Designing for Children 2019

- Play and Learn

The Museum of Solutions

Building community spaces for interactive and hands-on learning

Preeti Goel Sanghi, Museum of Solutions, India, preeti.sanghi@jsw.in

Tanvi Jindal, Museum of Solutions, India, tanvi.jindal@museumofsolutions.in

Mahika Shishodia, Museum of Solutions, India, mahika.shishodia@museumofsolutions.in

Aishwarya Narvekar, Museum of Solutions, India, aishwarya.narvekar@jsw.in

Shefali Bohra, Museum of Solutions, India, shefali.bohra@jsw.in

Abstract: The Museum of Solutions, is developing unique interactive experiences layered with activities that expose children to real world issues and encourage them to develop solutions. This paper focuses on the development of the museum space as it describes the process, experimentation and research that went into the formation of this initiative. Overall the museum follows a multi-pronged learning approach, which includes interactive exhibits, hands-on workshops and seminars, play and outreach activities. With focus on children between the age of 7 and 14 years, this paper documents the design process and brings together the insights and learning for development of similar spaces.

Key words: *21st Century Skills, Experiential Learning, Hands-on Learning, Design Thinking, Participatory Process*.

1. Education System in India

Children are naturally curious, and their desire to know and understand the world develops as they grow older (Kettle and Ross, 2018).

An encouraging and safe learning space that facilitates all forms of learning and skill-building is key to the creation of a holistic learning environment (Modell, Demiero & Rose, 2009). In India, the education system focuses primarily on the transfer of knowledge to children by encouraging them to memorise information and by testing their rote-learning skills. This specific form of learning is essential, but insufficient for the overall development of a child in

this pivotal stage. The role of education is to equip children with tools to understand the world we live in today and create sustainable solutions to challenging problems. At present, the mainstream education system in India is rigid and merit-based, marks play a major role in determining the future of a child.

Children are often overwhelmed and limited by these structures. Instead of working within the constraints of school systems, syllabi, time or assessments where specific forms of 'intelligence' are supported and strengthened, the Museum of Solutions intends to build a space for children to apply their learning to real life situations, to foster creativity, think critically, communicate effectively and work collaboratively.

The Museum of Solutions, believes that a child's curiosity has immense potential to bring about meaningful change in the present and future. Every child is unique and learns differently, thus the aim is to develop diverse methodologies to ensure that the needs of all children are met. Children will not be bound by the current inflexible curriculum as they will be presented with the opportunity to curate their own learning experience, based on areas of interest or priority.

2. Museum of Solutions

Museum of Solutions is inspired by the UN Sustainable Development Goals (UN SDG). In conversations with children regarding the idea of a museum that works with 'problems' and 'solutions', it was found that children resonated with some of the key issues addressed by the UN SDG's. Children discussed quality education, poverty, hunger, gender equality, sanitation, clean energy, development of sustainable cities, life below water and on land, climate action and, production and consumption practices. All the museum galleries, exhibits and workshops are based on these SDG's. The visitors at the museum will not only be exposed to the issues facing the world today, they will also be introduced to new ways of thinking and this will be a space for them to collaborate, seek resources and build solutions. Alongside the exhibits, children will be able to attend workshops and enroll in long-term programs to develop their skills or execute their solutions to issues independently and/or collaboratively.

The Museum's vision is to inspire, enable and empower children to make meaningful change in the world - together, today. Museums are safe, accessible and inclusive public spaces; that is why this space for children is called the Museum of Solutions. The needs and interests of children differ based on their backgrounds and other external factors. The ethos of the

Museum is captured by its three pillars-

2.1.　**Boldly Child-Led** – The Museum believes that a child's own curiosity is the key to unlocking transformative experiences. Museum of Solutions creates unique, personal journeys for each child where learning is led by a sense of play. Guided by the different ways children understand, interact and learn, these kinds of experiences allow for children to find their own way into relating to topics, and digging deeper, led by their own interests and curiosities.

2.2.　**Radically Inclusive** – The Museum believes that diversity is a driver for empathy-based experiences. Museum of Solutions develops resilience and comfort with friction, creating awareness and openness to others perspectives. The Museum wants to create experiences where children find common ground with those different from themselves, and foster young communities based on empathy and interdependence.

