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A Thematic Analysis of the Maker Movement in Cyberspace Across Cultural Contexts

Miss Avneet Hira, Purdue University, West Lafayette

Avneet is a doctoral student in the School of Engineering Education at Purdue University. Her research interests include K-12 education and first year engineering in the light of the engineering design process, and inclusion of digital fabrication labs into classrooms. Her current work at the FACE lab is on the use of classroom Makerspaces for an interest-based framework of engineering design. She is also interested in cross-cultural work in engineering education to promote access and equity. She holds a B.E. in Aeronautical Engineering and is presently completing her M.S. in Aerospace Systems Engineering.

Dr. Morgan M. Hynes, Purdue University, West Lafayette

Dr. Morgan Hynes is an Assistant Professor in the School of Engineering Education at Purdue University and Director of the FACE Lab research group at Purdue. In his research, Hynes explores the use of engineering to integrate academic subjects in K-12 classrooms. Specific research interests include design metacognition among learners of all ages; the knowledge base for teaching K-12 STEM through engineering; the relationships among the attitudes, beliefs, motivation, cognitive skills, and engineering skills of K-16 engineering learners; and teaching engineering.

A thematic analysis of the Maker movement in cyberspace across cultural contexts

Abstract

The Maker movement in education evokes a spectrum of reactions from it being the panacea for engineering and design education to a fad that will be forgotten shortly.
The theoretical inquiry we embarked upon this semester aimed at identifying both the potential opportunities and gaps the Maker movement presents for education. We started the inquiry from a perspective that this sort of approach to education has the potential to democratize engineering and design education through the use of co-working spaces (like Makerspaces). We collected evidence to support such a claim by understanding how Makerspaces are perceived in the United States and other cultural contexts, how academic literature espouses the virtues of Makerspaces, and finally connecting these virtues to developmental and educational theory. The study culminated in making connections between these areas and identifying the gaps that remain. Finally, we recommend lines of investigation that may help us better understand the potential benefits of Makerspaces in education.

Introduction & methodology

Our three-phased inquiry is driven and motivated by our perception of the power that co-working spaces hold to democratize education. Thus, each of the inquiries answers a pertinent question that can be related back to this perception with the aim of achieving deeper and broader insight into the different aspects involved.
Democratizing education is deeply associated to accessibility. This informs our first inquiry which aims at understanding how such spaces are presenting themselves in the United States, and other select cultural contexts. The search and analysis in this phase provides us with an understanding of what is happening in this space from a practitioner's perspective.
A large number of co-working spaces that hold our interest are referred to as Makerspaces. These spaces however are not necessarily affiliated to Maker media. Due to the generalized usage of the word Makerspace, in this paper "co-working spaces" and "Makerspaces" are used interchangeably. Our next phase of inquiry aims at assessing and understanding academic research literature that brings together Makerspaces and education. The search and analysis in this phase provides insight into the ideas and propositions of academic researchers who research in this field.
The third phase of this inquiry, we believe is an important incorporation for most new concepts or ideas with claimed educational benefits. We invoke on educational and developmental theory that is cited in academic research literature, and other theories that we believe could be applicable to Making and education. This analysis helps us situate our perception in theory, and also ground our suggestions for future work.
At this point, we find it imperative to situate the work done in this study as a thematic analysis. Even though our data does not replicate traditional data used for thematic analysis, this study sits well within the definition of a "method for identifying, analysing and reporting patterns"[1] (p. 79). Particularly as a theoretical analysis, as it renders well our theoretical and analytical interests in the subject matter.

