have a first step where the avatar of the participants (male and female versions) can be personalized with the age, height, and weight of the user. The second step would be to offer a meal registry for breakfast, lunch, dinner, and snacks that should be filled in every day. This section should also have a place to register physical activity. The app should be able to send reminders to the user to register their eating and exercising and/or physical activity. This aspect should be linked to the ideal intake of food groups and calories. Also, the avatar’s look should be transformed, depending on the healthy or unhealthy habits. For example, with junk food and not exercising, the app
should have images of looking sick, chubby, and sad. And if the registry is healthy, the avatar would look leaner, healthy, and happy. The app should be available as a free download for smartphones but also should offer a website version for teenagers who do not have access to such devices.

Other activities would focus on engaging parents and families as a support system for teenagers. In the second session, the student collaborators said they remembered that their parents knew about ACTIVITAL through a letter sent by the high school that informed them that their sons and daughters would be learning about healthy nutrition and physical activity. Even though the reaction of the parents was positive, they did not seem very interested. Another challenge for parents was to engage in a healthy behavior at home, where their eating habits still were sometimes unbalanced. For this reason, the student collaborators thought that ACTIVITAL should create an Online Health School.

This activity would be a series of videos available through YouTube, teaching parents and families about healthy recipes, nutrition, and workouts. The student collaborators suggested that a local chef could lead the cooking show along with the researchers of ACTIVITAL and that local athletes with former ACTIVITAL participants could be the faces of the workouts. This online-based channel could also invite families in contests to upload photos dishes with hashtags such as #loncheraACTIVITAL (#ACTIVITALlunchbox) or show a picture of the family working out with the hashtag #familiaACTIVITAL (#ACTIVITALfamily). As a prize and motivation to participate, families could win a basket of vegetables or fruits every month.

Facebook and Instagram are other social media platforms that would be useful to incorporate. According to the student collaborators, these platforms are largely used by
teenagers and allow them to interact with different content. Having a profile of the program would be useful to create an online community of the participants, providing them information about healthy nutrition and physical activity, create contests, and inviting the family and teen audiences to the program’s events.

After discussing framing in the second session, the student collaborators defined a tone for the overall discourse that ACTIVITAL must have.

*Insights for communicational tone for the ACTIVITAL program.* As new activities were suggested, it was important to define a communicational tone for the messages of the program. For this purpose, the framing theory concepts were reviewed and discussed with the student collaborators as a guideline to explore the discourse framing and message design. The student collaborators suggested that the messages should be fun and use slang that teenagers use to talk to their friends with positivity.

The student collaborators also said the messages of the program needed to inform high school teenagers about the consequences of unhealthy habits, such as chronic diseases. The student collaborators also said they believed the messages should always focus on how and which habits can be useful to prevent these illnesses. For this reason, the teenagers’ personal stories could be a positive approach to share ACTIVITAL’s message. An example would be a participant who talked about her experiences of how changing her habits represented a challenge, but also how her new healthy behavior improved her overall health. The student collaborators agreed that using personal stories that other teens could relate to could motivate high schoolers to believe they also could adopt a healthy lifestyle.

Some examples of messages were:
• “Dude, don’t forget to eat fruits and veggies in your snacks.”
• “Hey, squad, let’s have fun this weekend with a soccer match.”
• “Hey, buddies, let’s make a healthy lunch for everyone today.”
• “Bro, don’t forget to have breakfast this morning before class.”

**Research Question 2: How Can Teen Audience Engagement with Science/Health Communication be Improved?**

The response to this question was explored during the third and fourth sessions of data collection. The primary goal of this part of the research was to explore alternatives to improve the engagement of audiences of the ACTIVITAL program. This section of the results focuses on the participatory process of designing and defining the activities that would be best-suited for attracting the interest of high schoolers as future audiences of the program.

**Third session: Designing new activities for ACTIVITAL.** In this session, student collaborators created a collaborative Zine. The two main suggestions addressed two categories: (a) technology conduits, which would be an app linked to Facebook, Instagram, and YouTube; and (b) outdoor activities in parks and class breaks in high schools. The Zine described in detail the content and functioning of each of the activities.

**Prompt Question 3.1. What activities will you develop to create engagement with your audience around healthy habits (eating and physical activity)?** The ACTIVITAL app. The student collaborators said the app should include a game that invited the participants to move around and be active. According to the student collaborators, high schoolers of Cuenca enjoy and play games on smartphones frequently, and this could be an opportunity to gain their engagement. A good example was
Pokemon Go, a game that makes the users move and walk to collect creatures with their smartphones; when the user has more creatures, more points can be accumulated. For the ACTIVITAL version, the participants play the game by collecting fruits, vegetables, and healthy snacks that would make their avatar healthier. The game should consume at least 30 minutes per day to make the participant move around and walk. The more healthy foods the participant collected, the more points they would accumulate, and the points translate to a prize. Prizes could be coupons for healthy foods available at local businesses, the students said.

The app also could include a virtual health-meter that looked like the speedometer of a car that goes from green to red according to the overall performance of the participant; the app would show how much healthy food and physical activity were combined.

*Outdoor games for class breaks.* A key location for developing games for teens would be their high school during their class recess, with fun activities and prizes. The student collaborators thought that making a short competition with three challenges for two teams would be attractive to high schoolers. They named this activity *El Reto ACTIVITAL*, the ACTIVITAL Challenge. The competition would combine physical activity with a CrossFit routine, playing Twister, and following clues on the high school campus that would lead to a major prize.

*Prompt Question 3.2. What would you add or suggest to ESTPH current programs?* The student collaborators said they believed it was necessary to engage physicians of local health centers and hospitals as opinion leaders. A traditional health promotion strategy would place in local clinics copies of booklets with information about
the program. Yet in the culture of Cuencanians, people usually do not pay much attention to such materials and frequently lose them. A worthwhile strategy might be to ask local doctors to suggest that parents become informed about ACTIVITAL and provide parents the information of the accounts of the program for Facebook and Instagram and the ACTIVITAL app. Such a recommendation by doctors would carry an expert endorsement, which would be a useful health recommendation and might be likely to generate interest among teens and their parents.

**Fourth session: Exploring the proposed strategies of teen student collaborators and opportunities of collaboration with the ACTIVITAL research team.** In this session, student collaborators interacted with the researchers of ACTIVITAL. The discussion was productive and identified interest of both groups to collaborate in the future. Most of the student collaborators said they would like to design the campaign and create the communication materials with the researchers. The researchers thought it would be a good idea to create a public outreach program where the students can create new communicational pieces and promotional strategies for ACTIVITAL.

The ACTIVITAL researchers also said they believed that a peer health education program with students of Medicine and Nutrition School would be valuable as a public outreach program that allows the students to do their coursework requirement and professional practice.

As a final activity, all of the student collaborators were invited to participate in a word cloud by voting about how they envisioned ACTIVITAL. The most common results were health, physical activity, energy, life, movement, and people (Figure 24).
Unexpected Findings

This section describes information that emerged in the data collection process and was not expected in the study. It is important to clarify that the data of this section might not be directly related to the research questions of this study, although the data is included here because it can be useful to provide insights related to topics of interest of the audiences of ACTIVITAL that can be used as a bank of ideas to develop interventions or design communicational pieces that appeal to the audience. Moreover, it could lead to new avenues for research about health promotion programs for younger audiences of culturally diverse populations.

Other data also addressed the involvement of researchers and their willingness to innovate with science communication strategies and to collaborate with audiences.

Improving their physical appearance is a motivator for young adults to adopt healthy habits. The student collaborators frequently mentioned that the best motivator for teens to adopt healthy habits is a strategy that helps them to improve their physical appearance. Most of high schoolers care about how they look because they want to feel attractive and accepted by their peers. Moreover, student collaborators said that an
attractive appearance is influenced by the stereotypes younger females and males see in the mass media. Some of the most desired looks that teenagers pursue are a fit body for females and a strong body for males. Both genders also care about having healthy-looking skin and smooth hair.

The student collaborators were open to talking about their experiences as participants of ACTIVITAL. Moreover, they said that when they were teenagers, they chose a healthy diet and exercised to improve their appearance. The content of ACTIVITAL helped them to learn about the importance of sustaining a healthy behavior as part of their lifestyle beyond pursuing an attractive appearance.

Therefore, the student collaborators also spoke about how it is important that the program promotes health over an attractive physique. The ACTIVITAL program can focus on the importance of health and how a healthy lifestyle is beneficial for self-acceptance and for helping to prevent chronic diseases.

**Positive willingness of scientists and student collaborators to engage with science communication activities.** The student collaborators also spoke frequently about their interest to get involved with ACTIVITAL. Moreover, they asked several times about the possibilities of becoming peer health educators as former participants for younger teenagers. Other student collaborators were interested in developing the communicational pieces for the program. This possibility was well received by the researchers of ACTIVITAL, consequently researchers were motivated to think about future public outreach programs in which student collaborators could be involved.
The possibility of such participation demonstrated a willingness to explore new avenues to update and retool the program as well as to establish relationships with common interests between the researchers of the program and the former audiences.

At the University of Cuenca, the administrative work of research projects represents a barrier and an issue for researchers in terms of paperwork and labor, the researchers said. Also, due to budget cuts by the government and funding agencies, the work of professors and researchers becomes even more challenging when developing a research project and/or a public outreach initiative. Yet researchers typically are open to explore alternatives such as finding sponsors and securing donations to carry on their projects. Another positive aspect is that the ACTIVITAL researchers give a great deal of importance to the opinions of their audiences and take time to listen to them to improve their work.

**Discussion and Analysis**

This section of Chapter 5 focuses on the discussion and analysis of the findings of the ACTIVITAL case study at the University of Cuenca in Ecuador. As noted in the methodology section of this section, in Chapter 3, the data was coded into categories that are part of broader themes. These themes constitute the units of analysis of the ACTIVITAL case study that respond to each of the research questions.

As noted in Chapter 4, (see page 136, second paragraph of Discussion and Analysis section) this study followed the suggested guidelines of science communication for public engagement research. The creation of initiatives that motivate dialogue among scientists and society (Bowater & Yeoman, 2013) and the methodological design of participatory action research to facilitate an egalitarian and mutual collaboration among
scientist and society (Irwin, 2008). For the ACTIVITAL case study, this methodological suggestion led to an exploration of the issues of the program from the perspective of student collaborators and the interests of researchers through an egalitarian approach. The results led to the development of guidelines to update and retool the program for further implementation.

**Discussion of Research Questions and Findings**

The first research question—How can researchers/scientists of health behavior studies develop better science communication strategies for public engagement, from the perspective of teenage/young-adult audiences?—focused on developing strategies for fostering audience engagement with communication strategies and tactics of the ACTIVITAL program. Here, it is important to note that the program has not been implemented in high schools since 2012. Therefore, it was necessary to update it for the current audience of high school teenagers.

The student collaborators for this case study, as former participants of the program, reviewed the program they received in their high schools and first discussed key factors to update the program, to create new strategies for implementing ACTIVITAL in current times, while preserving successful strategies and improving elements that had room for improvement and that might have been challenging to gain audience engagement.

The second research question—How can teen audience engagement with science/health communication be improved?—explored how scientists and the audiences of their research projects can find a middle ground to collaborate about a topic of
research of mutual interest. Here, several avenues emerged and were accepted as interesting and feasible initiatives that can be implemented.