2.3.　**Rooted to Reality** – The Museum believes that the world around us is the inspiration to learn from, experiment within and the sandbox for making change. Museum of Solutions enables children to apply their learning in the real world and also understand how systems work and are connected, through inspiring local and global stories of individuals who are bringing about a change and making a difference.

The Museum of solutions is creating a space that allows children to create their own view and own relationship to the context around them by both bringing in stories from the outside, but also taking learning outside. It believes that a space that provides children from a range of backgrounds, the opportunity to discover new information, interact and develop skills together will lead to a greater understanding of the world.

The set of skills and tools required to navigate the present age are commonly referred to as '21st century skills'; the economists Frank Levy and Richard Murnane (2004) emphasise the significance of complex communication and expert thinking as skills that need to be developed to thrive in the constantly evolving environment we inhabit. These distinct and challenging skills form the core of the museum's philosophy. Lego (2017) lists the following as characteristics that arise from the convergence of play and learning: joyful, meaningful, actively engaging, iterative and socially interactive. The Museum of Solutions believes in the integration of play in the learning and development of children and hopes to explore the spectrum of playful learning as opposed to learning through direct instruction. According to Piaget's Stages of Cognitive Development, children that are 7 and older begin to develop an

understanding of concrete situations and begin to think theoretically, hypothetically and counterfactually. The target demographic at the Museum of Solutions includes children between the ages of 7 and 14.

3. Design for Learning

The research process started with 3Es outlined for the Museum, Empathetic, Enabled and Empowered which was the journey outlined for the learning experiences in the space (Fig 1). These provide a structure of exploration and problem solving within the space for children. On a larger level the 3Es relate to the 21st Century Skills – Learning and Innovation Skills as outlined by the P21 Organization which are the 4Cs- Creativity, Critical Thinking, Collaboration and Communication. 21st Century skills represent a wide variety of skills and values essential for children to prepare them for the future.

Approach The learning journey frames the educational goals that outlines the desired outcomes for every visitor experience.

Empathetic
Children will leave with more questions than they came in with, and the motivation to dig deeper into what they are curious about

Enabled
Children will find new ways to express themselves, bring their ideas to life and share them with the world

Empowered
Children will find their own unique voice and have the platform to share their ideas and opinions
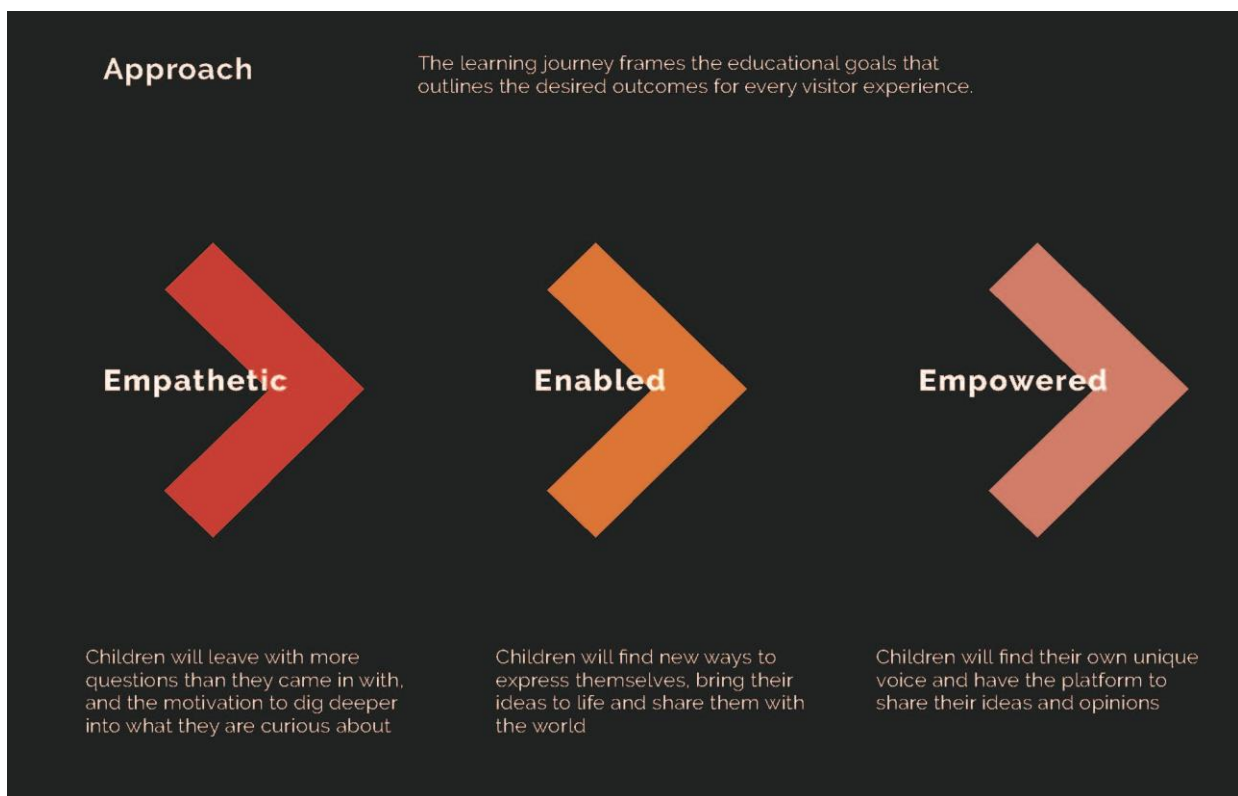
Figure.1 The learning journey outlined at Museum of Solutions

