

Meaningful Hands-On Professional Learning for Teachers: Building up a Constructionist Practice Through Circles of Inventions

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Abstract: Professional learning for in-service teachers, so necessary for education, can be a challenge for teachers in public schools in Brazil with lack of time and resources. Proposing innovative maker-centered learning may be complex for many homeroom teachers who have never, themselves, experienced a maker-centered classroom. In this paper, we share the design of a workshop to introduce constructionist learning to educators, that is planned around the Circles of Inventions framework, that is easily adapted to different contexts, while bringing up the value of experience itself and metacognition to the professional learning process.

Introduction / objectives

Professional learning for in-service teachers is an ongoing need for education practices to be reviewed, reflected upon and for best practices and research findings to enter classrooms and affect the learning of students. Organizing meaningful and profound professional learning experiences for in-service teachers, however, in the context of Brazilian public schools, is a significant challenge for school leaders and teachers with very limited time available to learn, work and plan together. For the last 5 years, the authors have implemented numerous learning experiences using a framework named Circles of Inventions (Ricci P., Lederman K. S. and Junqueira R. 2019) - which includes reading, making, reflecting and the sharing of new narratives and thoughts - with students in public schools and in other educational settings, as well as with educators, in Brazil and abroad. This framework has allowed for interesting professional learning processes related to Constructionism, through 2 hour workshops, that are accessible and profound as they enable teachers to: 1. immerse themselves as students, 2. think with their hands, 3. have their voices heard, 4. connect to other practitioners in a meaningful way, 5. make connections to their own curriculums and 6. work in groups in an equitable way. This paper intends to illustrate the design and implementation of this workshop in different contexts and highlight the challenges and learnings from these implementations to spark further discussion on how this framework may be used in diverse professional learning settings with multiple different learning outcomes intended.

Design

In order to foster a constructionist learning experience, where something meaningful, shareable and thought provoking is created (Papert, 1991), among teachers who are not necessarily familiar with maker centered learning practices, we came up with a variety of Circles of Inventions workshops which bring up the value of experience itself and allow for a metacognitive experience for teachers to think about their learning as well as of their teaching. For each group of teachers and each singular occasion, we chose specific texts capable of catalyzing a creative process, reflection and the articulation and sharing of new ideas. Elements that are aligned with constructionism and the 4 P's described by Resnick - Projects, Peers, Passion and Play. (Resnick, 2020)

The Circles of Invention are made up of three distinct moments: First, the **Circle of Reading** where a story functions as an immersion into a common territory of meanings which could be interpreted as a "microworld" to foster tinkering. This microworld may be interpreted as a safe place, a leverage for the child's personal ideas to emerge, and subsequently the tinkering itself becomes a microworld for new narratives to emerge and for the learning of story building and storytelling. This cycle could be related to Edwards' functional view on microworlds, where learners are expected to experiment, manipulate objects, engage in open-ended explorations as well as receive and interpret feedback, iterate and create new objects, solutions and challenges (Edwards, 1995. P. 144).

Second, the **Circle of Making/Tinkering** is not a moment to represent one's understanding of the story, but a time and space to tinker, think with one's hands about the questions raised by the educator. These prompts, must be carefully crafted to spark a possibility of inquiry and a creative process, individually or collectively. Third, the **Circle of Narratives**: a fundamental part of the framework where participants have the space and time to share their inventions and stories. From the thinking with these artifacts created, which connects to the concept of objects to think with (Papert, 1991) of constructionism, new narratives and thoughts emerge for the issues in

question, as well as space is made for the participants to express themselves, be heard and also listen to peers. (Ricci P., Lederman K. S. and Junqueira R. 2019)

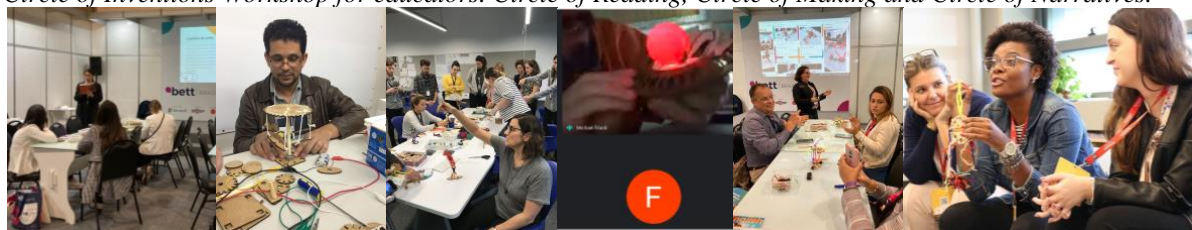
These professional learning workshops were designed to allow for equitable access into the learning experience, with low floors, high ceilings and wide walls (Resnick, 2020) and to fit in the busy schedules of public school teachers, both in urban and rural areas. The design of the workshop, carefully adapted to each context, also worked in educational congresses and conferences both in Brazil and abroad. Making visible the learning in the workshop is of utmost importance in this design, therefore in all workshops a digital sharable mural was used for the sharing of the participant's artifacts, narratives, ideas and reflections derived from the workshop. The discussion and conclusions present in this paper were also informed by the evidence of learning made visible in these murals.