The next section addresses the overarching themes that emerged from the study with available scholarship of health studies and science communication to provide several considerations, implications, and suggestions. These outcomes could be useful for planning, design, and implementation of science communication for health behavior change in Latin America.

Creating Better Science Communication Strategies for Public Engagement for ACTIVITAL

This section responds to Research Question 1 through the broader theme of the creation of an interactive strategy approach for health education. It includes a subtheme that argues that to reach a teen audience, it is important to explore how to create different types of learning experiences. These experiences must have two conduits—online and offline—that provide health education, games, and fun activities that motivate the interaction of teens and their families.

Creation of an interactive strategy approach. The student collaborators of ACTIVITAL said that the program uses an efficient structure, which is based on providing information and education combined with games and dynamic activities. This approach was efficient in 2012, but today, high school teens have different habits and preferences. For this reason, it is important to think about new learning experiences that promote interactivity and are enjoyable to teen audiences.

Science communication research based on the dialogic models, specifically, the transactional model of communication (Wood, 2003), promotes interactive
communication where the audiences and the sender (in this case the ACTIVITAL researchers) share a common context and experiences over time about how to adopt healthy habits. Moreover, the transactional model uses the insight of learning theory (Dierking et al., 2003) where people can share their experiences through different conduits and can establish a conversation that allows teen participants and their families and researchers to learn more about different alternatives to adopt healthy nutrition habits and physical activity (see Figure 25). Therefore, ACTIVITAL needs to create an interactive strategy that operates through communication conduits that promote interaction, mutual learning, and dialogue with their audiences. A key factor in the transactional model is that communication needs to be a frequent and sustained activity over time. Therefore, communication strategies that are based on one contact with the audience will not be useful (Bowater & Yeoman, 2013). Instead, constant and frequent communication will be necessary to engage teen audiences.

Figure 25. Creation of an interactive strategy approach and the subthemes that compose the discussion.

Several communication tactics suggested by the constructs of the learning experiences of the transactional model coincide with the considerations provided by
student collaborators of ACTIVITAL. Learning experiences of the transactional model are both media and events, such as websites and social media and informal social spaces with peers and family members (Dierking et al., 2003). In modern societies, individuals interact with topics of their interest through different conduits of communication and activities to have a holistic picture about a topic (Geib, 2011). For example, people can interact on social media platforms but also can attend clubs, classes, and special events that offer information and experiences to learn and interact around their interests.

For this reason, the media complementarity theory of the transactional model (Dutta-Bergman, 2004) suggested several guidelines useful for health behavior change programs. This theory proposes to use a mix of communication conduits that allow audiences to be approached through two-way communication (Tian & Robinson, 2008). Moreover, the mix of communication conduits must be selected according to the preferences of the target audiences (Parackal & Parackal, 2018). In the specific case of ACTIVITAL, student collaborators selected two types of conduits—online and offline experiences—for the communication of the program to develop different experiences and activities to engage the audiences.

**Online experiences.** As noted in the results section, student collaborators suggested the creation of the ACTIVITAL app. This strategy would centralize an interactive game, the links to access the social media profiles of the program (Facebook and Instagram), an Online Health School (healthy cooking tips and recipe videos), and the virtual registry of meals and physical activity. The app would be an online platform itself for the program that provides information and fun activities for participants and their parents.
In Ecuador, studies are not available that evaluate the effectiveness of the use of mobile health apps as part of health behavior change programs. Other studies conducted in Latin America about the use of mobile health apps demonstrate that apps are used mostly for monitoring patients with chronic diseases, accessing healthcare providers, and as health information resources (Saigí-Rubio, Novillo-Ortiz, & Piette, 2017). Therefore, creating and implementing the ACTIVITAL app represents an opportunity for researchers to explore and evaluate the outcomes and experiences of audiences in Latin America for preventive healthcare and behavior change. Such an app could also introduce mobile health communications that can help teenagers not only from a city but also could reach audiences in other cities and communities of Ecuador. Consequently, the program could reach more participants outside of Cuenca.

The Online Health School feature among the online experience strategies has scholarly evidence that demonstrates it can be an effective tactic for teen and parent engagement. SCT model evaluation studies in Latino populations have revealed that a key intervention approach for modeling health behavior is family recipe preparation (Ross et al., 2018). This feature is a set of YouTube video series based on healthy cooking and exercising; it also provides strategies that can be revisited by families over time to support the process of adopting healthier habits.

Available scholarship about the use of mobile health applications by young audiences in the United States has found that users prefer apps that are visually attractive and that can be customized according to the personal characteristics of the user (Warnick et al., 2019). Recapping the results, ACTIVITAL’s student collaborators said that an attractive feature would be that users could create an avatar of themselves. The avatar
would have the same age, weight, and physical characteristics of the user. Moreover, the avatar would be linked to the food registry and the game, and the user would be able to see how the avatar changes, depending on the registry of their meals and physical activity.

Regarding the effectiveness of interventions that use social media for health behavior change that has teenagers as audiences, there is evidence of positive outcomes for promoting healthy habits. A study evaluated seven health behavior change programs (Hsu, Rouf, & Allman-Farinelli, 2018). These programs used interventions that varied from using discussion boards for interaction in Facebook pages to in-person interventions to provide tips about healthy nutrition. These programs had positive results in increasing the intake of fruits and vegetables in the target group of teens. Most of the seven programs, however, were less successful in decreasing unfavorable food habits, such as the intake of fast foods. Consequently, in the case of ACTIVITAL, choosing a communicational mix that combines social media and internet-based strategies with in-person or offline events and activities for health behavior change of teenagers is a suitable communicational strategy. Moreover, in the future, health interventions could be designed by using social media as a platform of the program to reach the target audiences of teenagers and their parents.

A key factor that can be beneficial for the program is the opportunity to create an online community of the participants and their families through social media platforms such as Facebook and Instagram. In Ecuador, 98% of people older than 12 have a Facebook account, and 56.1% of Ecuadorians use it for entertainment (INEC, 2014). Therefore, Facebook represents an opportunity for engagement and a communication
conduit that could benefit ACTIVITAL to engage teens and their families around the content of the program.

Online experiences and the conduits described above will support the requirement of developing interactive experiences that ACTIVITAL requires for implementing the program. However, it is important to understand that also offline activities such as in-person interventions are necessary to promote the program. The following section will discuss the offline experiences suggested by the student collaborators with available scholarship.

**Offline experiences.** The student collaborators also discussed the importance of introducing outdoor activities and events to the ACTIVITAL program. Two types of offline experiences were mentioned to promote a better engagement of the teen audiences and their parents: (a) *Fin de semana ACTIVITAL* as a family activity, and (b) *El Reto ACTIVITAL* as a high school activity for teenagers.

*Fin de semana ACTIVITAL* was suggested as an activity that invited families to reunite around physical activity, information about the program, and an intervention based on the assessment of physical health (BMI, weight, and height checkup) with the researchers of the program. The suggested places for this activity are public parks of Cuenca once a month on weekend days, preferably Sunday. A systematic review and meta-analysis evaluated 47 studies that used family-based interventions to increase physical activity of children and teenagers of culturally and ethnically diverse audiences (Brown et al., 2016). The results of the study concluded that motivating parents, children, and teens would have positive effects on teens, with several considerations. First, interventions should be tailored to the local culture and context of the families of the
participants. Second, introducing goal-setting and reinforcement techniques increased the motivation of participants to sustain physical activity as part of their habits. Consequently, *Fin de Semana ACTIVITAL* as a family-based intervention designed by former participants considering their preferences has a high chance to be a successful strategy for audience engagement. Moreover, it gives the opportunity to engage parents and family members to the program and creates a positive environment for teen participants to adopt healthy habits. Research that evaluates the SCT model interventions in Latino populations for health behavior change reveals that parent involvement has positive outcomes. Family-based interventions increased the teen audience’s knowledge about healthy habits and about the self-efficacy of the family members (Ross et al., 2018).

*El Reto ACTIVITAL* was suggested as an outdoor experience based on a game-competition for teens that would take place during high school’s class breaks. Teens could participate in teams and would get a prize by competing in teams. A recent study evaluated the effects and mediators of the well-being of teens in resistance training, such as CrossFit routines, with team competition features. It is important to clarify that even though the study was developed in Australia, which is a context different from Latin American culture, it can provide interesting insights into this discussion. The results demonstrated that high school-based interventions have positive outcomes, such as (a) attracting the interest of teens to participate in the activity, and (b) participants reported positive changes in their self-efficacy toward performing physical activity (Smith et al., 2018). Therefore, in the case of *El Reto ACTIVITAL*, as a promotion activity, it could be
an attractive activity that is an enjoyable experience that allows participants to increase their self-efficacy for exercising frequently as part of their habits.

Other studies developed in Latin America suggest that designing health interventions based on virtual video games and physical activity games is an efficient approach for teen health behavior change. According to recent literature, the best-suited approach is to combine virtual video games and physical exercising with the health benefits of performing activities to engage the attention of Latino teenagers (Serrano et al., 2017). Consequently, the circuit of Reto ACTIVITAL also complements the game feature of the ACTIVITAL app, which is based on making the user move around a space to find prizes and clues for at least 30 minutes by jumping and running among other exercises for physical activity. According to the studies developed by the ACTIVITAL research team, the recommended daily routine of physical activity for children is a minimum of 30 minutes at a steady pace (Andrade et al., 2014).

The scholarship cited provides evidence that the strategies designed by the student collaborators have high possibilities to be effective when implemented in future. Moreover, the online and offline experiences complement and reinforce the content of the health promotion program of ACTIVITAL and integrate the key interaction factor that was missing before, which are the families of the teens.

**Improving Audience Engagement with Science/Health Communication in ACTIVITAL**

This section details the data analysis and discussion of the results of the ACTIVITAL case study and will enable this study to respond to the second research question of this project from the perspective of Latin America. This major theme is the
creation of collaborative teams formed by researchers and former participants of the program. This section discusses how to organize a collaborative team to implement the strategies proposed in this study and that will allow an improvement of the engagement of teen audiences to the science communication strategies adapted to ACTIVITAL.

**Creating a collaborative academia-society team.** In the process of suggesting alternatives for the scientific communication for public engagement of ACTIVITAL, there were several interesting ideas. These ideas crystallized in specific communicational strategies and tactics that attended to the issues and needs of improvement of the promotion of the program. In the process of detailing each tactic (detailed above through online and offline experiences), an important consideration emerged regarding the feasibility to implement these tactics.

For this reason, the student collaborators and the ACTIVITAL researchers discussed options for implementing the new strategies suggested for the program. Several alternatives were suggested, such as creating a student contest (college students could participate) for designing the app and new communicational pieces for the program. Other options were to create a public outreach program for peer health education and interventions for teenagers and their families and in local high schools of Cuenca. In the current structure of the University of Cuenca and the higher education law of Ecuador, implementing these alternatives would be possible through the mandatory requirement of public outreach projects that each academic department must offer (CES, 2016). Consequently, there is an administrative and policy structure that can facilitate the collaborative work of researchers and college students.
Currently, the organizational structure of the University of Cuenca facilitates the creation of interdisciplinary teams composed of researchers and students to develop projects that attend to local communities. According to the internal policy for public outreach projects of the University of Cuenca, the priority will be to support the creation of projects focused on health prevention or on any project based on research that promotes the well-being of the population (Universidad de Cuenca, 2016). Consequently, there are several viable options for creating collaborative spaces that promote the participation of students and researchers of the University of Cuenca. Moreover, this aspect represents an opportunity for designing new research projects that are interdisciplinary and implement programs that benefit the local community.

