STEAM for All
FINAL REPORT

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SUMMARY

This report explores the current state of STEAM for all (equity) in STEAM ISL (Informal Science Learning) and presents recommendations for future actions and research. The main goal is to address systemic barriers, highlight effective practices, and identify opportunities for innovation and expansion. Key areas covered include systemic challenges, best resources, case studies of successful initiatives, and priorities for future research and pilots. By addressing gaps and leveraging best practices, this report aims to guide educators, policymakers, and practitioners in developing inclusive STEAM ISL programs.

INTRODUCTION

Equity in STEAM ISL is essential for ensuring that learners from diverse backgrounds can access, engage with, and benefit from informal science education. The purpose of this report is to highlight the current challenges, opportunities, and practices that foster equity in STEAM ISL. Equity within this context means providing tailored support, resources, and learning environments that meet the diverse needs of all learners. The scope of this report focuses on the intersection of informal science learning and STEAM education, utilizing research, expert insights, and case studies to present key findings.

Informal science learning provides opportunities outside the traditional classroom setting, which can reach underserved communities and bridge educational gaps. This report highlights how integrating culturally relevant pedagogies, mentorship, and community-driven programs can create meaningful changes in learner outcomes. By identifying effective strategies and outlining future research directions, this document

serves as a guide for creating a more inclusive and equitable STEAM education landscape.

Refined Definitions

General Definition of Equity: Equity is the practice of ensuring fairness and justice in treatment, processes, and outcomes by acknowledging and addressing the diverse needs and circumstances of individuals. Equity involves providing tailored support and resources so that everyone has the opportunity to succeed, recognizing that different people may need different levels or types of support to achieve similar outcomes.

Equity in Relation to Informal Science Learning (ISL) and STEAM Education: Equity in ISL and STEAM Education is the commitment to providing all learners with personalized, context-sensitive tools and resources that allow them to fully and effectively participate in learning experiences, tailored to their individual needs. This also includes supporting educators and facilitators with the necessary resources and training to create inclusive, culturally relevant, and engaging educational experiences. Equity in ISL and STEAM also involves actively addressing and dismantling systemic barriers, ensuring that all learners, particularly those from underrepresented and marginalized communities, feel valued, supported, and capable of thriving in STEAM fields.

KEY FINDINGS

The current state of equity in STEAM ISL reveals significant systemic barriers that limit access for many underrepresented groups. Socioeconomic disparities often restrict access to resources and participation, with students from low-income backgrounds frequently having fewer opportunities to engage with STEAM programs. Furthermore, the lack of representation of diverse role models within STEAM fields creates an environment where marginalized students may feel excluded or unable to see themselves as part of the STEAM community. Cultural biases embedded in traditional learning settings also contribute to disengagement and underperformance.

Effective practices have emerged to address these barriers. Culturally relevant pedagogy has shown success by aligning educational content with the lived experiences and cultural backgrounds of learners. Community-based approaches, which involve local stakeholders in program design, have proven effective in ensuring that programs are relevant and inclusive. Mentorship programs provide sustained support and role models who reflect the diversity of the learners, fostering a sense of belonging and long-term engagement in STEAM.

Challenges persist, however, as dominant narratives within educational institutions continue to marginalize underrepresented groups. Limited resources and low engagement levels remain prevalent in underserved communities. Despite these challenges, there are notable trends in equity-based initiatives, including a growing emphasis on diversity, inclusion, and access. Research-practice partnerships are becoming more common, bringing together educators, researchers, and communities to co-develop solutions. Expanding interdisciplinary approaches, such as maker education and rural STEM initiatives, is helping to broaden the reach of STEAM education.

Additional Insights

Intentionally Designed Programs: Equity in ISL requires intentional design, where programs are crafted with equity as a core principle. This includes incorporating mentorship components (Hinojosa et al., 2021) and developing equity guidelines (Dawson, 2014) to ensure that all learners have the opportunity to engage meaningfully.

Understanding Multiple Perspectives: Equity is multifaceted and involves understanding different perspectives on what equity means, as well as recognizing the diversity of learners' experiences and the systemic challenges they face (Philip et al., 2017).

Equity in Diverse Contexts: Equity issues in STEAM extend beyond traditional ISL to include challenges such as access, diversity, and inclusion. For instance, access refers to who has the opportunity to participate, diversity to who is present in the learning space, and inclusion to who feels welcome and valued (Gaskins, 2021).

Culturally Relevant and Place-Based Education: Effective equity practices in STEAM often involve culturally relevant education models that resonate with the lived experiences and cultural backgrounds of learners. This includes integrating traditional knowledge and cultural practices with STEAM education, as seen in initiatives with Indigenous youth (Tzou et al., 2019).

Broad Diversity in Equity-Based Programming: Successful equity initiatives must account for the broad diversity of learners, considering factors such as ethnicity, gender, and location. Examples include using culturally relevant models for Latino communities (Juarez et al., 2017), integrating dance and STEM for African American youth (Hyater-Adams et al., 2019), and place-based STEAM pop-ups in rural areas (Vasinda et al., 2019).

Equity-Oriented Pedagogical Design: Pedagogical approaches in STEAM education should focus on equity-oriented goals, such as shifting the perception of failure in tinkering to one of iteration and learning, and ensuring that educators facilitate connections between learning activities and the lives of the participants (Ryoo et al., 2015).

