Part 2 - Bringing it all Together: Pedagogical Documentation and Maker Practices in Schools

By Melanie Mulcaster

Overview

This chapter delves into the theoretical underpinnings and histories of the maker movement in education and pedagogical documentation in an effort to define and ascertain how the underlying philosophy of one method (pedagogical documentation) can be used to complement, support, inform and guide teaching and learning practices in the other (makerspaces in education). While there is a plethora of literature that advocates either for the use of pedagogical documentation in the early years or the pedagogy behind the use of makerspaces in education, (Campbell, 2016; Daugherty, 2016; Fleming, 2015; Graves & Graves, 2016; Krechevsky et al, 2013; Martinez & Stager, 2013; 2016; Sheridan et al., 2014; Sheridan & Halverson, 2014; Stacey, 2015) there is little to no research that illustrates how these two approaches can be combined for maximum impact on teaching and learning practices in elementary environments. Part of the reason is that pedagogical documentation is based in the Reggio Emilia teaching philosophy primarily used to document learning in early childhood classrooms (Stacey, 2015; Wien, 2013). This literature review explores the connections between the Reggio Emilia practice of pedagogical documentation and the maker movement in education and compares them in order to determine how they can be used together to bring forth dialogue and discussion to drive learning and inform teaching in the makerspace.

History of and Significance of the Maker Movement

Making has been around since the dawn of time; people make things, then make them better (Martinez & Stager, 2013). Makers can thus be defined as people who see technology as an invitation to explore and experiment and as such, are producers and creators, builders and shapers of the world (Dougherty, 2016). The maker movement was enabled by makers: groups of people who envisioned the need for new opportunities and innovative spaces to tinker, hack, design and invent with foregoing and emerging technologies (Halverson & Sheridan, 2014). Viewed as the grand equalizer of society, the maker movement changes who gets to teach and learn, who gets to make, what and where things are made. To put it simply, there is more access to, and an increased ability to share tools and knowledge than ever before - and this access is more readily available to just about everyone (Daugherty, 2012; Hatch, 2014). In 2005, Dale Dougherty founded *Make* magazine to inspire the formation of communities filled with like-minded tinkerers who would help people start hobbies and learn new skills (Dougherty, 2012). The first Maker Faire (a community event where ‘makers’ share ideas and conversation) was hosted in California in 2006 and has been growing in popularity worldwide ever since -- close to 200 Maker Faires are to be held this year alone. The maker movement is open and collaborative, inventive and joyful; it is a global phenomenon that brings us all together and moves us towards being

producers of knowledge and products, rather than just consumers (Daugherty; 2016).

2.3 The Maker Movement and Makerspaces in Education

Educators were quick to recognize the impact the maker movement could have on teaching and learning in schools. One of the first educational makerspaces was created by Neil Greenfield at MIT in 2005 when he realized how little experience many of his students had with physical machines. His course entitled *How To Make (Almost) Anything* garners the interest of hundreds of students every year. Not to be outdone, the FabLab@school project by Paulo Blikstein adopted this model for K-12 schools. According to Google Trends, "maker education" or "makered" came into existence around September 2004 and has rapidly become synonymous with progressive education (Flores, 2015; Kurti, Kurti, & Fleming, 2014). The Maker Education Initiative, a non-profit organization created in 2012 supports educators by providing training, resources, and a community base in order to help facilitate the creation of engaging, inclusive, and motivating learning experiences through maker education (Maker Education Initiative, 2017). Makerspaces are becoming commonplace and are natural additions to school library learning commons environments (Fleming, Kurti, & Kurt, 2014; Kurti, 2015; Smay & Walker, 2015). These are spaces that uniformly recognize that students are natural experimenters and inquirers who want to know why things are the way they are (Dougherty, 2016; Martinez & Stager, 2014).

Makerspaces in schools have opportunities to transform education by facilitating new kinds of active learning for the 21st century, bridging the gap between informal and formal learning (Fleming, 2015; Oliver, 2016). Fostering the kind of creative and critical thinking we value in today's top innovators and creators, these spaces move our students into being creators, rather than blind consumers (Dougherty, 2016).