Involving families, teenagers, college students, and researchers would allow the creation of spaces for audience engagement around the ACTIVITAL program. Moreover, it would allow the integration of these stakeholders to participate, learn, interact, and establish relations that are mutually beneficial. Science communication for public engagement literature argues that creating collaborative spaces among academia and society around science communication activities allows scientists to share their knowledge with a wider audience and at the same time to ensure that scientific work is available to society for society’s benefit (Bowater & Yeoman, 2013). Consequently, science communication can be the first step to establish sustainable relations between academia and society. In the Latin American scenario, the process of opening spaces for collaborative work and discussion among people of different cultures and age groups is the cornerstone for fostering the public engagement of science.
Nonetheless, while there are several alternatives to establish collaborative teams, there are also possible barriers. The following section describes them.

**Figure 26.** Creating a collaborative team academia-society as a strategy for improving the audience engagement of ACTIVITAL.

*Possible barriers and difficulties for funding collaborative teams.* Public universities in Ecuador receive federal funds to operate. All public universities must offer free college tuition for undergraduate degrees, provide public outreach services to vulnerable groups and to the local communities where the institution is located, and must have relevant research projects. The University of Cuenca leads the ranking of the best universities in Ecuador as the best public university (CEAACES, 2015), which leads to receiving more federal funding, according to the higher education law (CES, 2016). Nonetheless, in the past five years, given the economic crisis and political instability of Ecuador, the university has suffered several budget cuts in the middle of the fiscal year that have limited the fulfillment of research and outreach services (RTU Noticias, 2018).
For this reason, due to the lack of resources, research projects and outreach projects/services were suspended, even though they had been approved.

Consequently, the funding instability represents a major threat to the sustainability of the collaborative academia-society team (see Figure 26). Moreover, the implementation requires resources and funding in order to operate and implement the communicational strategies. An alternative would be to apply for external funding grants and sponsors that support the implementation of the strategies. These alternatives are discussed in the following section of suggestions and implications.

**Opportunities for facilitating the collaborative team operation.** Funding instability represents a crucial factor that can have negative effects for sustaining and facilitating the work of the collaborative academia-society team. Nonetheless, favorable conditions exist in the scenario of the University of Cuenca that could benefit the operation of the collaborative team. Some of these conditions are:

**Incentives for faculty to participate in research and outreach projects.** The professors and researchers at the University of Cuenca, as at other public universities in Ecuador, once they are tenured through public contests for faculty search, have lifetime job stability, and even if federal funding is reduced, the faculty work stability is not affected. Moreover, once a professor/researcher is granted tenure, they have several opportunities for promotion. Some of the requirements that faculty must meet to get promoted to associate or full professor include research and publishing academic papers or books; public service (participating in public outreach programs); and student tutoring (serving as committee chairs for undergraduate and graduate students) (CES, 2016).
Consequently, faculty is highly motivated to collaborate in research and public outreach initiatives (see Figure 26).

Nontenured faculty also have the opportunity to participate in public outreach projects and research projects. Moreover, they receive certifications of their work and involvement from the academic department in which they work to accumulate verifiable experience. These certifications are useful for tenure-track faculty searches (Universidad de Cuenca, 2016).

For analyzing the context of ACTIVITAL, the organizational-level logic model (Yin, 2012) was also used as an analytic tool that facilitated the understanding of the possible emergent barriers and opportunities for the creation of the collaborative team academia-society for the program (see Figure 27).

Figure 27. Organizational-level logic model (Yin, 2012) adapted to the institutional barriers of the ACTIVITAL case study.
Suggestions and Implications

This section addresses the themes that emerged from the data analysis and discussion of the ACTIVITAL case study. These themes respond to (a) alternatives that will contribute to overcoming existing issues and (b) considerations that can be useful for the implementation of the suggested strategies. The suggestions and implications presented in this section discuss several reflections by consulting scholarship of health promotion studies, science communication for public engagement literature, the higher education law of Ecuador, and the internal academic policy of the University of Cuenca. Altogether, these references provide guidelines that inform how the context and its characteristics might influence the outcomes and suggestions of this study. Moreover, the implications expose possible difficulties that could emerge in the implementation of the suggested strategies for ACTIVITAL and possible alternatives that could be explored.

The Complementarity of the SCT Model and the Social Marketing Model for Planning Science Communication for Public Engagement for Health Promotion Programs

ACTIVITAL’s research and implementation used the SCT model framework for designing the formative research and the health promotion programs for high school teenagers. Applying this framework led to the creation of a comprehensive approach to understand the contextual reality of teenagers. Nonetheless, regarding the promotion of the program, student collaborators, as former participants of ACTIVITAL, recognized that the program needs to improve its promotion by developing communicational pieces and activities that are more interactive’. For this reason, this section addresses how the
SCT model and the social marketing model can complement the overall health promotion and science communication of ACTIVITAL.

**The SCT model as a key for understanding audience’s environment influential factors.** The formative research developed with the guidelines of the SCT model framework allowed ACTIVITAL to identify the environmental influences that affect teens. These influences were parent education, perceptions of nutrition and physical activity, and the health habits according to socio-economic status of the families (Ortiz et al., 2014). The formative research developed by the research team of ACTIVITAL facilitated researchers of the team in designing efficient strategies that led to effective results. Some of these results became evident also in this study, as most of the participants recognized that they learned to develop healthy habits that they still maintain eight years after their participation in ACTIVITAL. Moreover, the student collaborators identified clearly that the strategy that ACTIVITAL followed was providing them education and games that reinforced learning about healthy habits.

Available scholarship about the SCT model effectivity confirms that formative research facilitates the design of interventions that will be beneficial for the target audiences, and these interventions translate into effective strategies for the program (Baranowski et al., 2002). Nonetheless, the current environment for teens in comparison to 2012 is different. Communication strategies for health promotion have evolved. Moreover, families and teenagers might face different issues today. For this reason, updating the formative research study of ACTIVITAL will be necessary. The following section addresses several considerations that emerged from this study.
Formative research about the target audience of teenagers. As noted earlier, ACTIVITAL was implemented in 2012, and since then, teen audiences might have some different characteristics. As reviewed in the results section, the student collaborators said that as former participants of the program, a motivator was to achieve an attractive physical appearance, but ACTIVITAL also raised their awareness about the importance of healthy habits and the impact of those habits on their health. Moreover, as described, this goal is closely related to the influence of the stereotypes they are reinforced by the media and by the need to feel accepted by their peers. Several available studies provide guidelines for future formative research for ACTIVITAL.

Studies in Ecuador demonstrate that female teenagers aged 13 to 17 are at risk, because they have tendencies toward altered perception of their body image six times more than male teenagers (Barros-Ruiz & Yánez-Arias, 2018). Another recent study developed in Cuenca determined that teenagers have high levels of body dissatisfaction. Results of this study showed that 50% of the male and female participants of 14 years old had a moderate level of body dissatisfaction (Rodríguez et al., 2018).

Regarding physical activity habits, a study found that 30% of teens younger than 18 are sedentary and do not exercise. Moreover, their high schools did not offer an appropriate physical and health education curriculum (Rodríguez-Torres et al., 2018). For this reason, it will be important to explore more in-depth several of the concerns and challenges teenagers face in current times regarding nutrition and physical activity that are in relation to the goals of the ACTIVITAL program. The data of formative research could provide useful information to enrich the strategies suggested by the student collaborators. Moreover, it will be important to develop new strategies that are interesting
to teens and their families and to create opportunities for promoting a deeper engagement of the audiences.

**Social marketing complementarity for the SCT model.** This study found evidence that ACTIVITAL was a successful health behavior change program, although it still needs to retool its communicational strategy to develop more engagement of teenagers in the future. For this reason, several criteria of the social marketing model provide guidelines that could refine the suggested strategies proposed by the student collaborators of this study.

The notion of exchange of social marketing explains how audiences expect an immediate payback in return for performing a healthy behavior (Donovan & Henley, 2003). As mentioned by the student collaborators of this study, ACTIVITAL will need to provide prizes that reinforce the healthy behavior of teenagers and their families. Suggestions included healthy snacks during class breaks in high schools and grocery baskets to families that participate in social media contests. Consequently, participants and their families would be motivated to engage in the program by learning more about healthy habits and by having resources that facilitate their adoption of healthy behavior.

Moreover, offering prizes that motivate the engagement of participants with healthy habits is also related to the price component of the marketing mix of social marketing. Price encompasses the effort and economic expenses for performing a healthy behavior (Greene et al., 1999). Prizes that facilitate the effort of participants in health behavior change processes demonstrate that the program not only promotes the adoption of new habits but also supports the participants by providing them resources.
Promotion criteria of the social marketing model also provide useful considerations to plan activities, services, events, and strategies to persuade and engage audiences (Kotler et al., 2002). With ACTIVITAL, the student collaborators and researchers agreed that creating online and offline learning experiences would provide more opportunities to engage not only teens but their families, as influential actors of their health behaviors. A crucial factor that social marketing promotion suggests is to plan systematically and periodically several activities that reinforce each other coherently (Grier & Bryant, 2005). The new science communication strategy designed to promote ACTIVITAL proposes different activities and conduits that complement each other. For example, the online app offers health education, information, social media, and games that offer information and interaction about healthy nutrition and physical activity. At the same time, there are offline family activities that invite participants to interact with each other with outdoor physical activities. In both cases, online and offline learning experiences offer resources for participants to engage and adopt healthy practices based on their preferences and needs.

The social marketing model allows researchers to complement and refine the planning of health communication strategies of programs of health behavior change that use the SCT model framework. Moreover, both models can be used in health promotion programs of health behavior change without affecting or compromising research or its constructs. Consequently, both models can inform mutually its frameworks to develop efficient and engaging strategies for their target audiences.
Criteria for Designing the Communicational Mix for Science Communication for Public Engagement Initiatives

As noted earlier, the initiatives for science communication for public engagement require a well-structured communication mix. For this purpose, the transactional model through the media complementarity theory provides useful criteria for selecting the best-suited media conduits according to target audience characteristics and preferences (Parackal & Parackal, 2018). For this reason, formative research about the audiences will be the first step in selecting the best media conduits and designing effective science communication tactics. A second step of the media complementarity theory is understanding that media conduits act to complement each other. Consequently, audiences would interact on conduits where they could find information about topics of their interest (e.g., on social media) (Bowater & Yeoman, 2013; Dierking et al., 2003). Additionally, audiences would search for events of their favorite activities to attend, such as festivals, special events on public spaces, and parties. These events must offer social settings for interchange and dialogue among researchers and the audiences of society (Scheufele, 2013). Consequently, if science communication has the goal of reaching public engagement, then the communicational strategy must include communication conduits and interactive activities based on the interests of the audience.

Social media: A crucial conduit for science communication for public engagement in Latin America. Because Facebook has a high level of use and penetration in Ecuador, it is a conduit that must be considered for science communication. Studies developed in Latin America argued that Facebook and Twitter support and improve the visibility of scientific publications (Torres-Salinas & Delgado-
Lopez, 2009). Nonetheless, social media platforms must be considered not only as a component for promoting publications but also as an opportunity for researchers to count with a medium to dialogue with society. One of the new features that Facebook offers is Facebook Live, which lets users communicate in real time with audiences and create online events and discussion boards.

