Thinking with your hands

Tinkering at school boosts curiosity, creativity and the ability to learn

by Ana Moreno Salvo

INTERVIEW WITH BEATRIZ REY PEÑA

Beatriz is an art teacher at La Vall school in Bellaterra. She has been applying Tinkering in her classroom art studio for more than 5 years and collaborates with the Tinkering Studio at the Exploratorium Museum in San Francisco. She holds a degree in Fine Arts from the University of Barcelona and is a member of the educational platform Artencurs.

You are a pioneer in implementing Tinkering in the classroom. How did you learn about Tinkering Studio and how did you come up with the idea of incorporating it into your teaching, in that it a science project and you an art teacher?

My first contact with Tinkering Studio was in person. A few years ago, I was fortunate enough to spend an extended stay in San Francisco with my husband and children. For some time, we had been co-creating as a family with my children, which was a small laboratory of ideas. The visit to the Exploratorium was 'love at first sight', a springboard to see the potential of what we were doing. The place, the exhibition, everything attracted us from the first moment and we went back several times. I left there with the clear idea that I wanted that in my school. I loved the fact that even though it was a science museum, the artistic gaze was all over the museum. There were works and reflections resulting from manual activities merged with the scientific exhibition in all the spaces.

This is natural in an art museum, since art speaks of the world, of people and of people's relationship with the world, just as science does. Offering a gaze that takes the leap from art to science and vice-versa opens many ways of approaching reality.

In schools, it is necessary to make room for curiosity and for open, flexible and transversal ways of bringing the student closer to the world in an appealing and exciting way. Tinkering, or 'fiddling with the hands', opens up a wide range of possibilities.

Tinkering at school helps to bring multiple intelligences to the fore. Working with the hands is also a type of thinking that has an unconscious

They are hands that aren't working just for the sake of it but are constantly imagining, projecting, evaluating, revising, retesting

La Vall school
Bellaterra

and an intuitive component, which leads to reflection. With the hands you constantly test: What if this were thinner? And when I make it thinner, I ask myself: Does it work better now? They are hands that aren't working just for the sake of it but are constantly imagining, projecting, evaluating, revising, retesting. The more I get involved, the more conscientious the 'fiddling' becomes.

What do you think it brings to your students?

I believe it is a way of learning through experience that helps them to come up with their own strategies. The first thing you notice is that the students feel very capable and involved, which is a gateway to intense, connected, deep work. The

It is a gateway accessible to everyone, where curiosity engages them and motivates very flexible learning that has no limits

Tinkering proposals are presented as 'on floor, high ceilings, wide walls'. They are gateway that is accessible to everyone, where curiosity engages them and motivates very flexible learning that has no limits. Keeping curiosity piqued is key, and Tinkering clearly encourages this.

Perhaps an example will help to clarify this. Recently, the third-grade students were engaged in activities about balance. While experimenting with objects in equilibrium, we saw works by artists such as Daniel Firman with his balancing elephants, and they opened the way to very interesting conversations. The students played, drew and reflected, and everything was shared with the group.

This activity provided a field in which to investigate, where they all joined, and each of them gradually took it to their own terrain. When asked: Where do you see the relationship between balance and your life, they responded: 'My mother gives me balance. I am very messy and she helps me', or 'my stuffed animal gives me balance when I am sad', or 'balance is... like sweets: if

you eat some, other days you have to eat other things'. The connections that each makes with other aspects of their lives, food, emotions and family provide an artistic look where metaphorical meaning and physical phenomena merge. All of this materialised in balanced paper structures.

In subsequent sessions, balance appeared everywhere, in the hallway, in objects, in the city, in art, in engineering and in our own bodies! They are discovering something that they actually carry inside them, and it gives them a wonderful feeling: I can discover the world all by myself! And they do it by manipulating, observing, reflecting, trying different things, creating.

How did you integrate Tinkering into your classrooms? What are your main objectives and how do you work on them in class?

Integrating Tinkering into our school has been a process of fusion. The same thing is happening in other Studio and Atelier classrooms of the Institució Familiar d'Educació, where we have been working for years to build creative classrooms where the classroom design and the students' relationship with it is paramount. The students find a classroom designed by spaces, with different artistic languages, where the materials are at their disposal and encourage them to get down to work.

One benefit we are seeing in the students is that integrating the Tinkering proposals opens the range of possibilities with which they can express themselves and breaks the cliché, which unfortunately still persists, of 'art is not for me because I can't draw'. Another interesting aspect of Tinkering is that it always works collaboratively. Working, reflecting and sharing go hand in hand, and in this way, students are involved in the search for a solution that is really valid and can be shared, which increases their interest and commitment.