Historical Roots and Underpinnings of Pedagogical Documentation

Pedagogical documentation is based in the Reggio Emilia approach to early childhood education (Stacey, 2015; Wien, 2013). This approach to education was developed in response to Fascist doctrines that monopolized educational policies in Italy after the Second World War. In an attempt to provide their children with more democratic and collaborative settings, parents began to establish their own schools (Martinez & Stager, 2013; Stacey, 2015). Local constructivist educator Loris Malaguzzi led this education reform and has since inspired the Reggio Emilia philosophy worldwide (Edwards, Gandini & Forman, 2011).

In order to draw out how pedagogical documentation can be used to inform teaching and learning practices in a makerspace, it is also important to highlight other key principles of the Reggio Emilia approach to education. While the use of pedagogical documentation is only one key aspect of this approach, it is important to note that the principles are not viewed in isolation, but as dependent, interconnected and influenced by each other (Edwards, Gandini, & Forman, 1993) .

Image of the child.

The Reggio Emilia approach is anchored in the belief that children are rich in potential, strong, powerful and competent (Malaguzzi, 1993). In these environments,

children are resourceful, curious and imaginative advocators and constructors of their own knowledge through communication and collaboration (Kocher, Edwards, Giani & Forman, 2011; Gilman, 2007). They are filled with resources and a potential for educational "rights instead of needs" (Fraser & Gestwicki, 2002, p. 11).

Classroom environment.

The environment also plays a key role in the Reggio Emilia philosophy and is viewed as the "third teacher". Classrooms are equipped with interesting artifacts and materials to act as provocations to stimulate inquiry and collaborative learning opportunities (Martinez & Stager, 2013). Materials found in the space might range from items found in nature, recycled and donated items from local companies and families to digital tools for exploration. Value is placed on the learning environment as it helps support the development of creativity, innovation, critical thought and open-minded exploration.

The role of the teacher.

In the Reggio classroom, students and teachers are co-constructors of knowledge, not agents of wisdom. Teachers work without pre-set curricula and use the interests of their students to guide their instruction (Mawson, 2010). The primary role of the teacher in this space is to act as "researcher" and to observe, document and try to uncover the thinking processes of their students. Teachers listen, record and document the learning experiences of their students daily in order to help understand and drive future areas of study, not only within their immediate environments, but to inform and share transformational practices with colleagues within their professional learning organizations (Edwards & Gandini, 2015; Martinez & Stager, 2013).

Pedagogical Documentation Practices Defined

This section of the literature review will serve to: 1) define pedagogical documentation; 2) explain how and why it shapes and assesses teaching and learning practices; and, 3) outline the process of how it is carried out in the classroom and challenges countered for different audiences and purposes.

Pedagogical Documentation Defined.

Pedagogical documentation is more than just a tool - it is an attitude towards teaching and learning (Ontario Ministry of Education; 2012; Turner & Wilson, 2010). It has been described as a "search for meaning" (Rinaldi, 2006, p. 3), and a "curiosity to understand" (Vecchi, 2001, p. 158). It is a means of "visibly listening" and "listening with all our senses" (Rinaldi, 2001) to our students - using various forms and mediums to document (observational notes, videos, audio recordings and pictures) what our students are doing. Documentation makes learning visible in order to carefully examine and respond to how our roles as facilitators affect student voice in learning. Documentation is a means to shift our focus as educators - to help to identify our students' capabilities and assets collectively and collaboratively, in order to determine next steps in learning (Ontario Ministry of Education, 2015; Tarr, 2010).

Pedagogical Documentation as a means to assess and guide teaching and learning.