Currently, no studies are available that provide information about science-opinion leaders in Latin America who use social media platforms. For this reason, future research could explore, in the framework of media theories (especially two-step flow theory), if scientists could act as opinion leaders of society by using social media. ACTIVITAL currently does not have or use social media conduits. However, the results of this study demonstrate that former participants of the program suggested that scientists should find new strategies to interact with high schoolers and their parents. Moreover, recapping the strategies suggested by student collaborators, online conduits (social media, an app, and the Online Health School) were considered are a “must have” communication mediums for motivating interaction.

The researchers at ACTIVITAL were open to this suggestion. By the end of the data collection phase of this study, the leading researcher of the program and a faculty member of the University of Cuenca’s School of Computer Science began to design a public outreach program with a planned start date of March 2019.

**Funding Alternatives: Nonprofit Grant Funding and Crowdfunding Strategies**

As noted earlier, the federal funding of public universities in Ecuador is not stable. Public outreach and research projects are approved by the academic departments of universities with funds that are allocated according to the annual funding budgets of
universities. However, projects are often suspended in the middle of the academic year due to the pressure of the government budget cuts. Some Ecuadorian academics argue that frequently public outreach initiatives are more affected than academic research. The main reason is that the nature of these projects supports the critical debate of government issues, advocacy, or citizen participation, which constitute strong counterarguments to politics in power. Consequently, universities are perceived as subversive and are blocked by the government through budget cuts (Picq, Guanolema, & Perez-Guartambel, 2017).

Consequently, public universities need to consider new funding alternatives that offer grant funding that allows them to maintain their research and public outreach programs without depending exclusively on federal funds. Moreover, universities in Latin America have historically defended their right to maintain their institutional autonomy in service of society. For this reason, some initiatives have considered developing academic networks among universities. One example is the Tuning-Latin America Initiative, which united 18 institutions of higher education in the region to support funding for research and public outreach initiatives and for technical-academic support among universities (González, Wagenaar, & Beneitone, 2004).

However, in the specific matter of science communication for public engagement, few organizations provide grant funding in Latin America that support research and innovation in this discipline. Scholars argue that this emergent research discipline has support through the development of graduate programs over the past decade in Perú, Argentina, and Brazil. Still, few nongovernmental organizations promote research through grant funding that facilitates exploring and implementing science communication alternatives (Massarani et al., 2016).
A possible alternative will be to develop alliances with nonprofit organizations that have health promotion programs for children, teens, and families in Latin America, such as the World Health Organization and Unicef. Selecting nonprofit organizations would avoid compromising the ethics of the research programs and would limit the sorts of conflicts of interest that can emerge with private organizations or the government.

A new alternative for funding research projects of science communication is crowdfunding. Some examples are the web-based internet platforms Kickstarter.com, Rockethub.com, and Benefunder.com. These sites unite researchers or students who write a proposal, allowing them to present their initiatives to the public and to address the need to secure monetary donations to fund their inquiry projects (Mehlenbacher, 2017). In practice, crowdfunding for scientific research works by requesting donations from the public and reporting the results of research to the people who supported the research project. In this manner, developing science communication tactics that allow a direct dialogue among researchers and the public is crucial (Hui & Gerber, 2015).

Crowdfunding can also be a viable alternative that facilitates funding science communication initiatives in Latin American scenarios. Moreover, it also can support the engagement of audiences that support projects by designing a communication strategy that periodically presents the research advancements to the public funders. Developing periodic communication would allow researchers to ensure the transparency of the use of the funding and to build trust with the audience.
CHAPTER 6

CONCLUSIONS

This chapter summarizes the theoretical and practical implications of this study that contribute to the existing literature on science communication, health communication, and participatory action research. Each of these sections also addresses suggestions for future research in each of the disciplines. Moreover, this chapter also acknowledges the limitations of this study and how the limitations can be addressed in similar studies in the future.

The two case studies provided findings regarding the contrasting views, complementary considerations, and shared influential factors. Specifically, the studies showed that the SCT model and the social marketing model for health behavior change could act as mutually complementary frameworks for each model’s own formative research and communicational strategies.

The ESTPH case study evidenced that the social marketing model provides a framework to create effective communication strategies for promoting healthy habits in children. Nonetheless, the social marketing model’s criteria for formative research might overlook crucial factors that influence the audiences’ behavior that need consideration. For this purpose, the social marketing model-inspired approach to formative research can be complemented with formative research developed with the criteria of the SCT model constructs to provide more information about the influential factors that affect the behavior of audience, such as family dynamics, household budgets.

The ACTIVITAL case study revealed that the SCT model constructs could be used to develop a comprehensive approach to formative research that then led to creating
effective strategies for adopting and sustaining healthy habits among Ecuadorian teenagers. At the same time, it also became evident that the SCT model can benefit from the constructs of the social marketing model. Specifically, it was necessary to retool the communicational strategy of ACTIVITAL in order to motivate the engagement and interest of teenagers to adopt healthy behaviors by choosing effective communication conduits and designing activities that were attractive to audiences.

Additionally, in order to promote health behavior changes, it will be crucial to have a clear understanding of the culture and the context of the target audiences. In the context of the present study, the two case studies evidenced quite a few differences in cultural characteristics and other issues, as well as a few similarities. See Table 5 for a comparative summary of the main findings from the two case studies.

<table>
<thead>
<tr>
<th>Cultural Context</th>
<th>Use of the public space</th>
<th>Convergent findings and similarities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fewer opportunities to access healthy food given household budgets.</td>
<td>Public parks are perceived as unsafe spaces for physical activity. Consequently, these are not used by families.</td>
<td>Health Education/Nutrition is not part of the curriculums of high schools in the U.S. and Ecuador. Consequently, teenagers’ knowledge about how to maintain a healthy diet is very limited.</td>
</tr>
<tr>
<td>Children, teens, and their families are more exposed to fast food and unhealthy foods in schools and the urban space.</td>
<td>Public parks are related to criminal activity, drug consumption, and homelessness in Albuquerque.</td>
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<tr>
<td>Unhealthy foods are more affordable than healthy nutritional food options in Albuquerque.</td>
<td>Physical activity of children and teens takes place mostly at school due to mandatory Physical Education class requirements.</td>
<td></td>
</tr>
<tr>
<td>Obesity and overweight among children and teens is culturally more accepted than in Ecuador.</td>
<td>Malls, fast food venues, and restaurants with playgrounds for children are more accessible and convenient for families than parks.</td>
<td></td>
</tr>
<tr>
<td>Healthy food is affordable in Ecuador for families with average household incomes.</td>
<td>One of the parents - usually the mother - spends more time with children and teens at home. However, both parents work to sustain the household.</td>
<td>Public parks are the preferred meeting place for families and friends.</td>
</tr>
<tr>
<td>The Education Law promotes a healthy nutritional environment for children and teenagers by prohibiting fast-food purchase at school locations. Lunch options provided by schools provide exclusively healthy food options that combine vegetables, fruits, and grains only.</td>
<td>Public parks are perceived as safe spaces that are available to everyone.</td>
<td>Communicational conduits for engagement. In the U.S. and Ecuador social media were suggested as the best conduits to promote audience engagement and direct communication among researchers and the public, as well as to provide useful information and resources for audiences open to engaging in adopting healthy habits.</td>
</tr>
<tr>
<td>Fast foods from franchises (e.g., pizza, burgers, desserts, sodas) are usually more expensive than local vendors' foods and snacks.</td>
<td>Public parks are used almost everyday by most people. They serve as regular workout venues, sporting (soccer) fields, and children’s/teens’ playgrounds.</td>
<td></td>
</tr>
<tr>
<td>Obesity and overweight among children and teens is critiqued by their peers and frequently leads to discrimination.</td>
<td>Pets belong to the entire family and accompany all family members in the household. The care of the pet is the responsibility of all family members.</td>
<td></td>
</tr>
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</table>

Table 5. Comparative summary of the main findings from the two case studies.
In summary, regarding health communication studies for health behavior change, there are two crucial factors for developing effective programs that seek to promote healthy behaviors. First, it is necessary to develop a comprehensive framework that describes in detail audience characteristics such as sociodemographic information, culture, daily routines, communication conduits, and health beliefs. Second, it is crucial to design and plan communication strategies that are tailored to the characteristics of the audience targeted by the program.

Another important, yet unexpected, finding of the present study is that science communication for public engagement faces several barriers in research and practice. Mostly, these barriers come from the influence of funding agencies over universities in the United States and Ecuador. The process of conducting the ESTPH case study revealed a set of unexpected considerations for the feasibility of implementing science communication initiatives in the United States. These considerations are related to the influence of funding agencies that negatively affect the implementation of science communication initiatives in universities, affecting scholars’ research processes and their motivations to involve themselves in initiatives for public engagement. Still, despite these negatives, it should be noted that some universities in the United States are implementing community-engaged research initiatives and providing incentives for faculty promotion; such initiatives might be favorable for new science communication research and practice in the future.

The findings of the ACTIVITAL case study revealed that the current scenario for science communication for public engagement in Ecuador has a greater number of
opportunities in its universities than in universities in the United States. This is largely due to the criteria of Ecuador’s higher education law, which motivates faculty promotion through public outreach projects and community-engaged research. Nonetheless, as is also the case in the United States, funding agencies in Ecuador still negatively influence the sustainability of science communication initiatives because of the economic instability that frequently leads to budget cuts and project suspension. Consequently, funding agencies represent, both in the United States and in Ecuador, a critical factor that affects the overall process of science communication research and practice.

**Science Communication Studies**

Science communication research describes the tension between diffusion and linear-communication models versus dialogic communication models. This tension depicts how science communication research and practice, developed under diffusion and linear model frameworks, affect the participation and interest of audiences in scientific content. Consequently, audiences do not engage with science communication initiatives and are involved merely as consultation stakeholders with limited participation (Servaes & Malikhao, 2012).

Diffusion of innovations and linear-communication models, including, for example, the transmission model, do not consider the culture and context of audiences and do not provide a framework for dialogue among scientists and people. Consequently, the issues of audience interest and participation in science communication persist (Bowater & Yeoman, 2013). The linearity of these models works through one-way communication among its elements—sender, message, receiver, conduit—where information flows only through the sender to the receiver. The “privilege” of the sender
over the receiver is the starting point of the analysis of communication theories. Here, audiences, as the receivers, are in a secondary position where their opinions, needs, and interests are not part of the communication process (Bauer & Jensen, 2011). Another element that is missing from the diffusion and transmission models is the context where communication occurs, and its cultural and/or ideological characteristics (Arroyave, 2006). Therefore, by not considering the audiences and their context as crucial components of the science communication process, these theoretical models overlook other criteria of communication that are crucial influences. These shortcomings also lead to science communication practices and research that circulate around the same issues: the lack of an audience’s interest and participation.

In the framework of this study, which attended to two culturally diverse scenarios, it became evident that for developing inclusive and participatory science communication, diffusion-based models and linear communication models were not a suitable theoretical and practical framework. Instead, this study explored dialogic models of science communication that provided useful guidelines to propose new communication strategies to motivate audience engagement for ESTPH and ACTIVITAL and, by extension, to health/science communication programs in the public interest in general.

