the report

Tinkering Studio is in San Francisco's museum of science, art and human perception, Exploratorium. It is a workshop for playful invention, research and collaboration. It is an immersive, active, creative space where museum visitors are invited to explore an exhibition driven by curiosity, and where they can engage in investigations of scientific phenomena representing their ideas and aesthetics.

Sebastian Martin has been R&D Lead at Tinkering Studio since 2005. He studied Physics and Mathematics at the University of Erlangen-Nürnberg, Germany, which led him to explore earthquakes in the Chilean Andes and the boreal forests of Ontario through satellite images. His travels and studies made him understand the magnificent creative and playful possibilities of the natural sciences.

Tinkering Studio

A workshop-studio where people learn to investigate, invent and collaborate while playing

by Ana Moreno Salvo

INTERVIEW WITH SEBASTIAN MARTIN

You often say that Tinkering takes you back to your childhood, when you experimented with your toys. Could you explain what Tinkering Studio is and what it can contribute to the education of children and young people?

It's true, working in the Tinkering Studio often takes me back to my childhood days. Growing up in a family of toymakers in southern Germany, I remember spending time in my grandfather's workshop and enjoying inventing toys, taking things apart or playing with his tools. Tinkering is very different from the learning we often experience in schools, in that you don't rely on a teacher or other source of information but instead learn from direct experience with tools, materials and natural phenomena.

We often call it 'thinking with your hands'. It is a process in which you discover things as you go along. You learn to work without instructions. You feel comfortable not knowing everything. You learn to overcome moments of frustration, and more importantly, you learn to follow your own ideas and to change and adapt them according to the information you get from the materials and the physical world around you.

Ultimately, this changes the way we see ourselves as learners in the world and allows us to take charge of our own learning. This mindset empowers children and adults to take charge of their learning. They do not have to rely solely on what they have learned in school but are capable and competent human beings who can always expand their knowledge and skills through this process we call Tinkering.

How did Tinkering come about? Could you tell us about its start and some of the projects you are most proud of?

This work began with a project called 'Play Invent Explorer' in 2005 at San Francisco's Exploratorium. It was a network of educators working in science centres, and the goal was to explore materials at the intersection of science, art and technology. Tinkering workshops and activities always combine scientific and artistic processes. Process is a very important word in the practice of Tinkering because what we learn is the outcome of this kind of activity, so we care about the process of doing things more than the product.

> It is a process in which you discover things as you go along and work without instructions

I remember one of the first explorations we did with a small group of educators in which we experimented with light and shadow and created interesting shadow sculptures by placing small flashlights on moving platforms and arranging materials such as plastics and coloured gels to create interesting shadow patterns. During those workshops, we learned a lot about light and shadow and sparked so much interest in learning more that we realised this would be a great way to engage children. Museum visitors also learn about the subject because

we invite them to experiment with the materials driven by their own curiosity and desire to create something artistic rather than asking them to solve a problem or recreate an experiment.

So at the time I thought it would be a great idea to create a space in the Exploratorium where children could work in this relatively unstructured way without having a clear concept of the learning outcome beyond developing their ideas and following through on them. And this turned out to be the beginning of a whole new approach to practical education, which we now call the Tinkering approach.

Something I am very proud of are the first small experiments with our museum visitors. In the first studio play space installed more than a decade ago, we created an area for children to play with marbles and build marble machines. I learned that the environment, or the space that is created, makes a huge difference in the type of interactions that occur in the space. In this first study, we were careful to create an environment where the children felt at home and comfortable. They could play and sit on the floor. They were trusted, for example, to use scissors. In this environment, a lot of creativity emerged. Instead of spending two minutes, as in other science centre sites where we worked, groups of children spent an hour or more. And instead of just recreating an experiment, they built a marble run that we could not have imagined ourselves. And they proudly presented the complex contraption they had created. That's how we realised that the approach was right.

After that first experiment, we created a Tinkering Studio where visitors could make cardboard costumes and build a big city with this material to spotlight how creative you can be with a simple resource like this. I developed a way of playing with stop-motion animation, creating installations where it was easy to use a camera and take snapshots and then build a stop-motion animation.

The space that is created makes a huge difference in the type of interactions that occur there

We organised events that we called 'open make events', where we invited other people and educators to share the activities they came up with. We realised that we had discovered a way of learning that really put the learner in the driver's seat and created remarkable engagement. At one point we asked ourselves: What are they really learning? And out of that came the development of the framework we call the 'Learning Dimensions' of Tinkering, which I'm really proud of.

After more than 15 years of experience, do you think you have met your expectations? What new projects do you have in mind?