3.1.   How can developing a Design Mindset help in building 21st Century skills in children?
Design Thinking is a widely known methodology for problem solving which keeps the user at the center of the process. It calls for empathizing with the people, thinking out of the box, exploration and experimentation.

HOW DO WE SOLVE PROBLEMS WITH DESIGN PROCESS?

systems thinking
assumptions vs the actual
observations and insights
analysis and synthesis
field immersion
see the problem in larger context
identify the pain points
converge to the pressing issue
observe body language
generate problem statement
understand the user
how people feel
divergent thinking
brainstorm multiple ideas
meet people
think on paper, think visually
ask questions
be in their shoes
investigate
ideate
sketch to convey concepts
drawing as a important tool for expression, making connections, de clutter thoughts, expression - important part of process
define the user
narrow down the scenario
design brief
define
tangibility to the concept
what affects/ bothers you on a personal level?
problems as opportunities
make
make frugal prototypes
scale and use use over time
from exhibit experiences, scenarios built, stories told,
try/test
see functioning of the prototype
improve
feedback
stimulate the use of the actual product
emergence, new perspectives
dig deeper
test out the idea with multiple users
work on details
refine the concept
how could it be made better
go back to the user
feedback
take ahead the concept or scrap ?
build on the critique
involve the user in the process
problem solving with the user

Figure.2 Mapping out steps and learnings through the design thinking process

The Design process has been consolidated into 4-5 simple steps and each step requires various actions to reach the goal (Fig 2). These actions range from stepping out, to real world learning, churning multitude of ideas, devising new methods of information collection and processes, making tangible things, etc. These actions can each be introduced to children in steps with the purpose of building that skill itself. Developing a design mindset through smaller steps is a process which can make learning more real, relevant and effective. The importance of "thinking like a designer" is being explored by different initiatives to align with education and learning through different methods like play, making, challenges, etc.

3.2. Case Studies

3.2.1. **Design for Change** led by Feel Imagine Do Share (FIDS) methodology. The goal of the program is to bring forth a change of mindset I CAN - attitude shift among the children and develop 21st century skills. The program throws light on the potential of children and the scale of impact they can create in the society through their initiative. Through FIDS, Design forms an integral part of the framework. Here, Design is used as a tool to learning

experiences for children across different age groups and backgrounds. Children and their mentors both go through the design process as they navigate through the Design for Change (DFC) challenge. The program focuses on empathy, creativity, critical thinking and collaboration.

3.2.2. **NuVu Boston** - An iterative feedback driven program for children, based on an architectural studio model wherein every project is of two weeks and students are guided by a team of facilitators and a network of experts. They use design thinking to solve complex real world problems using creativity, critical thinking and collaboration. NuVu focuses not just on the making but learning through the crit process while innovating and navigating through the messiness of the design process. Making is a medium of building skills among the children. NuVu challenges students to learn in new ways: analytical thinkers are inspired to explore their creative selves, while creative students expand their capacity to think and learn analytically.

3.3. Methodology

The learning experiences at Museum of Solutions are planned through a series of experiential exhibits and workshops/programs focused on hands-on learning.