The design of the workshop comprises the following 6 moments. 1. Welcoming participants and introductions - creating a safe space for listening, thinking, making, sharing and reflecting. 2. The Circle of Reading - a carefully curated text is selected depending on the context and specific goals of the educators in the workshop, to spark thinking about a topic that leads the educators to reflect on their own and new educational practices. 3. In this stage of the workshop, the thinking routine Connect, Extend, Challenge (Ritchhart, Church, Morrison 2011) was adapted to provoke thinking about their own learning and teaching practices. In this adaptation, educators think about ways in which they connect to the text read, then extend their thinking through a group discussion related to their own practices and the ideas. 4. The third part of the thinking routine, Challenge, is transformed into a "making" challenge when the educators are invited to create an artifact to think with (Papert, 1991), to express an idea related to the previous discussion. This challenge, which becomes the Circle of Making/Tinkering, depending on the context, will be individual or in a group. During the Covid-19 pandemic, these productions were individual, but in in person workshops they tended to be as a group. 5. The sharing of this artifact with the group and the narratives that emerge are a vital part of the workshop. These narratives then feed the facilitators with information and insights for the final part of the learning experience, connecting everything to theory and practice. 6. The facilitators end the workshop sharing observations on the process, the artifacts and the reflections of the educators (students), making evident the big ideas and principles of Constructionist learning.

The design intends to be both a model for practices with students in diverse settings and disciplines, but also, and most of all, a lived constructionist learning experience that will spark thinking and possibilities for new meaningful and engaging approaches for teachers and students.

Figure 1

Circle of Inventions Workshop for educators. Circle of Reading, Circle of Making and Circle of Narratives.



Implementation

This workshop was implemented in at least 12 different educational contexts, such as urban and rural public schools, private schools, in an educational congress, in different conferences, as well as for research groups in universities in Brazil and abroad. The implementation described below will focus on one example of the workshop in an international conference with a multicultural group which we believe is representative of the experience. It is important to reiterate that in each context the reading offered and the provocation made were designed to be sensitive to the local audience, culture and specific workshop learning goals.

Soon after the lock down period was over, while teachers and students were beginning to go back to schools, we had a precious opportunity to design and deploy a Circle of Inventions with educators from around the world, during an online conference. For this event, we chose to read a poem by Maya Angelou, called Life Doesn't Frighten Me, celebrating the courage within each of us, while making fears visible. We chose this text believing that at that moment, the experience of fear was something really tangible for so many of us, something that connected people from different backgrounds and from where the participants can explore possibilities, tinker and build up meaningful and shareable "objects to think with" (Paert, 1991).

For the challenge of making something meaningful, followed by the reading, we used another insightful Thinking Routine: "Imagine If" (Project Zero, Agency by Design, HGSE, 2018). We asked all the participants to

answer, with their hands on, using materials available at their homes, the following proposition: Imagine If you could transform a childhood (or present) fear into something that puts you into action, makes you strong, and resilient. Build an artifact that could help you in this transformation.

Before the workshop, we shared with the participants a suggestion of materials that they could gather at home in order to tinker with during part of the meeting. When we have the chance to work with teachers in person, we use the Catalyst Kit, composed of sustainable items such as mdf pieces in organic and geometric shapes, pegs, rubber bands, pipe cleaners and also LEDs, motors and batteries, when and if possible we may also include robotic boards or programming apps into the activity. In online settings we ask participants for available things such as aluminum foil, any kind of wire, pieces of cardboard, tape and other possible reusable materials to be used.