**Dialogic Models as Alternative Frameworks for Science Communication for Public Engagement**

Dialogic models are based on promoting the interaction of scientists and people through the discussion of topics of interest and interchanging ideas, needs, and concerns. Additionally, the dialogic models offer several frameworks for understanding audiences. The ritual model facilitates to address some of the shortcomings of diffusion and linear
models. Specifically, the ritual model permits a focus on the characteristics of the context where scientific communication occurs for research and practice. Leach, Yates, and Scanlon (2008) argued that the ritual model framework is flexible and can be adapted to aspects such as the culture and the context of the audiences. These aspects will influence how science content is received by an audience. For example, audiences could reject, accept, or also the science content could motivate to raise the awareness of the audience. Moreover, it is crucial to consider that the context and culture will affect how audiences understand scientific information.

In this study, the dialogic models led me to explore the audiences’ experiences with the health programs as they related to their lifestyles. The results were evidence that the researchers did not consider crucial criteria in the promotion and communication of the each of the programs.

On one hand, concerning research, the participatory research design of this study enabled me to explore audiences’ experiences as former participants (ACTIVITAL) in and health educators of a program (ESTPH). Moreover, PAR research allowed me to determine which specific tactics of each program were suitable or unsuitable for the audiences of each case study in order to adopt a healthy behavior. The results not only allowed me not only to identify which tactics of each of the programs needed improvement but also to redesign how these tactics could be improved.

On the other hand, regarding practice, after science communication strategies were designed, it was essential to plan the implementation and suitable communication conduits for these tactics. The transactional model provided several guidelines for analysis of the results of this study regarding the suggested strategies of the student
collaborators. Specifically, the notions of interactive learning and dialogue (Bowater & Yeoman, 2013) of the transactional model suggest that choosing interactive mediums/conduits of communication made it possible to create interactive experiences for audiences and scientists (Dierking et al., 2003). Therefore, I found that two-way communication conduits or venues can allow scientists and audiences to learn from each other through dialogue and interpersonal interactions. Some of these conduits/venues are informal events, websites, or social media, mass media, and informational centers, depending on the nature of the research project that is promoted. For example, museums, hospitals, universities, and community centers (Davies, 2009) might also be appropriate for certain projects.

In the present project, the student collaborators in each case study teamed up to suggest tactics that take place in informal spaces to provide enjoyable experiences to learn about how to adopt a healthy lifestyle. These tactics comprised cooking classes, outdoor workout lessons, and sport-based games. Moreover, student collaborators and the researchers of ESTPH and ACTIVITAL concurred that it is important to provide useful resources to the audiences; for example, healthy groceries and snacks as prizes; physical activity experiences for family groups; a school pantry and an organic garden; and information resources that are available through websites, a mobile app or social media.

**Guidelines for Science Communication for Public Engagement in the Americas**

This study revealed common themes that both scenarios share in the United States and Ecuador for science communication for public engagement, from the perspective of young audiences. The student collaborators in both case studies of this study emphasized
that science communication needs to explore how to create interactive spaces that promote the exchange and discussion of ideas among audiences and scientists.

The outcomes of this study provide several guidelines that can aid the work of researchers who aim to develop strategies for science communication for public engagement.

**Building trust and creating safe spaces and experiences for audience engagement.** Science communication initiatives for public engagement first need to build trust with their audiences. For this purpose, the involvement of scientists in the process of science communication is crucial. Participants in this study in the United States and Ecuador agreed that the knowledge and credentials of scientists are crucial assets for building trust. The student collaborators stated that if they know that the information they receive comes from a scientist who has expertise and research, then audiences will perceive that the information is trustworthy and would not be damaging to themselves. Consequently, this study’s results reinforce the classic concept of opinion leadership developed by Katz (1957), which claims that the competence of an individual—a scientist or an expert, for example—who personifies certain values and has more familiarity with specific knowledge will be a potential opinion leader in the eyes of audiences.

Consequently, scientists must not only participate in science communication initiatives but also must demonstrate a true willingness to listen and collaborate with the audiences of their research. The involvement of another type of opinion leader will be explained further, below.
Another critical factor is to create safe spaces to develop events in places that are comfortable and accessible for audiences to discuss topics of their interest. Informal events that are different from the audiences’ daily routine activity of work and studies can facilitate this task. Moreover, these events need to happen in informal places, for example, outdoor locations such as parks; community centers; common areas, such as cafeterias or dining halls (in the case of schools or high schools); and coffee shops. Informal events need to combine the dialogue of scientists and the audience with participatory activities to create harmonious and enjoyable experiences. In this study, the student collaborators said that an attractive event to attend should combine outdoor activities with learning spaces about healthy habits and the opportunity to exchange ideas about their needs and concerns with scientists.

Moreover, events can complement the science communication strategy with technological tools and platforms, working as a set of support tactics that motivate audiences to adopt and sustain healthy behaviors by providing information resources about healthy habits. Scholarship on experiments in science engagement demonstrates that using technological platforms (social media, websites, and mobile apps) allowed researchers to reach optimal public engagement of audiences. The various positive outcomes of these experiments include amplifying spaces for audience’s participation, learning, and creating resources for advocacy (Selin et al., 2017).

**Designing the scientific content framing.** In communication studies, frames act as interpretative schemas that allow audiences to make sense of an issue (Entman, 1993). In the case of science reporting, frames developed by reporters construct schemas to help audiences to put issues into shared and understood contexts (White, 2013). In the specific
case of science communication research, available literature suggests that message framing must not rely on anecdotal observation of audiences. Instead, science content framing suggests that formative research is necessary (Bubela et al., 2009). Science communication initiatives need to design messages to promote scientific content engagement. However, this question remains: how best to create a message framing that is engaging for audiences around scientific topics?

The results of this study suggest that scientific content can find insights about audiences’ lifestyles, through two sources: (a) formative research and (b) participatory co-design of science communication strategies and messages. For obtaining these insights, it is necessary to identify the context and situations that are part of the quotidian life of audiences and familiar situations that can be related to the topic of research. Some useful insights: which are the favorite foods, music, hobbies, and the daily routines of audiences.

Moreover, additional useful insights to explore are the characteristics of language—tone and the slang/dialect—that audiences use to communicate with friends and family.

Formative research will provide useful insights for designing a discourse based on real-life situations and concerns of audiences for attracting their interest and to motivate future engagement. This study provided several useful examples to choose science content based on offering advice through nutritional tips, alternatives for cooking, and working out. The suggested message framing is a piece of friendly and fun advice from experts and peers that invites participants to adhere to a healthy lifestyle. The student collaborators of both case studies suggested that an efficient framing strategy would have
to be proactive and oriented toward offering solutions that are achievable in the real-life context of each program’s audiences.

**Opinion leaders for science communication.** As noted, the involvement of scientists in science communication for public engagement is a crucial factor to provide trust to audiences about the content they receive about a specific topic. Therefore, scientists must play an active role in the process of developing the overall science communication strategy for ensuring the accuracy of the content and the communicative success of their dialogue with audiences.

Available science communication scholarship argues that other ideal opinion leaders for science communication, in addition to scientists, include NGO representatives, religious leaders, and politicians, because these individuals have been successful in formulating messages about science that connects with audiences’ interests, leading to meaningful interactions (Bubela et al., 2009).

In the present study, student collaborators who were former participants of ACTIVITAL were able to speak through their lived experiences and could identify with audiences about the challenges of adopting healthy behaviors. In the case of ESTPH, student collaborators were health educators of children; they themselves were teenagers who could identify with the children’s context and the challenges families faced in adopting healthy habits. This study suggests that in the case of programs of health behavior change, former participants can be not only future peer educators but also can be opinion leaders of a science communication strategy for achieving strong audience engagement.
On one hand, opinion leadership of an individual is determined by aspects such as (a) the individual which shares personal characteristics with the audience to motivate identification and (b) individuals that have contacts who share a circle of acquaintances who share an issue or interest (Katz, 1957). On the other hand, peer educators must also be individuals who have the willingness to share their experiences with others and to be open to mentor people (Falk, Pettet, & Mpagi, 2016), and who, at the same time, are considered influential among their social networks (Frantz, 2015). Consequently, peer educators and opinion leaders share common characteristics, such as being former program participants or individuals with whom audiences can identify, and they must show a willingness to be in contact with others to share information. In the case of science communication, this study suggests that peer educators support audience engagement as well as the involvement of audience members or former participant audiences as opinion leaders who can motivate the engagement of target audiences with scientific content.

At all times, the role of opinion leaders and peer educators must be to be open to dialogue with audiences, whether the interactions about the scientific content communicated are positive or critical. The outcomes of the interactions are meaningful information that can inform further research, the design of public outreach initiatives, or new collaborative research that incorporates people’s interests and concerns. Future research of science communication could explore and describe how to incorporate opinion leaders into science communication initiatives for public engagement.
Health Communication Studies

This study was informed by two health behavior change models, the SCT model and the social marketing model. Additionally, scholarship of peer health education and mobile health applications was reviewed to analyze and inform the strategies proposed by the student collaborators of both case studies.

Regarding health behavior change models, this study argues that the SCT model and the social marketing model could be combined to provide a more comprehensive approach for developing efficient programs. The SCT model’s constructs can complement the social marketing model framework by providing guidelines for understanding the environmental influences, cognitive factors, and behavioral factors that individuals face by adopting a new healthy behavior (Bandura, 2004). Understanding the nature of these influences, such as cultural and socio-economic factors and interpersonal influences would provide better guidelines to design effective health communication. For this purpose, formative research is recommended to identify the crucial factors that influence target audience behavior.

The social marketing model does address several guidelines to understand the context of audiences regarding existing health problems and promoting preventive healthy behaviors (Shamsi, 2014). Yet it does not allow scholars to explore in-depth the influences of the behavior of individuals that could play a major role in adopting a new health behavior. In the specific case of this study, formative research was developed for the ESTPH program through the guidelines of the social marketing model. This study found that due to their household budgets, audiences had difficulties accessing the foods suggested by the program. The study also found that family dynamics of the participants
sometimes made it difficult to accomplish the suggested physical activities and nutritional recommendations. Nonetheless, the health communication strategy of ESTPH resulted in positive outcomes in audiences. The participants of this case study recognized that the marketing mix, the branding of the program, the activities, and the prizes were effective in attracting the attention of schools, children, and their parents. Consequently, target audiences were attracted to the promotion and communication of the program.

This study also shows that programs of health behavior change that are developed through the social marketing model achieve optimal communication and promotion. However, it is necessary not only to understand the audience but also to be aware of the factors that influence adopting or not adopting healthy behaviors. In the case of the target audience of children, the children are frequently dependent on their parents. Parents have control over the household budget and, typically, over food shopping decisions, as well as over other family dynamics that influence the process of health behavior change. Consequently, the formative research of the social marketing model can benefit from formative research developed with the SCT model. Formative research of the SCT model considers factors that influence audiences’ behavior and how these factors interact with each other. This secondary source of information about the audiences and influential factors will help to design effective interventions and health communication.

In the case of ACTIVITAL, which was developed through the guidelines of the SCT model, the formative research explored teenagers, their families, and socio-cultural and socio-economic factors that influence nutrition and physical activity. As a result, the research team of the program was prepared with thorough knowledge of the issues faced by teen audiences and their families. Program interventions and information were
designed by using the formative research results and led to effective outcomes of teens by adopting healthy habits. Former participants of the program, however, said that ACTIVITAL’s communication and promotion strategy would need to be improved if it were re-implemented. Specifically, as noted in the results section of Chapter 5, former participants suggested that the program needed to provide more interactive strategies to engage audiences.