3.3.1. Inspirations: Literature review, exploratory research

3.3.2. Interviews and participatory development with children

Insights from experts in the field of learning and creativity, educators, parents and children. An important step in the development process was formation of a children's panel to work with the team towards the development of experiences for the Museum. Children as a user group to work with can be very expressive and need to be engaged with the right tools and methods.

Children's Panel: The Children's Panel is a panel of 20 children who are working with the Museum of Solution to ideate and develop different exhibits and methods of learning that will finally go in the space. These children, in the age group of 10-13 come from different schools and socio-economic backgrounds in Mumbai, thus bringing in different perspectives and representative group of target audience for the Museum. The panel meets 1 Saturday every month through a series of experience and learning driven workshops which are designed to nudge the children to react to the material presented and actively be engaged in critical feedback and development of it.

3.3.3. Case study: Mithi River Children's Panel. A representation of learning journey through a Children's Panel session and insights towards further development.

4. Research, Development and Testing of Exhibits Ideas

4.1. Research (centered towards one experience)

The agenda of research for exhibits was to answer a few questions and bridge the gap between the real world and children by developing meaningful experiences and exhibits. It began with answering a few questions and connecting the dots with programming mentioned earlier.

4.1.1. Showcased below are a few questions and modes of research adopted.

- How important is it to give a localised context to enable awareness? Drawing Inspiration from existing museums for children.
- Making a case for Mithi River to be used as the driving subject of the space? Primary research, Secondary Research, talking to experts, associated people and agencies.
- Studying the existing water museums and mission across the globe. Secondary research, UNDP Goals, success rate of the museums.
- Studying the present relationship of children with environment and nature, globally and locally. Planning workshops and quantitatively analysing the responses.

4.1.2. Research around Mithi can be classified under 5 main headings:

- **People -** It talks about the involvement of different stakeholders, their pains, gains and problems with the Mithi River.
- **Waste** - Mithi river has been contaminated with industrial and domestic waste for years now. An overview of the types of wastes it receives from various industries and households has been outlined here.
- **Biodiversity** - Mithi river originates at Sanjay Gandhi National Park and meets the Arabian Sea at Mahim Bay, on the way it crosses Mahim Nature park, it houses various flora and fauna.
- **Water Health** - The alarming deterioration of water quality in Mithi has impacted biodiversity to an extent where fishes cannot survive. Why is this deterioration happening? Who are the contaminants?
- **Storm Water** - In 2005, Mumbai faced floods where thousands of people died. Mithi acts as the storm water drainage for Mumbai. A waste - choked Mithi led to floods in Mumbai.

Where in, the activities and nature of challenges are interdependent and derived. Showcasing the problem of Mithi river provides an opportunity to children in the museum to realise the scale of water pollution in a contextual scenario.
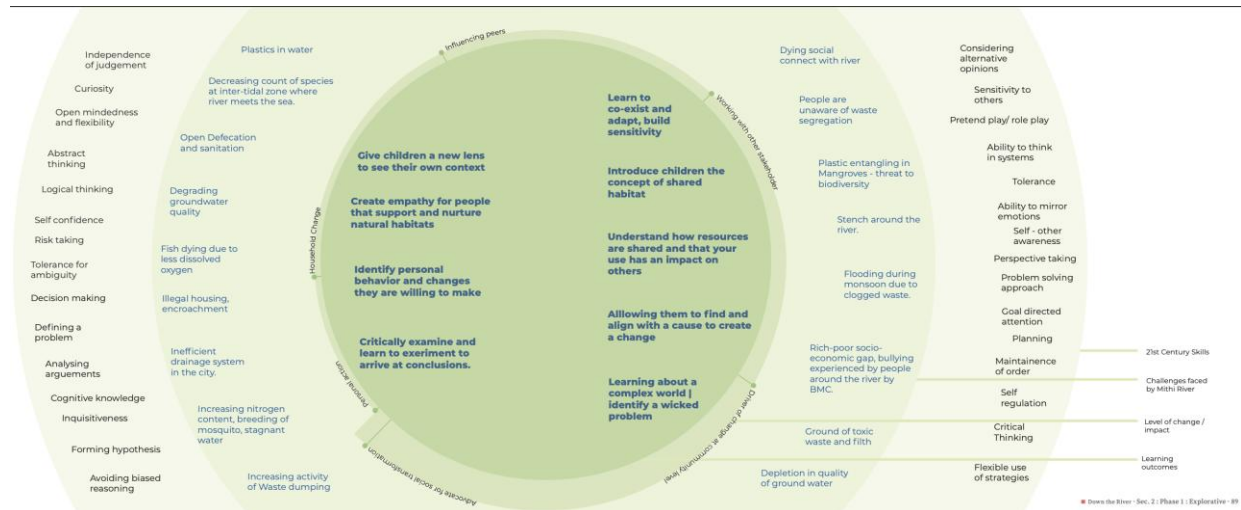
4.2.   Development of Exhibits