Findings

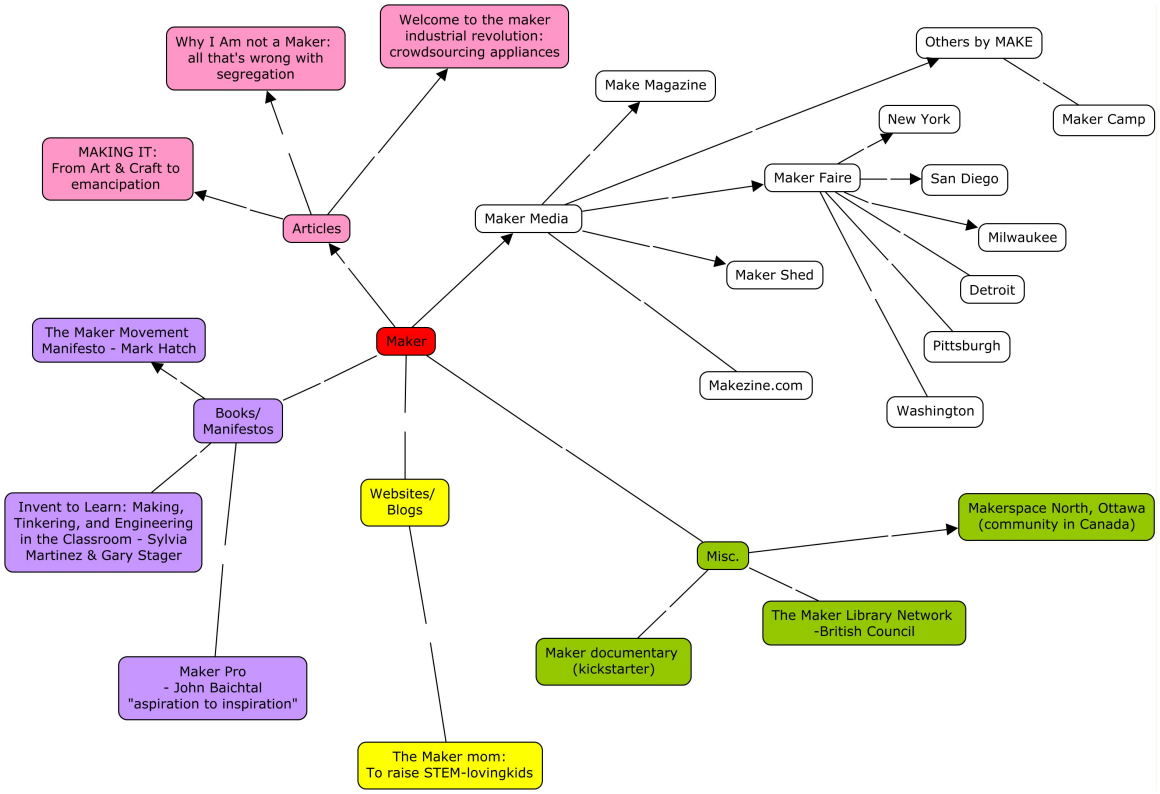

Figure 1. Makerspaces in the United States

Makerspaces in the United States and select other cultural contexts

The first search in cyberspace for this thematic analysis comprises of looking for pieces associated with the words “maker”, “make”, “makerspace” and “co-working space” over the Internet via a Google search. Figure 1 shows applicable results from this search in the context of the United States in the form of a concept map.

As is visible, large volumes of pieces are either directly from Maker Media or other associated projects. Projects directly associated include Make Magazine[2], Makezine.com, Maker Shed and Maker Faire. Maker camp [3] is also an initiative by Maker Media, however its doors are open for other non-Make participants too. Maker Faire has spread far and wide; cities like New York, San Diego, Milwaukee, Detroit, Pittsburgh and Washington are the first few that come up in the search.

Thought pieces in the form of blogs and contributions to periodicals have also made their way into the cyberspace. As most things written about over the Internet, these pieces invoke a wide spectrum of reactions. Work such as Making it [4] which relates art and craft to makerspaces, and an article in Popular Science [5] which explores the impact of makerspaces on crowdsourcing and manufacturing, form the positive end of this spectrum. At the same time, work such as “Why I am not a maker”[6] forms the other end of the spectrum where Chachra claims makerspaces as pro-segregation tools, that infuse a cult like thinking among pro-makerspace people. Another website which is not so much a thought piece, but a

collection of many resources and ideas is the Maker Mom blog[7], started with the agenda of raising kids who love STEM using Making as encouragement.
The Maker movement has also reached the more formalized side of publishing, which is represented in the forms of online catalogs and pro-Maker books. The Maker Movement manifesto by Mark Hatch[8] claims that every individual is a maker, and encourages people to make things that are personally meaningful to them in these spaces as artifacts "embody portions of our soul". A book by Martinez and Stager connects making and tinkering to the engineering classroom[9], and a book spearheaded by the Maker Media called Maker Pro edited by John Baichtal[10], reports on Makers who could serve as inspiration for budding Makers.
There also exist other activities around the movement that are not necessarily spearheaded by Maker media. These include initiatives such as Makerspace North[11], which is a Maker space in Ottawa, that brings together Makers from Canada, and networks such as the Maker Library Network[12] which is initiated by the British Council and spans multiple continents including Africa, America and Asia.

