
# Engaging Audiences Underrepresented in STEM Fields

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**ABSTRACT**

As providers of informal STEM education, including libraries, grapple with the issue of offering inclusive programs and meeting the needs of their specific communities, potential program facilitators seek knowledge and guidance to develop and deliver effective STEM programming for underserved populations. Key questions that might be asked include: Have best practices been identified for effectively engaging underserved audiences? What key strategies, if any, have emerged from previous informal science education efforts that can inform new program development? Over the past 10 to 20 years, museums, science centers, and youth-focused organizations that have taken the lead in informal science programming have developed and evaluated outreach programs for racial/ethnic groups in their communities, particularly Latinos. This has resulted in evidence-based strategies that can be used by other informal STEM program developers/facilitators to base the theoretical and practical underpinnings of new program initiatives.

[It should be noted that while the term "underserved" may include a wide range of audiences (e.g., girls and women, individuals with disabilities, immigrant populations, the homeless or displaced, veterans, ex-offenders, disconnected youth, LGBT populations), for the purpose of this paper, the focus will be on racial/ethnic groups that are underrepresented in STEM professions. According to the National Science Foundation, three racial/ethnic groups—Blacks, Hispanics and American Indians—are underrepresented in STEM.]

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## Background

As the U.S. population continues to become more diverse, institutions that provide informal STEM education – including museums, science centers, zoos, libraries – strive to become more inclusive and connect with the various populations represented within their service areas. During the past one to two decades, numerous efforts have been undertaken by informal learning institutions, particularly museums and science centers, to increase the engagement of underrepresented groups within their communities in STEM learning opportunities. Turning underserved communities into key audiences has also been a strong emphasis for libraries. Tonya Badillo, director of the Long Branch (NJ) Free Public Library, defines underserved communities as "groups that do not have equal access to programs and services…" and underscores the necessity of balancing core traditional services with "the ability to…provide relevant services to every population within our community" (ALA, 2014). A recent initiative of the American Library Association, Libraries Transforming Communities (LTC), also highlights the need to target an ever-wider range of underserved populations. LTC seeks to support "librarians to engage with their communities in new ways. LTC will help libraries become more reflective of and connected to their communities…" (ALA, 2015).

According to the National Science Foundation, women, persons with disabilities, and three racial/ethnic groups—Blacks, Hispanics and American Indians—are considered under-represented in STEM professions (NSF, 2013). This paper presents research results and summarizes effective strategies for engaging historically underrepresented ethnic groups in STEM learning activities, with an emphasis on Hispanic audiences. Key reasons for focusing on the Hispanic population are: (1) among the increasing diverse populations within the United States, Latinos[1] make up the largest group, reaching a new high of 55.4 million in 2014 (U.S. Census Bureau, 2015); and (2) review of the literature revealed research specific to Hispanic audiences involved in learning activities in informal settings. The promising practices/strategies that emerged from the review and analysis of relevant studies focus primarily on projects carried out by informal learning institutions such as museums, science centers, and youth-centered organizations such as 4-H. An important next step will be to explore how those research-based strategies can be moved into the library arena to make a significant difference for underserved audiences engaged in STEM learning activities through library initiatives.

## Program Development – Research Findings and Related Implementation Strategies[2]

***Environments should be developed in ways that expressly draw on participants' cultural practices, including everyday language, linguistic practices, and local cultural experiences*** (Bell, et. al., 2009). Designers of informal programs and spaces for STEM learning have long recognized the importance of prior knowledge that participants bring to learning environments. Rather than considering this knowledge as culturally neutral, it is important to pay attention to the ways in which culture shapes knowledge, orientation, and perspectives. Such an approach opens up vast opportunities for facilitators of informal learning to take advantage of the

[1] The terms "Latino" and "Hispanic" are used interchangeably in this paper.
[2] Source for this section: Correa Zeigler, 2009

cultural practices that a diverse set of learners might bring to the environment. Engaging members of the target audience in informal discussions (through focus groups or other interactions) may shed light on cultural norms and practices that participants bring to the learning environment.

