

# Integrating meaningful evaluation and tinkering learning through creative workshops and thinking routines

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## ABSTRACT

Make Believe Project (MBP) is an initiative sponsored by two organizations which are part of the Brazilian Creative Learning Network: Instituto Catalisador and Casa de Makers, both devoted to formal and informal education mostly with public schools. MBP was a 4-month project idealized by six educators allowing unmotivated public school teenage students with academic difficulties to explore their own beliefs, knowledge, interests, and imagination to co-create projects through the Agency by Design Framework (from Project Zero). With the Sustainable Development Goals as background, MBP designed 10 weekly after-school maker-centered learning workshops around the scientific concept of energy explored through hands-on experiences. As the main result, MBP stimulated the teenagers' self-confidence by making visible the triadic development of capacities, motivation and disposition regarding both scientific studies and creative projects.

## Keywords

Agency by Design; Creative learning; Thinking Routines; Maker-centered learning; Formative assessment

## 1. EDUCATIONAL SETTING. MBP BACKGROUND

The Make Believe Project (MBP) is a collaborative project idealized and developed along the first semester of 2018 with students from Escola Estadual Carlos Maximiliano Pereira Dos Santos, a public school in São Paulo, Brazil.

MBP idealizers are linked to two educational organizations that are focused on spreading creative learning experiences within private and public schools. These organizations are deeply engaged in projects related to maker-centered meaningful practices in schools, as well as in non-formal educational settings in Brazil. MBP idealizers are active members of the Brazilian Creative Learning Network (BCLN - <http://aprendizagemcriativa.org/sobre.html>).

One of the organizations, Casa de Makers (CM), where the MBP workshops were developed, is a private initiative that brings the Maker Movement to children and teenagers. It was created by Science teachers and equipped with the most varied tools, such as joinery tools, a 3D printer, and a laser cutter to encourage hands-on experience.

The other organization, Instituto Catalisador (IC), a civil society non-profit organization that brings together professionals from different areas with a common interest: creative and meaningful education. Joining Science and Culture through tinkering instigating activities, it offers possibilities to mix conventional materials and new technologies, promoting the encounter of different languages both to students and educators, school leaders and other agents in the educational system.

In 2017 MBP future idealizers decided not only to attend the Fab Learn Conference at Stanford University but also to visit several innovative educational centers in San Francisco and Palo Alto with a group of other Brazilian educators in a schedule organized by IC. It was a fabulous opportunity to get in touch with relevant educational initiatives for reflections on creative hands-on approaches, maker culture, project-based learning, integral education and learning communities.

After their return to Brazil, they stayed in touch and decided to create a study group to participate in an online MIT course, "Learning Creative Learning", accompanied by weekly discussion meetings in CM, inviting even more educators. Later, at the beginning of 2018, six of them decided to attend another course: "Thinking and Learning in the Maker-Centered Classroom" of Harvard University's Project Zero and to develop MBP.

## How the Make Believe Project was idealized

We were interested in delving deeper into our theoretical-practical approach as a learning community, understanding and applying creative learning and the Agency by Design (AbD) framework from Project Zero (thinking routines, learning cycle, sensitivity to design) to our

projects. Specifically, the MBP proposal intended to implement and observe the outcomes of the AbD framework with a new after-school group.

We invited students from different grade levels (12 to 15-year-olds) from a public school near CM and started working on developing dispositions toward our proposal: 10 after-school workshops of creativity and invention. We picked them up at school weekly. The ride from their School to CM was part of the proposal: each session began as a pedagogical walk, observing the city. This walk worked as a provocation and helped us create a bond with the group and develop an integral education approach (integrating city, life themes and didactic work).

As there were many students interested in participating, the school coordinator decided to prioritize teenagers with any kind of difficulty at school that would be motivated as a result of being chosen to participate. Therefore, students with bad behavior, low performance and lack of motivation participated in the workshops. These students belonged to low-income families, some with very low levels of literacy.

We were challenged to apply the AbD framework (looking closely, exploring complexities, and finding opportunities) to help them to develop a new way to see and notice the city. In each session, along with the ride from school to CM, kids were encouraged to observe the city from the themes related to Sustainable Development Goals (SDG) of Unicef and the United Nations. Their findings and comments were taken as a trigger later in the activities developed. Specifically, in this learning experience, we focused on putting in practice the thinking routines.