One goal is to help them discover for themselves that they have no limits. It is an opportunity to discover what you are capable of, your interests, your way of doing and solving, why you decide one thing or another. On the other hand, it is demanding; it requires commitment. Why do you choose a colour? Why do you do it that way? Do you like it that way not because your teacher or classmate likes it but because you like it? Students gradually see that they have to like it and reflect on it. Mot working with a model really helps them to be honest and really get involved. You need to find your own solutions, be creative, keep improving and be able to explain what you do and why you do it.

Art is the process of making something one's own, subjectivising something in the world, such as the colour green, and then sharing it

The role of the teacher is very important, and the work before and after the session is also very important. To do this, we have to learn how to document, listen to the students, mentor them respectfully and ask appropriate questions that help them to recognise what they are doing and to take a step further. The teacher should be open to working alongside the students, not in front of or above them. We have to zoom in and out as needed.

An example of how we work on an art-tinkering project in the classroom would be:

We start with a phenomenon such as magnetism, equilibrium, light or shadow. We research related Tinkering proposals and look for the materials to carry them out by transforming some space in the classroom. At the same time, we investigate artists for whom this phenomenon is important and discover through their work why it is important to them and what their point of view is. Without further explanation, the students begin to experiment. Based on Tinkering's proposal, they discover while playing, generating a shared reflection on and understanding of the phenomenon.

It's nice to see how each student notices something different and interacts differently. Some test and test without stopping, some observe what others are doing, some get frustrated, some are constantly discovering challenges. Some need to constantly show you what they have learned, some prepare it to share it as a gift. Some get blocked and ask permission for every little action.

As a teacher you learn a lot just by observing these different ways of doing things, and when working with a new group, your expectations about the possibilities of the proposal multiply.

In a second round, we go back to the artist's gaze. Beyond the references we have seen, the students become artists and initiate a personal relationship that merges the scientific and artistic parts. We go from the scientific what does it mean, how does it work, where have you seen it, how can I build it, to the artistic what is it to you, what does it mean to you, what aspect

La Farga school
Sant Cugat del Vallès

of society does it connect with. In a way, art is the process of making something one's own, subjectivising something in the world, such as the colour green, and then sharing it. Artistic expression is a response to something that comes from the outside-in and from the inside-out in an artistic expression of its own. This is where art complements and gives meaning to this approach to a natural phenomenon or object such as magnetism or equilibrium.

As a teacher who researches, experiments and reflects, what does art bring to science and what does science bring to art?
I think that art in school helps the students to know themselves through what they do. It's a way to communicate without words. Thinking by drawing, thinking by building, thinking by moving and interacting helps to bring to the surface aspects that are often hidden in other realities at school.

Science helps learners to relate to the world. Its laws, collective knowledge, research. The binomial art + science brings students closer to the world by helping them to build critical thinking where what they learn is related to the meaning it has for them and its contribution to society.

What is your collaboration with Tinkering Studio based on?
Tinkering Studio offers a number of guides, examples and workshops which they share openly. There is a clear intention to share and create knowledge together. And they do it with a Tinkering philosophy: without fear of sharing trials, successes and mistakes. Their approach is to make it easy for teachers, so the materials they use are always easy to get your hands on.

In this sharing and learning, we came into direct contact three years ago while preparing a European collaboration where we showed

The binomial art + science brings students closer to the world by helping them to build critical thinking

Tinkering's contribution to the artistic process. The lockdown was a really tough laboratory: learning collaboratively with your hands while online! When faced with difficulty, opportunity arise, and in part that's what happened: connections and collaborations appeared with everyone and I personally learned a lot and from many people.

Our collaboration has recently taken shape in two projects: First of all, we have exhibited a cardboard project from Artencurs in 'The Art of Tinkering'. It's a fantastic exhibition that has been on display all summer at the Exploratorium in San Francisco, where our students' work was displayed as an example. This work actually started in 2020, and the collaborations around it have been diverse, gradually becoming a project and staying open. Another recent collaboration has been on the prototype of a kit for tinkering with balance (Open kit for tinkering with balance)