Figure.3 Mapping content and learning goals

Now the agenda of the exhibits is to showcase it in a manner which is immersive, yet inspiring and engages children to empathise with the condition of the river. To bring and build design briefs and statement for the exhibits a set of learning outcomes were created (Fig 3). Every learning outcome has three main focus points:

- To impart a 21st century skill..
- Address issues and challenges faced by Mithi River to make children proactively question the macro and micro scenarios of water pollution.
- To drive children to bring about a change. A change can vary from a small behavioral change, a change at household level, a community driven change or become an advocate for the arising issue.

The exhibits are a set of high fidelity prototypes created to be used during the children's panel to learn from the them their engagement and immersion wrt to the content of Mithi river.

4.3.   Testing of Exhibit ideas with Mithi Children's Panel
4.3.1. Invisible River

Figure.4 Invisible River

A big fridge box was installed to build a darkroom, the walls being covered with illustration (Fig 4). The illustration was drawn using the invisible ink which could be read in a dark room using the black light torch. The illustration highlights the journey of a cigarette bud, a garbage bag, a pair of dry cells, and a glass jar. It shows the immediate, long term and cyclic effect of these pollutants entering water.

4.3.2. Water Health

Figure.5 Water Health Station

Allowing children to experience hidden messages from the biodiversity that is being affected by the polluted water in the river. The pH level of water if too high or too low can result into dying of fish / aquatic life present. 5 different water samples of the river along with pH strips were kept (Fig 5). Sample 1 pH paper had to be dipped into sample 1 water to figure out the pH of the water and the hidden message on the paper.

4.3.3. Become The River
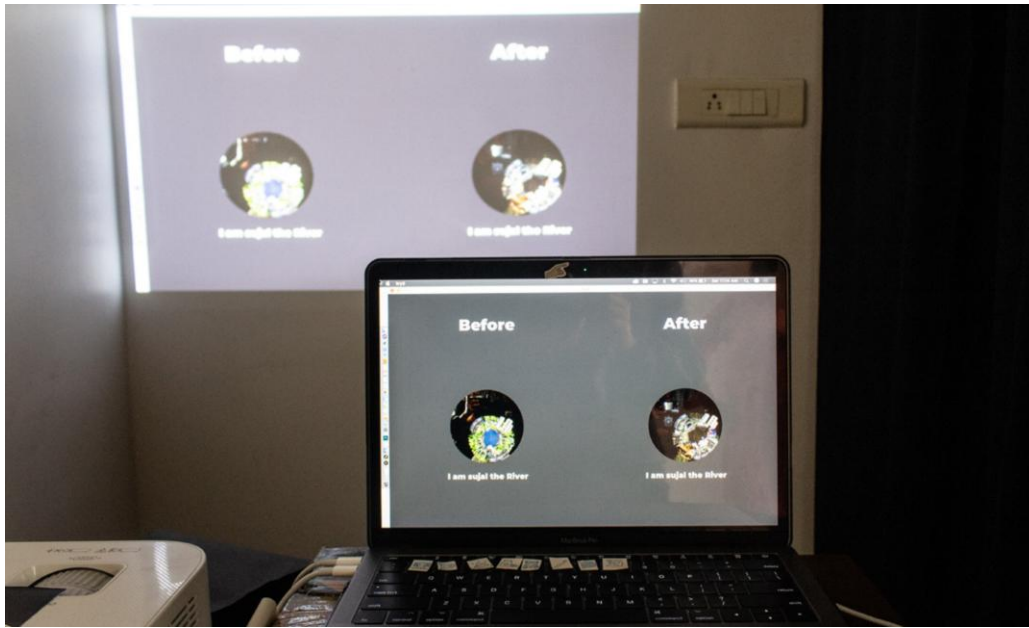
Figure.6 Become the River

The laptop keyboard no. (1-10) were disguised as different factors that pollute the river. As one would press on those icons the color of the water would change, biodiversity on the face filter would lessen and the pollutants would increase. The water became greyer as one proceeded. It was an empathy driven exercise to show / make the user realise - how helpless the river is, incapable of stopping- ping the damage all by itself. At the end of their exercise one can also see the before and after screen to compare the damage visually (Fig 6).