### **Main Challenges**

One of our biggest challenges was to design learning experiences that were really based on the student's response to what we were presenting to them. We had planned to incorporate the Thinking Routines (TR) at the second part of each workshop, but we realized it was not working. So we had to figure out how to introduce the TR in a meaningful way that did not interrupt the flow sparked by the tinkering and making. We started doing it in a language they were more interested in, such as recording audios and videos, uploading them in a real-time sharable digital board (padlet [www.bit.ly/oficinadeinvencoes](http://www.bit.ly/oficinadeinvencoes)), where they could revisit the activities, add comments, make contributions and share with colleagues and family.

Understanding the role and aims of the TR was a key point for this group. Students were not familiar with it, and to embark on this they had to unlearn to learn: they needed some time to understand that the TR were part of their learning process, making visible even to them what they were learning and that it was not a bureaucratic evaluation of a traditional school. By the time the TR had become a habit of mind in our meetings, it made sense to them and they were willing to do them.

To have classes outside the school environment, at a makerspace context (so diverse from the regular class, with desks in rows) was a completely new experience for the students. Although they may have previously built toys or models in occasional workshops at school, to learn from making-centered practice was something they were experiencing for the first time. That is one of the reasons why we chose to apply the TR with them, in order to help make it visible that a learning process was really happening.

Besides all these, there were the differences among each of us, as educators, regarding maker-centered activities as an educational strategy, as each of us had a different teaching approach in our own learning spaces. All these differences have enriched our experience.

## **2. DESCRIPTION OF THE EDUCATIONAL EXPERIENCE**

Our main general goal in all 10 sessions was to develop hands-on creative learning experiences, using AbD framework to foster in students a new way of seeing and noticing the city, helping them to develop agency with hopes that they could see themselves as city changemakers.

We started sharing the general goal of our workshops which was to wonder about opportunities to redesign the city. We challenged students to imagine and experience a tinkering activity of a future world (as Brazil in the 22nd century) on some specific themes, such as shelter, feeding, clothing, and transportation. In the following sessions, Unicef's SDG challenges would be introduced as a generative theme within the 11th SDG: how to make cities and human settlements inclusive, safe, resilient and sustainable.

### **Thinking routines used to make thinking visible: evaluation *as* learning**

TR developed by Project Zero's research (Richard et al 2011, Clapp, 2017) are triadic scaffolding resources for students to think and, at the same time, TR act as a formative evaluation tool that shows both to teacher and to students what and how their knowledge and skills are around the studied object. We planned a sequence of didactic activities supported by different TR:

1. **See/Think/Wonder:** As we walked with students from their school to CM, we encouraged them to observe the city, the streets, the people and to, looking closely, find complexity and make use of authentic inquiry opportunities. At CM, they first created something by tinkering then drew or wrote down their perceptions and insights.
2. **Parts/Purposes/Complexities:** related to close observation of a mini LED. We intended to deeply apply the TR by developing an activity that is called "What makes your eyes bright?". They tinkered with the LED and found out a personal way to express themselves by modeling a structure to support the LED alighted and to create curious city objects by tinkering with modeling mass. We ended the activities by asking students for words representing their feelings about all meetings, and with a cellphone app, we created a Word Salad as a tag cloud of feelings.



Students on different MBP moments: city walking, creating electrical gadgets and recording their perceptions, insights, and questions by means of Thinking Routines (as a triadic scaffolding tool to make thinking visible and recorded).