Strategies to consider, based on this research finding:

- Provide culturally attuned programs and activities, which requires involvement of representatives of the target audience as active partners.
- Utilize program staff that is culturally competent and engenders respect and trust (e.g., competency in language skills, cultural understanding, respect for traditions and values).
- Encourage families to use their home language as they participate in programs.

***Informal environments for learning should be developed and implemented with the interests and concerns of community and cultural groups in mind*** (Bell, et. al., 2009). Educational environments must value the relationships that learners themselves value (Basu and Calabrese Barton, 2007). Project goals should be mutually determined by facilitators/ educators and the communities and cultural groups they serve.

Strategies to consider, based on this research finding:

- Actively seek and include the knowledge base of the target audience throughout planning and implementation phases of a project. This may include exploring non-traditional partnerships with organizations that are familiar to the target audience.
- Identify community "gate keepers" or "cultural brokers" who are respected within their communities; seek their input, so as to include contextually driven approaches.
- Build trust among the target audience, which takes time (thus, a long-term commitment is required for efforts aimed at achieving equity in STEM education/programming).

***It is important to help learners identify with science in personally meaningful ways*** (Bell, et. al., 2009). Associating scientific thinking and STEM topics with engaging, enjoyable events and real world outcomes can create important connections on a personal level. If individuals see how those topics are relevant to their own lives, their interest in these subjects is likely to increase. Science education "…should lead to independent self-activity. It should empower individuals to think and to act. It should give individuals new ideas and investigative skills that contribute to self-regulation, personal satisfaction, and social responsibility" (DeBoer, 1991).

Strategies to consider, based on this research finding:

- Incorporate cultural experiences into the program that are recognized and shared by the audience and are therefore personally meaningful (the experiences might be related to entertainment, customs, etc.).

- Link science programming to everyday topics that are culturally relevant (e.g., food, sports, music, clothing).
- Make use of a variety of processing modes (observation, discovery, contemplation, etc.) and linguistic cues (visual aids such as artifacts, models, photos, charts, props) to increase the likelihood of connecting with the audience, helping them make personal connections, and encouraging them as learners.

***The cultural variability of social structures should be reflected in the program design*** (Bell, et. al., 2009). For example, facilitating means for participants to share experiences with family members may be highly valued by communities that have regular and ongoing family interactions, which may include extended family members. Therefore, designed spaces that serve families should include consideration of visits by extended families.

Strategies to consider, based on this research finding:

- Learn what social structures are important to your target audience (through interaction with community members and/or a community "cultural broker").
- Integrate promotion efforts that include advertising in relevant community locations that are part of the audience's overall social structure, once identified (e.g., posting flyers in markets, churches, laundromats).
- Design activities that allow opportunities for both adults and children to participate, either working together or separately at the same event.
- Provide snacks/light meals, offer childcare, or provide shorter events, if needed, to accommodate work and family schedules.

## Key Strategies for Engaging Parents[3]

***Building Trust.*** Informal learning educators and facilitators have the opportunity to build trust among Latino families by working with and through local leaders who are trusted sources within the community, such as a pastor, parish priest, or an active community organizer or volunteer. Once the trust is established and parents are engaged, informal STEM learning programs for parents and children can provide powerful motivation to explore educational opportunities and career paths previously not considered.

***Focusing on Career Options.*** Latino parents, particularly immigrants, are seeking economic success for themselves and especially for their children. By linking STEM activities and hands-on approaches to careers in science and technology, informal learning professionals have an opportunity to expose families to an increased repertoire of career options that can potentially serve as wealth generators for families. In many instances, learning about and exploring a variety of STEM career options and the differences in income levels associated with different careers has been an eye-opening experience for families. Inviting Latino STEM professionals to interact with families and share their career stories can be an effective means to strengthen the experience for participants and provide significant role models. Results of studies indicate that individuals tend to seek role models who are similar to them in some

[3] Source for this section: Sanchez and Arce, 2009

easily identifiable way, such as gender or race (Bandura, 1986; Hackett & Byars, 1996; Karunanayake & Nauta, 2004).