After doing this work for over 15 years, I have yet to meet my expectations. And that's for the simple reason

that when I started it with the team, we were not at all certain where this would go, and we were amazed at how it expanded and proved to be a rich and deep approach to learning. The practice of Tinkering is growing and expanding around the world. I am fortunate to be involved in constructivist learning at a time when this approach resonates so much around the world. And that's probably because right now the traditional school systems are not able to prepare children for the complex world in which we live.

Many new and future ideas will come from educators, not necessarily from Tinkering Studio. I am sure there will be new ideas and discoveries from teachers coming from the networks we work with.

We will continue to explore how to engage younger learners with the natural world and scientific phenomena and what the role of facilitators should be when dealing with young children. I am also very interested in the role of educators and caregivers or parents in Tinkering.

Teachers should become experts in the practice of inspiring and supporting children

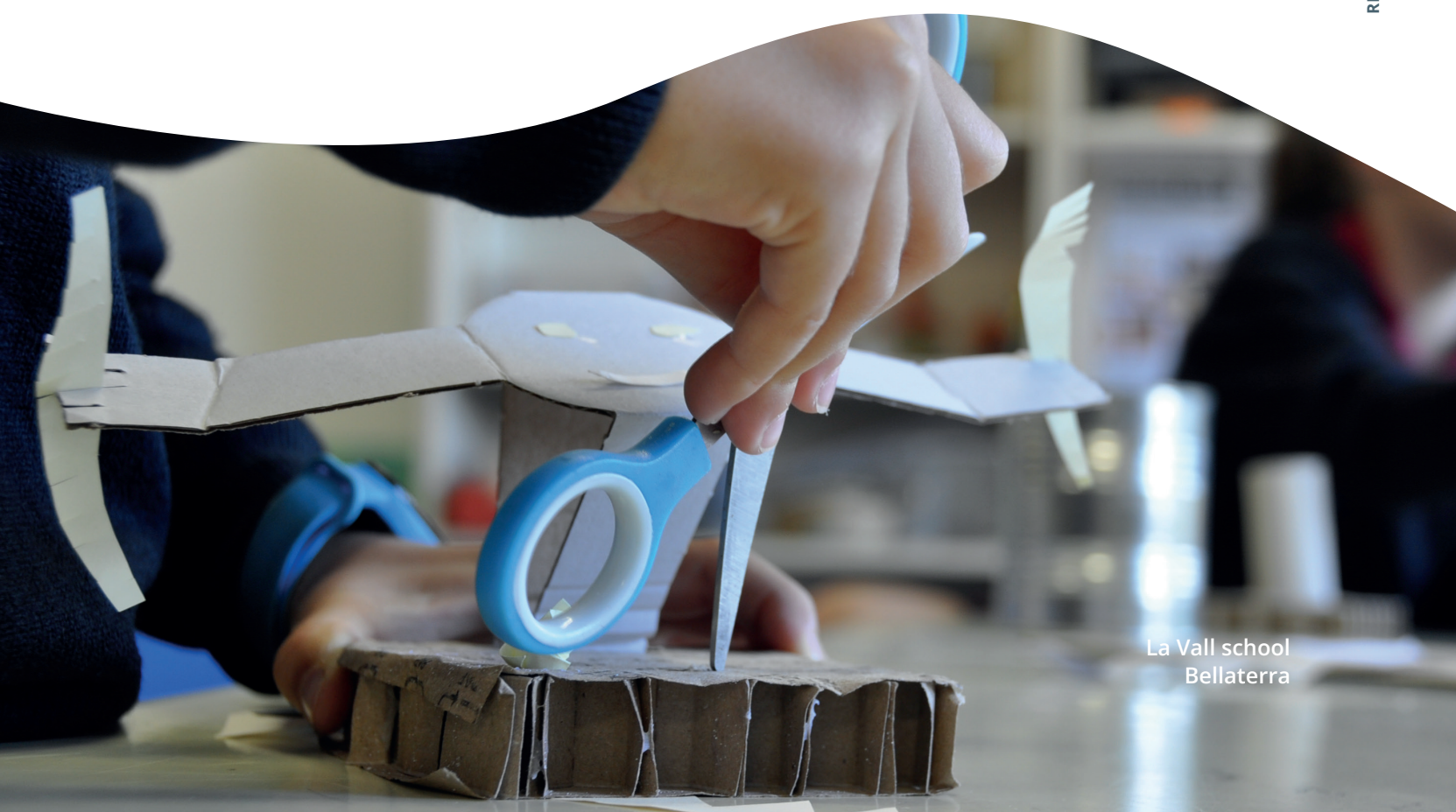
During the guidance and teaching assistance in the Tinkering process, it would be great if instead of being subject-matter experts and asking children to complete tasks, teachers would become experts in the practice of inspiring children, supporting children in their goals, noting and documenting the learning that is occurring, and then creating moments for the children to reflect on their own learning.