5. Research, Development and Testing of a Program Idea

5.1. Research – The research process for programs started with a deep dive into design mindset, play and making and how these methods are being used to create learning experiences for children. The importance of value of a playful approach towards learning was considered as it promotes constant iteration and exploration and builds on the curiosity of the child. The tools developed centered around playful learning usually focus on learning led by

self and find applications in foundational literacies as well as developing skills and qualities. These tools form a channel between children and adults and therefore are easy to adapt and lead to a cohesive learning experience. Play driven tools let children lead the learning experience as "a child's work is to play" and adults support/scaffold in the background. It promotes an attitude of iteration over perfection which goes a long way in building design mindset.

5.2.   Development of programs - Working with Children's panel for development of programs involved development of tools and methods around gamification, making and aspects of design process to test for understanding and engagement. Throughout the many sessions different topics were explored - plastics, people, water, cities and systems, etc. The sessions primarily focused on short duration programs which called for discussion, collaboration for resolution, empathy and problem solving, etc.

scenario building   gamification   problem solving

Figure.7 Methods used for the panels

The Intent was to work with children, understand the user group, what are the sort of methods or prompts children respond to and how can tools be developed to inculcate a design mindset. Learn from other makers and facilitators and observe how they approach and plan programs. Focus was on immersion in field, interaction with children as they go through the process and interaction of facilitators with children.

5.3. Testing of Program idea with Mithi Children's Panel – The objective of the program was to

bring forward how the problem of Mithi River is a wicked problem and why it has been so difficult to solve through the Program using Actions Cards in The Stakeholder Game.
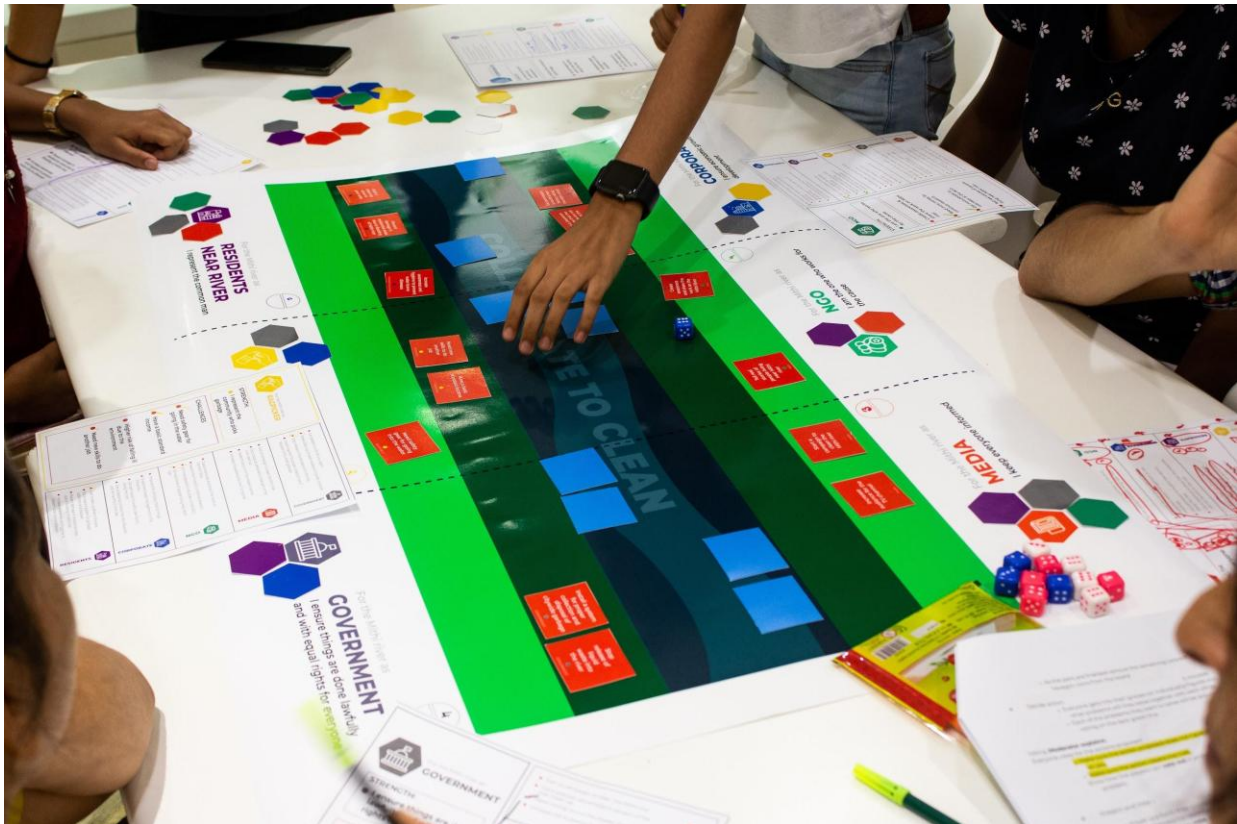