Pedagogical documentation provides us with the mirror we need to reflect our practice and supports our growth as educators in many ways (Stacey, 2015). Reflection is an essential component of an educator's practice as it is how we assess the process and the products of learning to consider how the adoption of new pedagogies might be incorporated into professional practices (Crichton & Childs, 2010; Shabazian, 2016). When shared, documentation further engages colleagues and students in purposeful dialogue and conversation about learning that helps to improve intentional practice for all stakeholders involved (Buldu, 2010; Haynes, Cardno, & Craw, 2007; Krechevsky, Rivard, & Burton, 2010; Stacey, 2015; Wong, 2009). Rinaldi (2004) asserts that the relationship between documentation and assessment is fundamental to our experience.

.

The process, phases and progressions of pedagogical documentation.

Krechevsky et al, (2013) identify four key practices of documentation: observing, recording, interpreting and sharing. The Ontario Ministry of Education (2012, 2015) adopted these practices in their monographs on pedagogical documentation to recommend three phases of documentation 1) observing and recording student experiences 2) interpreting learning in the service of pedagogy and 3) responding, sharing and building a culture of inquiry and collaboration. Seitz' (2008) stages of the documentor experience correlate within these phases, as well as Wien's (2011) progressions in documentation (2015). An overview of these approaches to documentation is summarized in Table 1.

Visible Learners Four Key Practices of Documentation	Ontario Ministry of Education Pedagogical Documentation Phases	Seitz's Stages of Documenter Experience (2008)	Wien's Teacher Progressions in Documentation (2011)
Observing **Recording**	Observing and Recording Student Experiences 	• Deciding what to document • Exploring technology use • Focus on children's engagement	• Developing habits of documentation
Interpreting	Interpreting Learning in the Service of Pedagogy 	• Gathering information • Connecting and telling stories	• Becoming comfortable with public recounting of activities • Developing visual literacy skills • Conceptualizing the purpose of documentation as making learning visible
Sharing	Responding, Sharing and Building a Culture of Inquiry and Collaboration 	• Connecting and telling stories • Documenting decision making	• Sharing visible theories of interpretation purposes and further curriculum design • Developing visual literacy skills

Seitz, H. (2008). The power of documentation. *YC: Young Children*, *63*(2), 88-93.
Stacey, S. (2015) Pedagogical documentation in early childhood. St. Paul, MN: Redleaf Press.
Wien, C., Guyevskey, V., & Berdoussis, N. (2011). Learning to Document in Reggio-inspired Education Early Childhood. Research and Practice. Vol. 13, No. 2.

Table 1: An overview of practices, phases, stages and progressions

For the purposes of this research project, the Ontario Ministry of Education's (2015) phases will be adopted. A closer examination of the phases, implications and challenges faced in the pedagogical process are addressed below.

Phase	*Implications*	*Challenges Faced*
Phase One: Observing and Recording Student Experience	Tarr (2010) asserts that in this phase that educators need to remain curious and begin with what they wonder about learning. Teachers are encouraged to observe students through a lens of curiosity to keep an open mind to uncover their students' strengths and capabilities to inform future instructional practices. Pedagogical documentation serves as a form of advocacy for students, and is asset driven; allowing us to view our students through a much wide scope that is often obscured by curricular expectations (Wood, Thall, & Parnell, 2015). Documentation in this phase can take many forms (observational notes, video, audio, photographs).	Olsson (2009) confirms that the lens through which we document student learning is extremely vital; one can not just look for what we expect will be obvious in the risk of shutting down new learning entirely. In order to collect data efficiently, one must develop habits of documentation (Stacey, 2015). An organized and efficient system is required to avoid lost notes, and overloaded memory systems. Stacey (2015) notes we must find a way to make documentation work in our classrooms, or it will not happen at all.
Phase Two: Interpreting Learning in the Service of Pedagogy	When educators take the time to interpret documentation, they develop a greater understanding of how students can be supported in learning.	Documentation is a process of making choices, and when we interpret these choices, we become aware of what we value and consider important in our students' learning (Tarr, 2010). Often educators underestimate the depth of reflection involved and the documentation required to do justice to our students' thinking and ideas (Stacey, 2015). In this phase it is crucial to share interpretations with colleagues to provide additional perspectives, to challenge biases, and to validate new learning (Bowne, Cutler, DeBates, Gilkerson, & Stremmel, 2010; Ontario Ministry of Education, 2015).