One of its goals is to develop the students' creative capacity through exploration, perception and the construction of their own scientific prototypes. To what extent do you think Tinkering helps students to be more creative and to trust in the potential of this ability that is so important today?

Creativity does not occur in a vacuum. Curiosity and inspiration are important ingredients for a creative process. The tinkering creates situations in which, for example, a beautiful reflection off a crystal glass makes us curious to know exactly how that light moves or reflects. It can arouse curiosity and engagement. When a student discovers this and develops ideas for projects she wants to do, then it's up to us to take her ideas seriously and encourage her to try something she hasn't tried before. When children go beyond the limits of their knowledge, that is when creativity can emerge.

What can a student do in a Tinkering studio?

A Tinkering studio can take many forms and changes every time you visit. You will usually find inspiring materials and examples centred around what we call an exploration



La Vall school
Bellaterra

space. It could be about wind and air, or the exploration of mechanisms and movements. A student could develop his or her own idea and interest around any of these topics.

They could also start by simply playing with some of the objects and materials they find. If they are attracted to something, they might decide to start a project: create their own mechanism to tell a story, such as making a small automaton that can be operated. Then they could make little figures move and tell a story. And that story could be about a topic that interests the student, such as soccer, or it could include a pet they have at home.

In a Tinkering studio, you can create a project with personal meaning around a theme that is related to natural phenomena.

Do you have experience or have you thought about how tinkering could support formal education? What could a teacher or school in Spain do if they wanted to introduce Tinkering in their classrooms?

There are places all over the world where you can do some of these things. And these places can be your grandfather's workshop, as in my case when I was a child. It could be in an artist's studio, or in an informal learning space such as science centres like CosmoCaixa, but it could certainly be at school, too.

Schools around the world are developing the Tinkering approach. And one fantastic example is the work being done by the 'Artencurs'[1] group in La Farga or La Vall schools, for example. Reggio Emilia in Italy is our long-time partner and an inspiration for our approach. I believe there are many aspects of Tinkering that are applicable when working with younger children, and it is being done very successfully in formal school settings. For a teacher in Spain who wants to get started, Bea Rey, from the Catalan school La Vall, has good examples for taking the first step. We find some Tinkering activities, such as "Marble Machines" or "Scribbling Machines", to be a good starting point. For this reason, we have developed online materials that can help to organise an activity with this methodology.

In general, there are three aspects that are important to think about: the materials themselves, finding rich and inspiring materials that are simultaneously familiar and attractive; the environment, creating a space that is not a traditional classroom but a place where children and students can sit around the table and collaborate, where they are surrounded by interesting materials and inspiring examples; and how we, as educators, contribute to this play. Our role as educators in creating a good Tinkering activity is to support, inspire, show interest in students' ideas, create moments of shared understanding and create moments of reflection.

And at home, what can parents do to encourage their children's curiosity for science and their ability to bring their ideas to fruition with their own hands?

We often hear from enthusiastic parents and children who have created a Tinkering experience at home. For example, some made their own "Marble Machine" after visiting the Tinkering studio, or started making stop-motion animations after trying them out at the Tinkering studio. When the COVID-19 pandemic caught us by surprise, we decided to focus on families and children at home and think about how we could support them to create Tinkering experiences in their own homes. We realised that many phenomena, such as light and shadow or the balance of objects, could be explored by Tinkering with materials you already have at home.

Parents can provide time, inspiration and suggestions for their children to engage with scientific phenomena in a playful way at home. A good example of this would be to

Educators should to inspire, show interest in students' ideas and create moments of shared understanding

accept Tinkering Studio's invitation to set up a chain-reaction machine in your home using materials you find around the house, such as kitchen items or toys or dominoes, and placing them in a chain so that when one item falls, it triggers an amazing chain reaction machine. Doing this type of activity at home can be more exciting than doing it in a public space, because children can use the objects they like and are interested in.

It is a good way to experience scientific phenomena such as gravity, the mechanisms of movement and logic in a playful way. The Tinkering Studio website offers some suggestions, called 'Tinkering at Home', for parents or caregivers who wish to get started in Tinkering with simple materials in their own home. As always, Tinkering at home is a social activity and should be done as a group, which means that the adults in the family should also be involved. This can be a great opportunity to create a co-learning situation with the children. Finally, whether you are a caregiver, parent or teacher, we at the Tinkering Studio are always interested in receiving feedback from the community and highly value children's ideas and creations. You can send a photo or a short note to the Tinkering Studio through the 'Tinkering at Home' website or on the Tinkering Studio social media.

Note

[1] Artencurs is an educational platform in continuous development based on the conviction of art's potential as an educational and change tool.

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