An example of an artifact created by one of the participants was built upon his fear of spiders. We used a padlet to encourage them to post brief narratives about their inventions, and what this specific participant shared was: "I am frightened of spiders. I imagined if... I can turn the spider's web into a colorful pattern with nature inspired flowers, petals etc. that becomes a bouquet." As participants share their artifacts and stories, it is a moment for facilitators to document aspects of these descriptions that may translate into important principles behind Constructionism and may be used as references at the closing of the session. In this workshop, it was also very evident how these authentic narratives that are born from each one's tinkering moment bring the group closer together, creating a safe space for exploration of ideas, discussion of sensitive topics and the building of a sense of community. The way in which all artifacts and stories are valued in the discussion and may bring new insights into a topic also allow for voices that may be silenced in other contexts, to find welcoming space and be listened to.

The discussion propelled by the artifacts and narratives, allowed for the building of understanding of the relevance of the Circles of Inventions as a practice that can be used with students in different occasions and disciplines, and also made possible for facilitators to pinpoint the main ideas behind Constructionism such as learn by doing, technology as a construction tool, hard-fun, learning to learn, freedom to make mistakes and learn from them. The Circle of Inventions, its process and products also springboarded the possibility of tackling constructionist concepts such as, 1. microworlds as they became immersed in the shared meanings of the story, 2. body sintonicity, as their whole bodies became engaged in the tinkering and sharing processes 3. debugging, as obstacles were reached during the "making" process, when iterations and reviews were needed to reach a final shareable object. 4. transitory objects, as they reflect upon how much thinking happened with the objects they created 5. powerful ideas, as educators think about teaching and learning, which are big ideas, as they listen, make and share. As one participant put it, in the digital mural: *"I loved the way this experience was designed - very refreshing. The narrative itself helps one to reflect upon one's own personal experiences and then motivates one to create something that is personally relatable and yet also more universal."*

Conclusion

Having an object constructed by themselves, to think with and tell stories with, was extremely powerful and relevant for educators to make their thoughts visible, in the most varied contexts, from a professional learning session in Brumadinho in the interior of Brazil to a session at Teachers' College, Columbia University. The process of making and tinkering with different materials was very significant for participants to elaborate new narratives provoked by the Circle of Reading. After running Circle of Inventions for six years, we can say that the narratives participants come up with would not be the same without having this opportunity to think with their hands, and notice new meanings and angles not previously thought of as regards to a subject. In one occasion for example, after the reading of a text on sandcastles that get washed away by the ocean, a teacher mentioned she initially could only think of a hole, but after the tinkering moment she had created a kite and shared a story related to the possibilities of escape and movement created by these transformations.

Experiencing with their bodies a Circle of Invention from the beginning to the end, and not only hearing or reading about the framework and its fundamentals, is crucial for the whole understanding of how powerful this practice can be. We have observed that educators that have participated in the workshop, feel confident and keen on implementing this constructionist practice, the Circles of Invention, in their classroom. The participation in a workshop helps them realize that: 1. It is a low floor practice that does not demand much previous knowledge related to making skills 2. With wide walls, the Circle of Reading opens numerous possibilities for integration with the curriculum, for socioemotional learning, and for connections between students and teachers. 3. And has tall ceilings as each participant, or a group, has the chance of making something really significant, meaningful and sophisticated, connected to previous knowledge and experiences, also valuing different ways of thinking and knowing into the group

For teachers who are not familiar with teaching and learning maker practices, the Circle of Inventions may be a comfortable place from where to start. Another key point is that the hands-on process is not oriented to

a product that works, but actually to something that carries meaningful ideas and even feelings, something that makes thinking visible and shareable. For those teachers who are more into technology, the Circle of Invention framework contributes to bring back the “meaning ingredient” that unfortunately many times happens to be missing in highly equipped makerspaces. The artifacts can be drafted and created digitally and then fabricated with the use of 3D printers and laser cutting machines. The feedbacks below, received after implementing this Professional Learning Workshop using the Circle of Inventions framework, encourages us to engage in discussions to improve and spread even more this practice among other educators, in Brazil and abroad:

“...I think Circles of Invention are a brilliant idea that is full of possibilities for improvisation. I believe that the structure is one that builds a much-needed bridge from STEAM to social emotional learning.I also believe that something different happens when you allow people to “think with their hands” and then reflect on the wisdom that they can see in what their hands have made real.” Susan Klimczak

“I think the most relevant aspect of this experience was to relate an abstract thought to a tridimensional object. Not only did the ideas give life to the object but also the object gave life to new ideas.” Participant in workshop

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