It becomes clear, then, that the SCT model framework complements the social marketing model and that the social marketing model provides useful guidelines to design health promotion programs. Social marketing provides criteria that can guide the design of communication for health promotion. Specifically, the social marketing model provides useful criteria for message design and for the selection of the best-suited communicational conduits based on understanding the audiences (Grier & Bryant, 2005; Kotler et al., 2002). In the case of ACTIVITAL, this study suggests new activities, ideas for prizes to motivate audiences, and online conduits to promote better engagement and interactivity of audiences. Some of the new strategies created in this study by the student collaborators and the researchers of ACTIVITAL constitute innovative alternatives for research and practice in Latin America. Specifically, we see how mobile health applications can support the implementations of programs of health behavior change. No studies are currently available that explore the use of mobile health apps for health behavior change in Ecuador or Latin America, or specifically that offer research on the promotion of healthy nutrition and physical activity. Thus, the present study makes an important contribution in this area.
As noted in the discussion section of Chapter 5, few studies have explored mobile health applications in Latin America. Most of the available studies of health communication looked at the uses and outcomes of apps used for patient monitoring and for accessing healthcare providers and information (Saigí-Rubio, Novillo-Ortiz, & Piette, 2017). No studies are available that explore mobile health apps as interventions or health promotion strategies for health behavior change in Ecuador and Latin America. For this reason, the results of this study call attention to the opportunity to explore the design and implementation of a mobile health app for ACTIVITAL.

This study also contributes to the literature in health studies that explore how programs in health behavior change can develop and then implement a methodological approach for developing health promotion strategies. The research methodology of the present study combined participatory action research and qualitative methodologies to retool existing health promotion programs by involving the program’s audiences and researchers. As a result of this hybrid approach, new strategies and tactics were suggested to each case study to improve audience engagement. Some previous studies have involved participatory research in health communication studies for health promotion co-research, exploring, among other topics, youth mental health promotion, intervention, and treatment (Hagen et al., 2012); how to facilitate the access and engagement of migrants in primary healthcare research (O’Reilly-de Brún, 2015); and the use of participatory research interventions to increase physical activity and dietary habits in African American audiences (Wong et al., 2010). However, no analogous scholarship addresses health behavior change among children and teenagers. The present study contributed to filling this gap by taking an interdisciplinary and participatory research approach to the
development and analysis of science communication for public engagement for health promotion programs in the United States and Ecuador.

**Participatory Action Research Studies**

Several critiques were discussed in the data analysis section of Chapter 4 (the ESTPH case study). Specifically, scientists questioned the validity of the science communication practices for reaching public engagement proposed by the present study. The scientists’ critiques emerged when the student collaborators made observations about health promotion tactics used by the program. Specifically, these observations suggested changing or modifying specific practices and interventions with new alternatives developed by the student collaborators of this study. The researchers questioned the methodological design of this study, arguing that PAR and qualitative methodologies did not provide data that could be generalized to the overall target audiences of their research projects. Moreover, some of the researchers claimed that to implement major adjustments to their programs, they used or would need to use quantitative studies that provide descriptive data that reflect the opinions of their target audiences.

Researchers’ critiques of the PAR methodology used in this study reflect the perspective of a different research tradition. Most of the researchers who participated in this study have academic training in health sciences and public health. Moreover, these researchers conduct their own projects on health behavior change using quantitative methods. As a research methodology, quantitative studies seek the generalizability and transferability of the results as a crucial factor for the relevance and success of research (Weis & Willems, 2015). By contrast, PAR methodologies seek to develop an alternative
approach to traditional research methodologies that historically do not provide voice and participation to the people involved in the research (Chevalier & Buckles, 2013). Additionally, PAR research has as one of its goals the establishment of networks for mutual collaborations among academia and society (Jordan & Kapoor, 2015). Consequently, PAR represents a research paradigm quite different from that of quantitative studies. The PAR framework is based on collective participation, collaboration, and discussion among people to develop alternatives for different issues, rather than on prioritizing the production of data that is generalizable.

PAR methodologies scholarship argued that this research approach is useful for developing an egalitarian space for researchers and members of the general public to explore, analyze, co-create, and learn about a specific issue (Hacker, 2013). Further, PAR research is facilitated by the collaboration and participation of researchers and people by using action reflection processes. These processes allow PAR-oriented scholars to identify issues and their causes, to develop alternatives to solve these issues, to implement these alternatives, and to evaluate the outcomes (McNiff, 2014). This study was designed to explore how science communication could create strategies for audience engagement related to two case studies. PAR and qualitative methodologies allowed me to establish an egalitarian research framework among researchers and student collaborators to dialogue about how to motivate children and teens to engage in and adopt healthy habits. Moreover, the PAR methodology allowed me to suggest new strategies to improve the communication strategies that each case study applied. Therefore, PAR methodologies, such as those that guided the present project, cannot be fairly critiqued in terms of the criteria of relevance or expected outcomes of quantitative or qualitative
research. Instead, a PAR-based study’s success must be assessed through its own criteria of effectiveness.

Existing literature argues that the success and effectiveness of PAR methodologies is determined by the level of participation that a research project provides to the people involved in the inquiry process (Chevalier & Buckles, 2013). Other criteria for the success of PAR projects include the degree of access and participation of the actors involved in the research project, the clear demarcation of the roles and responsibilities of researchers and co-participants, and the effort that is spent building formal and informal networks to sustain future collaborations (Mackenzie, Hoverman, & Baldwin, 2012).

This study followed the suggestions for methodological research design recommended by prior science communication research. As noted, existing scholarship suggested that future studies that explore public engagement of science should follow a PAR research design for including society’s needs and interests (Bucci, 2008). In the framework of this study, PAR methodologies allowed me to create a setting for dialogue among programs’ researchers and their audiences. The results of this dialogue provided alternatives for each case study to motivate audience engagement. Also, this dialogue allowed me to discover and analyze critical factors that influence the audience of each program yet were not considered previously by researchers.

In the context of U.S. and Latin American universities, there are emergent initiatives that seek to motivate community-engaged research. These new initiatives seek to promote a deeper engagement of academia and society. In the specific case of this study, the University of New Mexico is introducing new research initiatives that promote
community-engaged research through the training of faculty and allocating resources to facilitate the research design and implementation of participatory research. These initiatives are supported by the university’s Office of the Provost and senior vice president of academic affairs through its Community Engagement (UNM, 2019). Additionally, UNM is working to build the infrastructure to become a community-engaged university of research. Consequently, new criteria for faculty evaluation and promotion will consider the initiatives of professors in community-engaged research and teaching (D. Weiss, personal communication, January 6, 2019).

PAR methodologies will be useful for the researchers of UNM in the process of transitioning into a framework that motivates community-engaged research. Specifically, PAR methodologies can serve as a first step toward creating networks and building relationships with different community groups in Albuquerque and New Mexico. For example, an exploratory study design can unite researchers, local communities, and advocacy groups to dialogue about different topics of interest. The outcomes of a PAR exploratory study can support the elaboration of research proposals for new community-engaged research projects.

At the University of Cuenca and in higher education law of Ecuador, there are policies that promote the development of public outreach and research projects that attend to the needs of society. Moreover, these policies are related directly to the criteria for faculty promotion, which motivates professors and researchers to create programs that involve society (CES, 2016; Universidad de Cuenca, 2016). Nonetheless, PAR studies remain a practice that is considered new to the researchers at the University of Cuenca. According to the Provost Department of Research at the University of Cuenca, most of
the university’s current research projects continue to use traditional quantitative, qualitative, or mixed methodologies to develop their research projects (DIUC-UC, 2019).

Future research in Ecuadorian universities could benefit from PAR methodologies, given the legal requirements of higher education law for undergraduate and graduate degrees. Moreover, PAR methodologies could facilitate the development of public outreach initiatives that can emerge from existent research projects that explore issues that directly affect the local and national population. Public outreach initiatives can emerge from the results of research to design and plan programs that can be implemented in ways that involve the local community but also lead back to new topics of research. Specifically, through the experience of this study with ACTIVITAL, the present project identified clearly that teens needed to be motivated to learn about healthy nutrition and physical activity habits and about how to incorporate these into their everyday lives. In this study, the exploration developed through PAR methodologies that sought to design alternatives to promote the engagement of the teenagers and their families. As a result of this study, researchers now plan a public outreach project that will be based on creating better interventions by involving college students in the process of creating the new communication pieces and events as part of the health promotion plan of ACTIVITAL.

**Limitations of the Study**

This study encountered several limitations. As this project was conducted through the use of participatory action research and qualitative methodologies, the recruitment of participants relied on voluntary enrollment of student collaborators. The pool of potential participants was high school students who were health educators of ESTPH and in the
case of ACTIVITAL, former participants of the program who were in high school in 2009 to 2012, and currently are in college. Consequently, the case studies involved different age groups, education levels, and cultural contexts. And while both case studies were health behavior change research projects that promoted healthy nutrition and physical activity habits, the results of the present project are limited in generalizability to other science communication projects.

Nonetheless, as noted in the discussion, suggestions, and implications sections of Chapters 4 and 5, formative research developed through ethnographic studies would help to create a deeper understanding of audience lifestyles in the case of other research projects. The results of ethnographic studies would facilitate the design of more-accurate science communication strategies to promote engagement.

While I was conducting this study, it became evident to me that an autoethnographic research approach might have been more relevant for empowering the audiences of ESTPH and ACTIVITAL. For example, the student collaborators could have had more power in the research process through an autoethnographic study by describing in detail and in-depth their lived experiences with each case study. Consequently, the student collaborators could have described their feelings, uncomfortable situations, emergent issues, among other factors, and of course could have provided more in-depth comments of their perspectives as health educators of children (with ESTPH) and as former participants (with ACTIVITAL). Also, an autoethnographic research approach probably could have contributed more meaningful results, such as raising researchers’ awareness to the importance of providing a voice to their audiences in health studies. Specifically, the results of an autoethnography of the student
collaborators could have motivated researchers to be more self-critical in how they approached audiences and about the procedures they might have suggested for adopting healthy behaviors.

This study, as a participatory action research project, succeeded in providing opinions of and suggestions from the audiences for the improvement of science communication, although this project did not explore in-depth the possible critiques that the student collaborators might have regarding the researchers’ roles and attitudes in programs of health behavior change. For this reason, I believe that an autoethnographic study could have provided a more critical approach based on the perspective of the student collaborators.

This study focused mostly on exploring how science communication can develop strategies to improve audience engagement through the dialogue of student collaborators and researchers. However, the study did not consider other contextual criteria that influenced the feasibility of implementing science communication initiatives. Some of these criteria emerged as unexpected findings of this study; these included institutional barriers, researchers’ attitudes and skills regarding science communication, and limitations imposed by funding agencies. All of these criteria can influence the processes of science communication in the United States and Latin America.

In terms of analysis, the unexpected findings of both case studies showed that there is a major influence on researchers by funding agencies in the United States and by government funding in Ecuador. Therefore, the analysis of these findings must also consider how the political economy of each country influences academic research by setting the agenda of relevant research topics and disciplines. This analytical scope
probably could elicit overarching themes that have different effects over research in the
disciplines of social sciences, health sciences, and communication studies. Specifically,
how and why are some disciplines more favored than others by having more funding
opportunities? Moreover, in the case of science communication for public engagement,
this question is pertinent: If science communication facilitates the dialogue among
academia and society, why are there so few opportunities for funding? And why are there
even fewer conditions recognized by universities that motivate faculty and the stability of
science communication projects?