Figure.8 Mithi Program: The Stakeholder Game

The Stakeholder game (Fig 8) was developed as a board game centered around different people of the city coming together to clean the Mithi River while solving their own problems - aimed at critical thinking and collaboration. The program was planned to be conducted in 3 groups of 6 each. The Session started with the stakeholder's action cards sorting in groups - a precursor to the actual program which gave overview of the stakeholder roles in society. The stakeholder game followed- 1/2 hour sessions with two rounds- followed by debrief and discussion with one facilitator and expert on Mithi on each table.

Throughout the session it was observed that children were comfortable with gameplay which helped them absorb the content/intent behind the game. The game did provide understanding of roles in the society and as a program worked as a reflection to build the learning and experience journey. The intended takeaway that all sections of society have a part to play in problems that we face and its resolution was understood through gamification and role play.

6. Conclusions

Building 21st century skills is becoming more important with rapid developments in science and technology. While schools find it difficult to incorporate alternative learning methods in regular curriculum, it is important for all children to have access to spaces that allow them learning at their own pace. The Museum of Solutions is being developed as one such space in Mumbai, with a hope to complement learning in schools and homes for children from diverse backgrounds and abilities. This paper highlights the research and experiments that have gone in the development of the Museum, using tools such as field studies, in depth interviews and prototyping. The children's panel validated that interactive experiences that are child-led, not only provide memorable learning experiences for children but also provoke them to solve issues that bother them.

References

Bruner II, G. C. and Kumar, A. (2007) Attitude toward Location-Based Advertising [Online PDF].
<http://www.jiad.org/vol7/no2/bruner/Attitude%20toward%20locationbased%20advertising.pdf> [Accessed 18 July 2007]

Kettle, B. and Ross, E., 2018. Strategies for engaging curious young minds in mathematics. *Educating Young Children: Learning and Teaching in the Early Childhood Years*, 24(1), p.33.

Levy, F., & Murnane, R. J. (2004). Education and the changing job market. *Educational leadership*, *62*(2), 80-84.

Shaheen, Robina. "Creativity and education." *Creative Education* 1, no. 03 (2010): 166.

Arnone, Marilyn P., and Barbara L. Grabowski. "Effects on children's achievement and curiosity of variations in learner control over an interactive video lesson." *Educational Technology Research and Development* 40.1 (1992): 15-27.

Sobel, David M., and Susan M. Letourneau. "Curiosity, exploration, and children's understanding of learning." *Active learning from infancy to childhood*. Springer, Cham, 2018. 57-74.

McGuinness, Carol. "Playful Thinking in Action: Tools for Cultivating Children's Thinking." (2018).

Whitebread, David, et al. "The importance of play." *Brussels: Toy Industries of Europe* (2012).

Russ, Sandra Walker. *Affect and creativity: The role of affect and play in the creative process*. Routledge, 2013.

National Research Council. (2013). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Academies Press.

Bell, Stephanie. "Project-based learning for the 21st century: Skills for the future." *The Clearing House* 83.2 (2010): 39-43.

Saavedra, Anna Rosefsky, and V. Darleen Opfer. "Learning 21st-century skills requires 21st-century teaching." Phi Delta Kappan 94.2 (2012): 8-13.