3. **Parts/People/Interactions: to foster student's reflections about electrical systems.** We presented students to some situations and asked them to identify and reflect on Systems and their parts, people and interactions. Small groups were challenged to represent the energy path (partially) from the "place where it is generated" to their house. Some misconceptions detected at the brainstorming activity appeared again, allowing us to discuss it deeper. Students were asked to share their work through a personal video. We ended up constructing their own System definition. One of the kids concluded: System is harmony.
4. **Think/Feel/Care: to continue reflecting on systems and interactions.** We created a role-playing game to think holistically and exercise perspective-taking approach (empathy with others' perspectives) about systems, identifying the parts of an electrical energy system, their chain interactions and to reflect about the people involved. The situation presented was that their neighborhood would be without power for a couple of days because of a natural disaster. Different people would be involved, each of them with a different point of view and each group of students was representing a character and should create a dialogue among the people involved. This way, we worked with Think, Feel, Care routine, as well as continued reflecting on systems and interactions.
5. The learning process involving empathy and perspective-taking regarding different people's needs, led students to: investigate how electrical systems work (looking closely); explore some gadgets that could generate energy (exploring complexities); build a model representing a city and its electricity system (finding opportunities).
6. **"What if/Imagine If" to foster the collective inventions.** We presented the activity in a way to open a final creation by design that was an invitation to reflect on all whole MBP workshops. We discussed the integration of the three maker's capacities: looking closely, exploring the complexity and finding opportunities to think more about them. The use of "Imagine if" TR was a support to the tinkering prototyping of a mini electrical system connecting action with reflection about the people involved in this system, as well as in identifying the connections in the System.

### 3. CONCLUSION

#### 3.1 Results

AbD was a powerful framework for planning meaningful maker-centered learning activities that allowed us to focus on the SDG. TR were relevant tools to make student's thinking visible and registered. By this formative approach, we could intertwine the learning and the evaluation processes: on the one hand, the evaluation carried out could be incorporated as learning; on the other hand, the recording of the learning process worked as self-assessment and as support to increase self-confidence for students. As a whole, this learning approach model integrated competencies to foster sensitivity, capacities, and dispositions. We understand the basis of this powerful learning approach is provided by: a) making visible student's prior knowledge and connecting it to new concepts and to other student's hypothesis involved within the understanding of general concepts; b) tinkering experiences to think in a concrete way, constructing gadgets that allow the reflection in the practice of these concepts and the appropriation of the knowledge involved; c) communication in context, as a mean to amplify students thinking into a collective construction, allowing them to share with more students and teachers from their own school the knowledge built up during this process, creating dispositions toward: listening and observing one another (allowing all group participation, an opportunity for each one to express themselves), and also developing student's agency by fostering their curiosity and practicing different types of choice (from choosing objects on design hunt to defining a project to design and build).

Considering all that, we were able to gather evidence that students were learning throughout each different strategies we deployed. Besides the ideas and thoughts we collected while the students were immersed in tinkering experiences, the testimonials they gave to each other when sharing their plans in the mini-group reunions or presenting the work done, we could observe and analyze their learning process through the use of the TRs (sometimes done in audio, sometimes in writing and drawings). The students' learning journeys were also registered in the referred digital board (padlet) built collaboratively along the workshops. A retrospective video was edited by the educators

and presented to students at the last session with the intention of helping to make visible to the students all the steps they had been through and what they had learned in each moment. We invited the students to fill a reflexive diary too, as a personal activity to conclude this cycle of learnings, recordings, and evaluation. MBP video can be found in this link: [https://www.youtube.com/watch?time\\_continue=1&v=einPG3JO1z8](https://www.youtube.com/watch?time_continue=1&v=einPG3JO1z8).

As a follow up from MBP, Julia Andrade created a teacher's professional development course on Instituto Singularidades University applying the maker-centered learning framework and tools from PZ. As a result of continuing research on meaningful self-evaluation tools (on *assessment as a learning perspective*), she developed a quick self-evaluation graphic methodology to make student's own perception regarding any learning topic visible and self-assessable (from curricula subject matter to maker's skills and dispositions). The tool was successfully applied to more than 400 public schools teachers and their students by Reference Center of Integral Education at Tremembé/SP. A version of this quick self evaluation tool can be found at Integral Education Curricula Platform Methodology: <https://educacaointegral.org.br/curriculo-na-educacao-integral/materiais/etapa-1-met-autoavaliacao-rapida/>

Excited about the impact of the TR, Instituto Catalisador, parallel to the MBP, also incorporated them at Projeto Pontapé in Pirituba, São Paulo, a partnership with Instituto MRV with more than 400 students from public schools. To make it accessible to many more Brazilian educators, IC established an agreement with the AbD Team and translated all AbD's TR to Portuguese, which are now available in their website ([www.agencybydesign.org/thinking-routines-tools-practices](http://www.agencybydesign.org/thinking-routines-tools-practices)).