In Ecuador, research is financed predominantly through federal funding.
However, the constant economic crises of the country jeopardize the general stability of
research projects, because the government frequently applies budget cuts to universities.
For this reason, science communication initiatives might face several challenges in
implementation and sustainability. Consequently, I recommend that future research
studies focus on the institutional opportunities and barriers that science communication
faces in the United States and in Latin America. Specifically, future studies could allow
scholars to identify and describe in-depth the existing issues for science communication
research and practice in universities, higher education policies, and funding opportunities.
The results of such studies would allow the scholarly community to create more
understanding about the causes and consequences of each of the issues and how they are
interrelated. Further, these results would provide an opportunity to future scholars to
propose solutions and alternatives to navigate these difficulties.
APPENDICES

APPENDIX A

Eat Smart to Play Hard, UNM Prevention Research Center,
Albuquerque, New Mexico, United States

Eat Smart to Play Hard (ESTPH) was created and is managed by the social marketing team of the University of New Mexico, in the Prevention Research Center (UNM PRC). This research group is affiliated with the UNM Health Sciences Center, as a home for multidisciplinary community-engaged prevention research and health promotion. ESTPH is a 4-year-old program focused on reducing obesity and preventing chronic disease in the children, families, schools, and communities across New Mexico in the United States.

The social marketing team of the program plans to expand ESTPH to other counties in New Mexico by working with different organizations and agencies, such as the state Department of Health, New Mexico State University, Kids Cook, Las Cruces Public Schools, Cooking with Kids, to reach local school districts to work closely with students, parents, schools, and communities to achieve the program’s goal. This initiative is funded through the U.S. Department of Agriculture’s Supplemental Nutrition Assistance Program Education (SNAP-Ed) and Obesity Prevention Grant. The program also collaborates closely with the New Mexico Human Services Department, which administers funding at the state level.
Detail of the Functioning of the Program

The program works through several strategies to engage children, parents, and teachers. It’s a six-week program that is supported by the following tactics and communicational material:

**Passport to Fun Booklet.** It contains fun activities and healthy recipes that take students on “an adventure of healthy living.” As with a traditional passport, it allows students to earn stamps, except that the stamps are given for meeting weekly nutrition and exercise goals. During the six-week program, students are encouraged to track their daily intake of fruits and vegetables in effort to help them increase their consumption of these foods. Students collect stamps in their passport over the six-week period and are visited by the ESTPH team to enjoy the Fun Day, which is a mini-party event with games and prizes in each school at the end of the six weeks.

At the start of the campaign, students are asked to sign and have a parent sign the passport pledge. Later, students are asked each week to make a recipe at home that includes fruits and/or vegetables and to also participate in a fun activity. These activities must be certified by the signature of their parents. Every day, students are asked to track their daily consumption of fruits and/or vegetables by using stickers provided in the passport booklet. Once a week, the students are responsible for getting their passport stamped by their teacher, after the recipe and activity have been completed.

At the end of the six weeks, students bring their stamped passports to participate in the Fun Day. After the stamps in the passports have been revised, the passports are revised by their school teacher.
**Promotion.** The program also offers multiple poster applications for reinforcing key messages. Messages for parents of preschool-aged children: “They take their lead from you. Eat fruits and veggies, and your kids will too.” Messages for kids aged 8-10: “Eat Smart to Play Hard. Eat fruits and veggies at meals and snacks.” Messages for parents of elementary school-aged children: “Want your kids to reach for a healthy snack? Make sure fruits and veggies are in reach.”

**Newsletters.** These communicational pieces are sent home weekly by the teachers to the parents of the participants. This is to reinforce the connection with parents. The goal of the campaign is to bring home these healthy behaviors.

**Fun Day.** This is a final activity held at each school at the end of the Eat Smart to Play Hard campaign to celebrate the students’ achievements. This component of the project is critical to the success of the overall campaign because it serves as the students’ final incentive to participate. Schools try to integrate fun and healthy activities by using community resources they know their students will enjoy.

**Overview of audience**

After a successful implementation of the program, the research group is interested in exploring the role of teenagers as leaders and as peer health promoters to children.

A pilot exploration has been done with Health Leadership High School, in alliance with Cienaguas International Elementary School, in Albuquerque, New Mexico. For this purpose, Health Leadership High School students are involved as health promoters by receiving credit hours as part of their educational requirements.
**Communication goals of ESTPH with this study**

When a dialogue with the social marketing team of the program began, there were several needs and requirements to implement to promote the dissemination of the campaign and the engagement of children participants and their families.

The main goal will focus on supporting the process of ESTPH to approach researchers of teen health educators to boost the sustainability and expansion of the campaign. Students in 10th and 11th grades at Health Leadership High School serve as health educators for the children in the ESTPH program.

- **Engagement goals.** Build more interest and participation of families and parents by supporting the involvement of their daughters and sons in healthy lifestyles.

- **Social media improvement.** ESTPH must use appropriate social media platforms for the dissemination of the campaign and must choose an appropriate platform, such as Facebook or Instagram. It also is important to explore social media strategies to promote engagement by the audience.

**Theoretical considerations for ESTPH**

The ESTPH program was developed through a social marketing framework This model was the primary guide to structuring the program’s activities, communication, and research.
APPENDIX B

ACTIVITAL, University of Cuenca, Ecuador

VLIR UC Food Nutrition and Health

ACTIVITAL is a health promotion program that is the result of the interdisciplinary research groups of the School of Medicine and the Department of Chemistry at the University of Cuenca in Ecuador and at the VLIR Program of University Cooperation Alliance of Belgium. The research findings of ACTIVITAL reveal that dietary habits of children and teens in the province of Azuay, Ecuador, are nutritionally unbalanced. The primary influences are the cultural aspects of the Andean region, the perception of healthy looks for children, and nutritional and cooking habits. The perceptions of parents of a healthy-physical condition of their sons and daughters are based on assumption that “a healthy child should be chubby.” A second factor is related to the cooking habits and the Andean diet of Ecuadorian families, specifically in the city of Cuenca. The Andean diet combines abundant portions of carbohydrates, saturated fats, fruits, and vegetables. However, the core issue is the unbalanced proportions of these foods in daily food intakes. Both influences are related to the cultural knowledge of parents; cooks at schools and high-school cafeterias, who prepare the meals in public and private schools and high schools, all of which dramatically influences the health of children and teens (Ochoa-Aviles et al., 2014).

Intervention and activities of the program

As communication materials, the ACTIVITAL program developed one booklet for the students of high schools. It provided games, recipes, a daily food intake registry, and a test to self-assess the nutritional habits of each student.
ACTIVITAL developed several interventions to address the issues cited above. All of the activities were facilitated by the researchers of the program. First, physical assessments (weight and height measurement and blood-pressure control of children and teens with parent informed consent), created an awareness of the current physical condition of children and teens. By comparing the current health conditions of the participants with age and height standards, it was possible to determine overweight levels and data for general nutritional and health conditions.

The second intervention was a series of workshops to teach healthy cooking techniques, recipes, and nutritional tips. The workshops were directed to teachers, parents, and cooks at food venues in schools and high schools. The goal of this intervention was to introduce new cooking recipes for preparing balanced meals and healthy snacks for children and teens. The workshops’ content focused on teaching how nutritional combinations for Andean foods and the proportions suitable for meals. An additional aspect was to raise awareness about the adverse effects of unbalanced eating in children’s growth and teen’s physical development.

The third and final intervention was a workshop for children and teens about physical activity and healthy nutrition habits. The workshop had two sections. The first was a cooking workshop in how to prepare healthy meals and snacks. The second included information and suggestions for physical activity that promotes health, such as sports, and outdoor games. Additionally, local athletes were invited as speakers to talk about their experiences and to describe how sports contributed to their health and life success.
The workshops and interventions were made possible through the funding of a previous alliance of the University of Cuenca and the Ecuadorian Ministry of Education. The events were offered at no cost to the participants or schools. The workshops took place on the campuses of the schools and high schools.

The results of these interventions were positive outcomes after one year of implementation. The research team evaluated the same groups after one year of the overall implementation and found sustainable results. The evaluation was identical to the first intervention by a physical health assessment. The results showed lower blood pressure and lower body mass indexes were found in the participants and were attributed to their healthy eating habits (Andrade et al., 2014). Significant weight loss of children and the teens also was reported. Additionally, most of the participants incorporated at least one hour of daily physical activity; most also were eating healthier lunches, whether they were prepared at home or at food venues at in the schools and high schools.

After realizing the positive results of the program, the research group recognized that efforts to maintain the results achieved by the participants validated the consideration of new strategies focused on sustaining these new healthy habits.

**Communication goals of ESTPH with this study**

For this study, through dialogue with researchers at ACTIVITAL at the University of Cuenca, there is a current need to communicate the results of this research program and to focus the campaign’s dissemination to the audience of teenagers in 10 high schools of the Azuay Province in Ecuador. Additionally, the researchers require more mechanisms to engage parents to support the new healthy habits of teens.
Overview of the audience

The audiences of the health promotion program ACTIVITAL are the following:

1. Youth aged 13-15 at 10 high schools of the campaign in Cuenca, Ecuador.
2. Parents aged 25-40 of children and teens. This group is fundamental as providers of the household.

Communication goals

1. Promote the engagement of new participants from the audience of teenagers in physical activity and healthy nutrition as a habit.
2. Motivate observational learning about healthy options for lunch and overall nutritional diet through ACTIVITAL’s recipes and by exercising the advice developed by the research group.

Theoretical basis and models that sustain the program

ACTIVITAL applied the socio-cognitive theory as a model of behavior change (Bandura, 2004). This model presents an interconnection across cognitive factors, as the parents’ knowledge about a healthy diet for their sons and daughters that is influenced by environmental factors (the cultural belief that a healthy kid/teen is “chubby” and not slender). Also, regarding environmental factors, the Andean diet is high in carbohydrates (bread, potatoes, and beans in unbalanced combinations), which combined with low physical activity at any age is the primary cause of obesity. That said, fruits, vegetables, and proteins are abundant in the daily intake of foods of the Andean diet, which represents an opportunity to establish a healthier and balanced diet Behavioral factors lead parents to opt for high-calorie diets at the moment they are preparing breakfast,
lunch, dinner, and snacks for children and teens. In conclusion, the issue of these factors is deeply interrelated by local culture and beliefs (Andrade et al., 2014).

The first set of interventions developed by the ACTIVITAL researchers provided information about the alternatives that can lead to better health for parents, school staff (teachers and cooks), and children/teens. As part of the interventions, the strategy providing physical education to children and teens in schools and high schools called attention to the participants and their support system about their current physical condition and the availability of strategies available for improving health conditions.