Taking ISL into Formal Environments: Bridging informal and formal learning environments is key to expanding equity in STEAM. Programs that bring hands-on STEAM learning into underserved schools or that develop workshops for high-need students are examples of how informal learning principles can enhance formal education (Walker, 2021; Wolf, 2021).

PRIORITIES FOR FUTURE WORK

Future research should focus on expanding culturally relevant pedagogy by developing frameworks that more deeply integrate cultural contexts into STEAM learning. This includes tailoring content to the specific needs of cultural groups such as Indigenous, Latino, and African American communities. Bridging informal and formal learning environments is another critical area for exploration, with pilot programs needed to investigate best practices for connecting informal STEAM initiatives with formal K-12 classrooms.

Long-term engagement is essential for fostering sustained interest in STEAM, especially for underrepresented groups. Longitudinal studies could provide insights into the effectiveness of mentorship programs and community-driven initiatives. Additionally, research into the equitable use of emerging technologies, such as artificial intelligence and virtual reality, can help ensure that technological advancements do not exacerbate existing disparities. Evaluating accessibility programs like Touch Tours will further inform how to create inclusive and supportive environments for learners with disabilities.

Conclusion

This report highlights the importance of addressing systemic inequities in STEAM ISL through effective practices, case studies, and future research directions. By fostering inclusive learning environments and promoting culturally relevant programming, STEAM ISL can provide equitable opportunities for all learners. Collaboration between educators, policymakers, and communities is essential for achieving long-term success in creating inclusive educational ecosystems. Programs such as Touch Tours demonstrate the power of community collaboration and inclusive design in addressing the diverse needs of learners.

CASE STUDY

Touch Tour programs were initiated by The Houston Museum of Natural Science by an expressed need from the blind community in Houston. The program focuses on access to artifacts and content in the Museum that blind patrons may not be able to

experience during a regular visit due to the style of the Museum's exhibit displays or lack of resources available in the Museum for this community. The program creates access for blind patrons, using tools and specialized presentations, to the same content that other patrons experience. The program led to wider changes in accessibility throughout the Museum.

Members of the blind community approached staff at the Houston Museum of Natural Science in 2018 to initiate a program similar to one that they attended at the Museum of Fine Arts, Houston called "Art Beyond Sight". These representatives were interested in learning about art *and* science, but HMNS did not have a program like this in place. Staff and representatives from the community came together to discuss different program formats, logistics, and support required. A pilot program was conducted after staff trained with representatives from the MFAH and after this program ran, learned what adjustments to make for future programs. Feedback from the blind community was crucial in developing and evolving what the program is today.

In the current state of the program, Touch Tours take place every other month from 10:00-11:30am and focus on a different Museum topic with tactile materials to explore and the opportunity to explore the Museum independently after the program. Guests are greeted at their MetroLift (accessible public transportation in Houston) by the Museum's Accessibility Programs Manager or Museum volunteers who act as sighted guides to guide those who would like it to the educational space where the program takes place. Attendees include patrons who are blind, low vision, sighted with a physical disability, and/or caregivers. Most attendees are older and interested in lifelong learning opportunities. A presentation is given by the lead presenter and tactile materials are passed around by assisting volunteers. These presenters and volunteers are trained on disability etiquette with the blind community and how to create an engaging presentation for this community specifically to ensure that learners feel supported. Many presentations cover cross-curricular topics, such as biology and geography or art and cultural currency. The volunteer who leads the program will take weeks of prep time to consider which tactile objects will represent the topic best and get creative with how to bring them into being. For one tour that focused on Astronomy and Space, the volunteer leading the program created a to-scale replica of planets in our universe attached to a string. This complex concept of distance in space was made simpler for attendees who could feel how far each of the planets were apart from each other on the string. Other presenters have utilized 3D printed items, puff paint patterns, and plastic or resin models to represent their topic. Some have used music or scents to make the topic more engaging as well. Once the program is over, staff and volunteers assist participants upstairs to eat lunch and/or catch their scheduled MetroLift rides. This program is free because many participants would not be able to visit the Museum and have an engaging experience without it. Maybe participants would also not have the funds to attend otherwise.

Within the Museum, focus on the blind community through this program has caused other departments to consider accessibility and equity across all Museum learning experiences. The Exhibits, Building, and Graphics Departments have worked to

incorporate more inclusive interactives and displays within our exhibits so that patrons who are blind can engage and make connections between concepts throughout the Museum. Traditionally, museums have had displays behind glass which is not accessible to guests who are blind. Using resources like mobile/audio guides, tactile representations, Braille, and other creative resources, the Houston Museum of Natural Science aims to create a more accessible and inclusive environment that provides equitable educational environments for all learners.

Within the blind community in Houston, space has been created for collaboration, expression of needs, and discussion of pain points related to the program at the Museum. Systemic issues related to the public transportation system for people with disabilities has been a major pain point for our program. The blind community being able to have a working relationship with the Museum, review materials and programming and provide feedback, and feel included in Museum planning have been invaluable. Trust in the Museum within the community has expanded and led to different partnerships that focus on equity and access for other groups within the disability community. Although there is always room to improve, based on verbal and quantitative feedback, the impact of this program on the blind community in Houston has been positive.

KEY REFERENCES

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