Tinkering Studio has projects around natural phenomena from a scientific vantage point. They have one related to balance called 'Exploring Balance' with different approaches that vary and expand. In recent months, they have been working on prototypes that allow for autonomous exploration of balance, offering contact between the material and the students and generating individual learning by the simple act of playing and building something with it. The way they develop the prototypes is based on applying their own Tinkering method. They explore materials with an objective, but often without knowing where they will end up. In the case of 'Exploring Balance', Sebastian Martin toured different European countries, and when he passed through Barcelona he suggested that I and my colleagues from La Farga school participate in this prototype. It seemed like a great opportunity to learn, and we created a makerspace for the occasion and spent a day with Sebastian to make the prototype. It was very interesting, because building the material helps you understand much better what you are doing and what can happen next. I personally found Tinkering to be a very powerful way of learning for both the student and the teacher. We were then able to put the material into practice at CosmoCaixa, first in workshops for families and then with CosmoCaixa trainers to reflect on Tinkering. At CosmoCaixa, they have a space called Creactivity based on the Exploratorium in San Francisco. From here the collaboration continues. This year we will experiment with these prototypes in our art studio classrooms, create documentation, reflect on how to move forward and share our experiences with the Tinkering Studio team and whoever we meet along the way.

What future possibilities do you see for Tinkering at a school like yours? How can we create a symbiosis between the two that produces environments rich in STEM learning and creativity?
Working with the hands while reflecting on what is happening allows the teacher to observe where we start from, what real knowledge the students have. If we ask students what they know about balance, they are able to say something, but when they 'play' with balance for a while, they are able to find many connections with their daily life.

The time wasted 'tinkering' is not wasted; it is a time of a great deal of reflection, and it ends up boosting the students' learning incredibly. Thus, starting with a Tinkering experiment at the time we are working on previous ideas before any learning, especially in science, brings the students' knowledge to the table and piques their interest.

We do this with the intention of opening the students' minds, curiosity and interest to learn where they need to learn.

Let me explain it with an example. One of the star activities of the Tinkering Studio is the 'Marble Machine', which are marble circuits on the wall, through which a circuit is redesigned using a trial and error strategy so that the marbles can go from one side to the other. During this activity, many things happen that require collaboration, design, evaluation and reflection on what is constantly happening. First, students are invited to explore with the materials, such as the marble, the wooden pieces, the ramps and the springs, and to build a circuit while overcoming problems, controlling the speed of the marble, changing the slope, reducing the speed, analysing the friction.

This activity can be a starting point to work on physics, mathematics and engineering concepts, and it can be related to other subjects, such as talking about the digestive system, as I have seen in examples from other schools, or thehistory of the Industrial Revolution or the parts of a narrative when constructing a story.

In the Art Studio, for example, once they have 'fiddled' with all these concepts and internalised them, we encourage them to reflect further and suggest, for example, that they imagine that the marble is something or someone. At that moment, the circuit takes on another meaning, and we ask them to tell us its story. Usually the students' stories are related to the materials used. It is amazing how they make the circuit their own. One time, 12-year-old students used a piece of bicycle inner tube and had serious difficulty understanding its behaviour and getting the material to do what they expected it to do. In the final story, they had turned the piece of rubber into a 'teenage elephant' that was unpredictable and you never knew how it was going to react.

In Tinkering, the projects are open, and although the way in is quick and easy, there is no limit to their depth.

As a teacher, one of the keys to enhancing students' creativity is not to determine the end of the projects but to focus on the students' process. It is necessary to lay the groundwork but then leave all possibilities open. The less we imagine what might happen, the more creativity is going to be enhanced. In this way, students create their own paths. If you propose an activity in which there are one, two or even three paths, but you know them previously from the beginning to the end, the students will be able to choose among them, but there is a fourth, a fifth, and a sixth path that we miss. There is a lot to lose. If we start without these limitations, the task is more intense, because we have to mentor each student more on their way, to make them understand it, to help them to take decisions, to reflect, to see where they have arrived and to evaluate the whole process, but it is worth it. This is achieved through good documentation, which may be time-consuming but it guides the process and has a lot of potential. We are the first to benefit, as it helps us to grow and to plan things better. In addition, students learn a lot from each other when they share and explain the path they have chosen, why they have done it and how they have done it. It is a method that triggers exponential learning, which helps each student and the whole group.

At a recent conference in Barcelona, Ryan Jenkins of Wonderful Idea Co told us that, 'Tinkering is one way to learn. It's not the only way to learn, and it may not be the best way to learn, but I'm convinced that when you learn without Tinkering, you're missing something.' I believe this is true. The hands must be taken into account when learning and losing the fear of experimenting. Tinkering brings possibilities along the lines of making learning interesting, quick, real and meaningful for the learner. It is worth using it, in school and not only in the art classroom. It can be useful in all subjects and even in the playgrounds: why not? In the particular case of STEAM subjects, Tinkering Studio provides a very interesting connection that especially helps students understand and become interested in these subjects.

It is necessary to lay the groundwork but the less we imagine what might happen, the more creativity is going to be enhanced

La Vall school
Bellaterra