Phase Three: Responding, Sharing and Building a Culture of Inquiry and Collaboration	Learning does not end when we present our findings; rather it serves as a catalyst for reflection and action with and for all community members. Documentation can be shared through a variety of digital and non-digital mediums: journal entries, learning stories, audit trails, document panels or sharing learning on various social media platforms.	The time and they money it takes to create and share learning through variety of mediums is one challenge many educators face - there is simply not enough of it. Printing colour pictures to include in documentation panels is costly, if even a school has access to a colour printer at all. The development of visual literacy skills is of utmost importance; one must carefully consider how they are displaying documentation to ensure it is attractive to viewers and provides enough information to generate discussion of the quality of learning therein (Ogunnaike-Lafe & Krohn, 2010; Stacey, 2015; Wien, 2011). How documentation is played in public forums raises additional ethical concerns (Ontario Ministry of Education, 2015; Seitz, 2008; Tarr, 2011). We must consider carefully how all students and student work are being showcased with respect. Free and informed consent must be gathered and we must ensure that student privacy is respected and personal information remains confidential.

Table 2: An outline of the phases of pedagogical documentation, implications and challenges

Bringing it all Together: Pedagogical Documentation and Maker Practices in Schools

The Reggio Emilia practice of pedagogical documentation and the maker movement in education share similar philosophies (Table 3).

Pedagogical Documentation Underpinnings	Maker Movement in Education Underpinnings
Students are viewed as competent, and capable of driving their own instruction.	Students are viewed as curious resourceful, innovative and capable agents of change.
Children construct their own learning and understandings.	Children construct knowledge through the creation of personally meaningful artifacts.
Learning viewed as a social process that is co-constructed with teachers and classmates.	Learning viewed as a communal process where all have responsibilities to be teachers and learners.
The role of the teacher is to act as a researcher. They "listen carefully" to document the child's thinking to help guide future instruction.	The role of the teacher is to be a guide and partner in learning. Teachers respond to the interests and passions of their students to guide the continual development of the makerspace.

Table 3: A direct comparison of philosophies between the Reggio Emilia approach of pedagogical documentation and the maker movement in education.

From this comparison, one can accurately discern how the practice of pedagogical documentation could be used to inform and enrich teaching and learning practices in the makerspace (Table 4). Martinez and Stager (2013) have been long time champions of Reggio Emilia philosophies. They state that it may "represent the world's most mature model of sustained constructionism and progressive education" and believe that the lessons learned from the Reggio Emilia approach could have "profound implications for every level of education, not just preschool" (Martinez & Stager, 2013, Chapter 1, paragraph 71).

Reggio Emilia Practice of Pedagogical Documentation		How it can be used to transform teaching and learning practices in the Makerspace
The process of documenting learning serves to uncover student interests and value their capabilities in learning.		• Pedagogical documentation can serve to help adapt learning experiences in the makerspace to empower students and to meet their interests and needs. • Pedagogical documentation can serve to reveal what and how students are learning to determine next steps in their acquisition of knowledge. • Pedagogical documentation can serve to inform future instruction, professional practices and next steps for incorporating making across the curriculum.
The process of documenting learning serves to form community partnerships by initiating dialogue and conversation between learners.		• Pedagogical documentation can serve to help build communities and partnering for real learning in the makerspace. • Pedagogical documentation can act as a catalyst to help us question, reflect, collaborate and facilitate meaningful dialogue about learning in the makerspace with colleagues and students to inform our professional practices. • Pedagogical documentation moves us from a "culture of teaching" to a "culture of learning".

Table 4: How pedagogical documentation informs teaching and learning practices in the makerspace.

In summary, making is not just a random act. Knowledge building through making relies extensively not only on the process of making, but how we share, communicate and reflect on thinking for understanding.