To maintain the results of the participants of ACTIVITAL and to expand to new groups with the alternatives proposed by this program, more determinants in the SCT model can be addressed to motivate the sense of self-efficacy, the outcome expectations, to setting goals for participants, and introducing motivations (Bandura, 2004). The SCT model factors and constructs will be used to design new communication activities (i.e., contests and communication through social media) to reinforce the learning of the information provided in the workshops and interventions to engage children/teens and their parents and family. The goal of this strategy will be to create a support system for interacting and acquiring new knowledge to include it in their daily habits for promoting health as a system that reinforces the outcomes of the program and leads to the sustainability of new health behavior.
APPENDIX C

Informed Consent/Assent Forms for the Student Collaborators and Parents ESTPH Case Study

Science for All: Exploring Science Communication for public engagement in culturally diverse scenarios in The Americas
Assent to Participate in Research
August 2018

You are being asked to join a research study conducted by Dr. David Weiss, the Principal Investigator, and Denisse Vasquez-Guevara, student researcher from the Latin American & Iberian Institute of UNM. This project is an exploration of how scientific inquiry for promoting a healthy lifestyle can be communicated better to the society for creating public engagement. In specific, the program *Eat Smart to Play Hard* of UNM Prevention Research Center.

If you decide to join the project, you will be considered and named our collaborator student. As a collaborator student, you will help us to create new knowledge and ideas for communicating scientific research projects as the ESTPH project in the future. As a collaborator student, you will be asked to assist in participating in 4 focus groups sessions. In the fourth, and final session, you will be asked to dialogue about your insights and ideas about ESTPH with the researchers of this research project. The PI, researcher student, and the collaborator students will present their ideas (developed in the three prior sessions) about how can ESTPH be better communicated to the public. These sessions will take place in Health Leadership High School in pre-scheduled weekdays, and each session will last 45 minutes. The overall project will take approximately one month and a half.

We do not foresee any risk of things that might affect the collaborator students. There may also be some benefits or good things that happen. Which will be that the ideas and insights that this project generates will contribute by building and knowing more about new ways that help to improve how to communicate science, for making it more interesting and useful to other people. Moreover, for improving the ESTPH program. Although this project has considered all the legal policies that protect underage research participants. It does not represent any economic, physical or psychological or economic danger. The risk of losing confidentiality for your information is low because we will maintain procedures to protect your personal information safe. As a collaborator student, you will be asked to create a nickname for your participation in the focus groups. The nickname used and created by you will have to be the same from the first to the last of the focus group session. You will be called by your nickname at all times and will use a name tag with it in each session.

As a collaborator student, you will be also free to decline your participation at any time in the research process. Moreover, you can also refuse to keep participating in any moment of the research process.

Any information about your identity as a collaborator student will be kept secure by the researchers by not identifying your real name. For this purpose, each collaborator student will be asked to create a nickname for themselves. By this nickname is how the researchers will call and identify you in the sessions, and in the overall research process. Although, collaborator students will have to sign a form with your real name and contacts for reminding you of the date and time.
of each session meeting. At all times this information will be only managed by the researchers (PI and student researcher) to maintain your personal information safe.

Also, in each session, as a collaborator student, you will have to register your assistance for keeping a record that you participated to collect your compensations at the end of each session. If you join the project Science for all, you will get healthy snacks every session. At the end of the overall research process, the total compensation will be $25.00. For each focus group session, you will receive $6.25 at the end.

If you stop attending, you can email us at vasquezdenisse@unm.edu to tell us more about why you could not come to a session, if you desire to discuss more your reasons. You can also give any complaint to the PI of the research project Dr. David Weiss through the email davidweiss@unm.edu.

If you decide to withdraw from this research project, you can choose to notify the student researcher of your reasons to not keep attending. In any case, the student researcher will send you an email if you stop attending for asking you if you decided to leave temporarily and will return to Science for All sessions, or if you do not want/can come to the remaining sessions. If you choose not to answer the email that the student researcher will send you within the prior 24 hours of the next session, you will be considered as withdrawn.

Although, the information provided by you, if you decide to withdraw will not be used for the data analysis. The information provided by the withdrawn collaborator students will be destroyed and removed from the data transcription prior the data analysis.

We suggest that if you are interested in participating, you should talk to your parents or legal guardian first about this project before you decide to join this study, and get they permission. Please, before signing this form talk to them about your interest to be part of our research, and make sure they permit you. Your parents/legal guardian must sign as a proof of their consent, or you won't be able to participate in the project. You should also sign this form to be able to participate.

If you have any questions at any time, please call or email David Weiss through of his/her assistants at 505-544-8836, or email us at vasquezdenisse@unm.edu. If you would like to talk to someone else, you can call the Office of the IRB at (505) 277-2644 or email at IRBMainCampus@unm.edu.

You do not have to be in this study. Your participation is voluntary. If the student chooses to be in the study, he/she can change your mind at any time. Signing this form means you have read this form and all of your questions have been answered. You and your parents will be given a copy of this form.

I agree to join this study.

_________________________________  _________________________  __________________________
Name of Parent/Legal Guardian of the  Signature of the Parent/Legal of the  Date
Child Participant

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<tr>
<th>Name of Child Participant</th>
<th>Signature of Child Participant</th>
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Researcher Signature (to be completed at time of informed consent)

I have explained the research to the participant and answered all of his/her questions. I believe that he/she understands the information described in this consent form and freely consents to participate.

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<th>Name of Research Team Member</th>
<th>Signature of Research Team Member</th>
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| Date |  |
APPENDIX D

Informed Consent for the student collaborators of ACTIVITAL

Ciencia para todos: Exploración de la comunicación científica para el compromiso público en Escenarios Culturalmente Diversos en las Américas

Asentimiento para participar en la investigación

Enero de 2019

Se le ha pedido que se una a un estudio de investigación conducido por el Dr. David Weiss, investigador principal, y Denisse Vásquez-Guevara, estudiante investigadora del Instituto Iberoamericano e Ibérico de la UNM. Este proyecto es una exploración de cómo la investigación científica para promover un estilo de vida saludable se puede comunicar mejor a la sociedad para crear un compromiso público. En específico, el programa ACTIVITAL de la Universidad de Cuenca.

Si decides unirte a Ciencia para todos, serás nuestro alumno colaborador. Como estudiante colaborador, nos ayudará a crear nuevos conocimientos e ideas para comunicar proyectos de investigación científica como el proyecto ACTIVITAL en el futuro. Además, como estudiante colaborador, se le pedirá que ayude y participe en 4 sesiones de grupos focales. En la cuarta y última sesión, se invitará al colaborador a dialogar con nuestro equipo de investigación sobre sus ideas e ideas sobre cómo se comunica el programa ACTIVITAL. El I.P., el estudiante investigador y usted como estudiante colaborador presentarán sus ideas (desarrolladas en las 3 sesiones anteriores) sobre cómo se puede comunicar mejor a ACTIVITAL al público. Estas sesiones se llevarán a cabo en el aula ... del Campus Central de la Universidad de Cuenca, en días de la semana programados, y cada sesión durará 45 minutos. El proyecto en general tomará aproximadamente un mes y medio.

No prevemos ningún riesgo de que les ocurra algo a los estudiantes colaboradores. También puede haber algunos beneficios o cosas buenas que suceden. Que será que las ideas y las ideas que este proyecto y través de su participación contribuyan construyendo y conociendo más sobre nuevas formas que ayudan a mejorar la manera en que se puede comunicar la ciencia para hacerlo más interesante y útil para otras personas y mejorar el programa ACTIVITAL. Aunque este proyecto ha considerado todas las políticas legales que protegen a los participantes de investigación menores de edad. No representa ningún peligro económico, físico o psicológico o económico. El riesgo de perder la confidencialidad de su información es bajo porque mantendremos seguros los procedimientos para proteger su información personal. Como estudiante colaborador, se le pedirá que cree un apodo para que participe en los grupos focales. El apodo tendrá que ser el mismo desde la primera hasta la última de las sesiones del grupo de enfoque. Su apodo es la única manera de llamarlo e identificarlo en todo momento, y deberá usar una etiqueta con su nombre en cada sesión.

Como estudiante colaborador, también podrá declinar su participación en cualquier momento del proceso de investigación. Además, también puede negarse a seguir participando en cualquier momento durante el proceso de investigación.

Cualquier información sobre su identidad como estudiante colaborador será mantenida segura por los investigadores al no identificar su nombre real. Para este propósito, se pedirá a cada alumno colaborador que cree un apodo para ellos. Con este apodo es cómo los investigadores lo llamarán e identificarán en las sesiones y en el proceso general de investigación. Aunque, los estudiantes colaboradores deberán firmar un formulario con su nombre real y contactos para recordarle la
fecha y hora de cada reunión de sesión. En todo momento, esta información solo será administrada por los investigadores (PI e investigador estudiantil) para mantener segura su información personal.

Además, en cada sesión, usted, como estudiante colaborador, tendrá que registrar su asistencia para mantener un registro de su participación. Además, para recoger sus compensaciones al final de cada sesión. Si el alumno se une al proyecto Science para todos, obtendrán bocadillos saludables en cada sesión. Al final del proceso de investigación general, la compensación total será de $ 25.00. Por asistir a cada sesión, recibirás $ 6.25 como compensación.

Si deja de asistir, puede enviarnos un correo electrónico a vasquezdenisse@unm.edu para contarle más sobre las razones por las que no pudo participar o para retirarse del proyecto. También puede presentar cualquier queja al investigador principal del proyecto de investigación Dr. David Weiss a través del correo electrónico davidweiss@unm.edu.

Si decide retirarse de este proyecto de investigación, puede optar por notificar al investigador sobre sus motivos para no seguir asistiendo. En cualquier caso, el estudiante investigador le enviará un correo electrónico si deja de asistir para preguntarle si decidió irse temporalmente y volverá a las sesiones de Ciencia para todos. Si no quiere / puede asistir a las reuniones restantes, puede elegir no contestar el correo electrónico dentro de las 24 horas posteriores a la próxima sesión. De esta manera, se te considerará retirado.

Sin embargo, la información provista por usted, una vez que decida retirarse no será utilizada para el análisis de datos. La información provista por los estudiantes colaboradores retirados será destruida y eliminada de la transcripción de datos antes del análisis de los datos.

Sugerimos que si está interesado en participar, primero hable con sus padres o tutor legal sobre este proyecto antes de que decida unirse a este estudio y obtener su permiso. Antes de firmar este formulario, hable con ellos sobre su interés en formar parte de nuestra investigación y asegúrese de que se lo permitan. Tus padres / tutores legales deben firmar, o no podrás participar en el proyecto.

Si tiene alguna pregunta en cualquier momento, llame o envíe un correo electrónico a David Weiss a través de sus asistentes al 099-747702, o envíenos un correo electrónico a vasquezdenisse@unm.edu. Si desea hablar con alguien más, puede llamar a la Oficina del IRB al (505) 277-2644 o enviar un correo electrónico a IRBMainCampus@unm.edu.

No tienes que estar en este estudio. Tu participación es voluntaria. Si elige participar en el estudio, puede cambiar de opinión en cualquier momento.

Al firmar este formulario, significa que ha leído este formulario y todas sus preguntas han sido respondidas. Usted y sus padres recibirán una copia de este formulario.

Estoy de acuerdo en unirme a este estudio.

________________________
Firma del Padre/Madre del estudiante colaborador

Nombre del Padre Madre/Tutor Legal
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<th>Nombre del estudiante-participante</th>
<th>Firma del Estudiante-participante</th>
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_Firma del investigador (a completarse al final de la investigación)_

Le expliqué la investigación al participante y respondí todas sus preguntas. Creo que él / ella entiende la información descrita en este formulario de consentimiento y acepta libremente participar.

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<th>Nombre del Investigador</th>
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