***Successfully Engaging Parents.*** Cecilia Torres and Amalia Marquez (2005) state five characteristics shared by 10 outreach programs that have successfully engaged Latino parents:

- Committed Program Champions: developed outreach initiatives with the aid of committed personnel and leadership that had access to networks and resources.
- Cultural Considerations: built trust, established strong community relationships, provided services for parents such as language assistance and transportation that help overcome barriers and facilitate parent participation.
- Program Evaluation: served as a tool in learning about needs and preferences of target population and assisted in targeting outreach efforts more effectively.
- Successful Partnerships: were critical in efforts to build trust, gain access to families, leverage funding and resources.
- Stable Funding Sources: secured diversified funding from government grants, local corporations, and foundations.

## Youth-Focused Program – Key Attributes[4]

Building on the research focused on working with Latino youth, the Oregon 4-H Latino Outreach Project designed its programs to be culturally responsive. The design of culturally responsive programs began by inviting Latino youth and adults to work with 4-H to build a vision for youth and identify their needs and interests.

**Oregon 4-H Latino Outreach Program Characteristics:**

- Programs are holistic in perspective
- The community has a voice in program development
- The cultural identity of youth is acknowledged and reinforced
- Both Spanish and English are used
- Family oriented programs in addition to youth focused programs are offered
- Culturally specific projects are available
- Bilingual/bicultural staff support programming
- A cultural affinity group is provided for youth while encouraging them to participate in multicultural contexts
- Programs set high expectations
- Separate training for Latino volunteers is provided as needed

[4] Source for this section: Hobbs and Sawer, 2009

## Participation in Informal Science Learning Activities – Primary Influencers[5]

**Key values that influence leisure decisions**
When making choices about leisure activities, studies identified several key values that influence leisure decisions:

***Promotes and maintains family unity.*** Latino families from a range of backgrounds use leisure time to build and maintain cohesion within the family (Garcia-Luis, 2007; Garibay, 2009, 2007, 2006, 2006b). Therefore, activities in which the entire family can engage are highly valued. Leisure activities often include extended family, such as cousins, aunts, uncles, and grandparents (Garibay, 2009; Pizzini, 2000). Fostering family unity seems to be especially important to Latino families in lower socio-economic situations; due to parents' heavy work schedules (e.g., two jobs or working six days a week), these families have limited time to spend together (Garibay, 2006, 2006b).

***Goes beyond relaxation.*** Key benefits associated with leisure activities include reducing stress, having fun with family and friends, and being entertained (Garcia-Luis, 2007; Garibay, 2007; Monaco and Strasser, 2006). Some studies also indicate, however, that leisure is felt to have a broader purpose beyond recreation, and that activities are often selected based on this perceived benefit (Garibay, 2009, 2006b). For example, in some studies, (Garibay, 2009, 2006, 2006b) respondents highly valued activities that provided opportunities for them to learn something new or exposed them to something they had never seen.

***Has some educational merit, especially for children.*** Latino parents highly value the education of their children (Gasbarra and Johnson, 2008; Casas et al., 2005) and have high aspirations that their children will achieve a better standard of living and quality of life than they have. It is not surprising, then, that leisure activities seen as educational are highly regarded and directly influence leisure choices (Garibay, 2009, 2007, 2006b; Garcia-Luis, 2007; Monaco and Strasser, 2006). All other things being equal between two potential leisure activities, those with perceived educational benefit are more likely to be selected.

## Conclusions

Presenting the work of various researchers/educators was a deliberate approach used by this writer to provide an overview of research results as well as on-the-ground practices used by experienced informal STEM educators to engage underrepresented audiences in informal STEM learning activities. It is evident that common threads exist among the varied research results and associated strategies presented in this paper. Thus, as facilitators or informal educators develop STEM programs to engage underrepresented audiences in learning activities, the following key points should be considered: (1) take the time to build relationships and establish trust among the target community; (2) ensure members of the target audience are involved as active partners in project planning and development; (3) acknowledge and draw upon participants' cultural identity/practices; (4) integrate experiences that are culturally relevant and personally meaningful to participants; (5) utilize bilingual/

[5] Source for this section: Garibay, 2009

bicultural facilitators to support programming, as appropriate; (6) develop programming that is family-oriented and engages the entire family; (7) emphasize the program's educational merit and integrate a STEM career focus if possible; and (8) identify potential barriers to participation and develop strategies to overcome those obstacles.

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