### 3.2 Broader Value

The triadic theory of disposition developed by Project Zero shows that when the agency is developed by the design of students' own projects they not only develop capacities but also dispositions and sensitivity to use their own capacities and knowledge. If for any student it is a strong statement, for students with several academic difficulties it is especially important, because this approach not only develops capacities and motivations but also brings out some disposition and self-confidence to notice their own ongoing capacities as learners, facilitating a metacognitive approach to science learning.

The MBP experience shows us that the AbD Framework favors the planning of maker activities and integrates evaluation and learning through TR. It facilitates documentation, portfolio registration and supports student thinking. It opens a new way to think about learning and evaluation, bringing both together evaluation as learning.

The maker empowerment resulted in a fast outcome: in the end, they were very proud of themselves and their complete meaningful creations. We were assured that TR really organize minds, hands, and hearts (dispositions).

Tinkering (as creative and visible "thinking with fingers") is powerful. Student managed to come up with interesting objects in a few minutes. Maker-centered learning brings rapid observable results in terms of motivation, engagement and maker skills.

To articulate hands-on moments with shifting (small and big) group discussion empowers learning and perception (retrieving, connecting and articulating ideas and perception)

Furthermore, we have realized that creating educator communities allows rich experiences and excellent results. It leverages each member's performance, too.

As a valuable feedback, the school principal told us that she could see that during and after MBP, some of the students were behaving differently with her and with other teachers at school. They had become more talkative and open-hearted. We, in fact, had observed this change during our encounters at the CM, and it was very meaningful for us to learn that they brought this different attitude back to school. More than that, we were glad that the principal had noticed this change of perspective in the students and that she was considering it a relevant result. We must point out that she was so committed with the proposal that she even accompanied the group one session at CM. It gave us the impression that this project also left some impact on her.

## 4. BIOS

**Carmen Sforza** is an educator and researcher on the Maker Movement and Education 4.0. She is managing educational projects in public and private schools aiming to help to transform educational approaches.

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## 5. REFERENCES

- [1] Ackermann, Edith K. 2014. *Cultures of creativity and modes of appropriation: From DIY (do it yourself) to BIT (be in it together)*. [https://www.researchgate.net/publication/263090009\\_Cultures\\_of\\_creativity\\_and\\_modes\\_of\\_appropriat](https://www.researchgate.net/publication/263090009_Cultures_of_creativity_and_modes_of_appropriat).
- [2] Bacich, L., & Moran, J. 2018. *Metodologias ativas para uma educação inovadora - uma abordagem teórica-prática*. Penso Editora Ltda.
- [3] Clapp, E. P., Ross, J., Ryan, J. O. & Tishman, S. 2017. *Maker-centered Learning, Empowering young People to Shape Their Worlds*. Jossey-Bass.
- [4] Papert, S. 2007. *A Máquina das Crianças: Repensando a escola na era da informática (edição revisada)*. Nova tradução, prefácio e notas de Paulo Gileno Cysneiros. Porto Alegre, RS. Artmed.
- [5] Petrich, M., Wilkinson, K & Bevan, B. 2013. *It looks like fun but are they learning?* Available: <<https://llk.media.mit.edu/courses/readings/DesignMakePlay-Ch1.pdf>>. Last access 01/12/19.
- [6] Platt, C. 2016. *Eletrônica para Makers: um manual prático para o novo entusiasta de eletrônica*. São Paulo: Novatec Editora.
- [7] Resnick, M. & Rosenbaum, E. 2013. *Design for Tinkerability*. In Honey, M. & Kanter, D. (eds) *Design, Make, Play: Growing the Next Generation of STEM Innovators*. Disponível em:< <https://web.media.mit.edu/~mres/papers/designing-for-tinkerability.pdf> >, acesso em 18/07/2018.
- [8] Resnick, M. 2017. *Lifelong Kindergarten. Cultivating Creativity through projects, Passion, Peers and Play*. MIT Press.
- [9] Ritchart, Ron; Church, Mark; Morrison, Karin. 2011. *Making thinking visible: How to promote engagement, understanding, and independence for all learners*. Jossay-Bass.
- [10] Robinson, K. 2016. *Creative Schools. The Grassroots Revolution, that's transforming education*. Penguin Books.
- [11] Wilkinson, K. & Petrich, M. 2013. *The Art of Tinkering*. Exploratorium and Weldon Owen Inc.