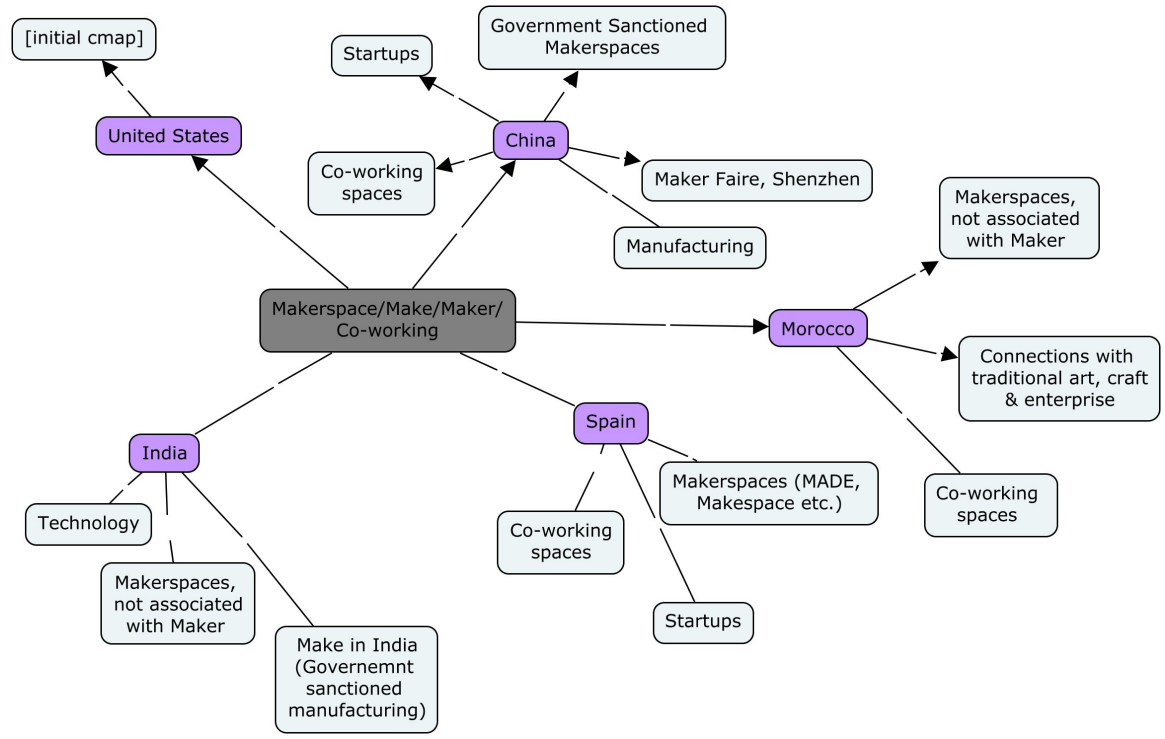

Figure 2. Makerspaces in select other cultural contexts

The second part of the cyberspace thematic analysis comprises of looking at the same keywords, but in different cultural contexts. We first attempted changing the location and searching the country specific Google page, however that still brought up results from the United States. We assume this has to do with the traffic that these pages receive. So the results that can be seen in Figure 2 in the form of a concept map are a result of searches with the same keywords as the previously reported searches, along with the name of the country in question.
In China, most of the results are dissociated from Maker media other than a Maker Faire in 2015 in the city of Shenzhen[13]. Most of the results cover a large start-up culture[14] in China

with Makerspaces being an offshoot of this culture, and at the same time incubators for new start-ups. Makerspaces are also closely related to innovation and manufacturing[15]. We found profiles of several co-working spaces spread in many big cities of the country, and also reports on sanctions by the government to set up new Makerspaces in the country[16].
A search in Morocco also shows results that are not associated with Maker media[17]. The Internet also reports on several other co-working spaces[18] in the country where people come to co-create, bounce ideas and work in communal spaces. With its rich heritage in art and craft and associated enterprise, the locals tend to draw connections with their traditions and philosophy of Makerspaces[19].
In Spain, several spaces again not associated with Maker media but claimed as Makerspaces come up in our search[20,21]. In Spain like China, Makerspaces are associated with the concept of start-ups, which is the encouragement behind many other co-working spaces in the country.
In India, Makerspaces appear to be more associated with the technologies used in them particularly 3 D printing[22]. There are a few Makerspace like spaces across the country that serve different clientele such as rural youth, urban corporate employees, hobbyists and students[23]. The government launched a campaign[24] via which it plans to increase the manufacturing output of the country manifold.

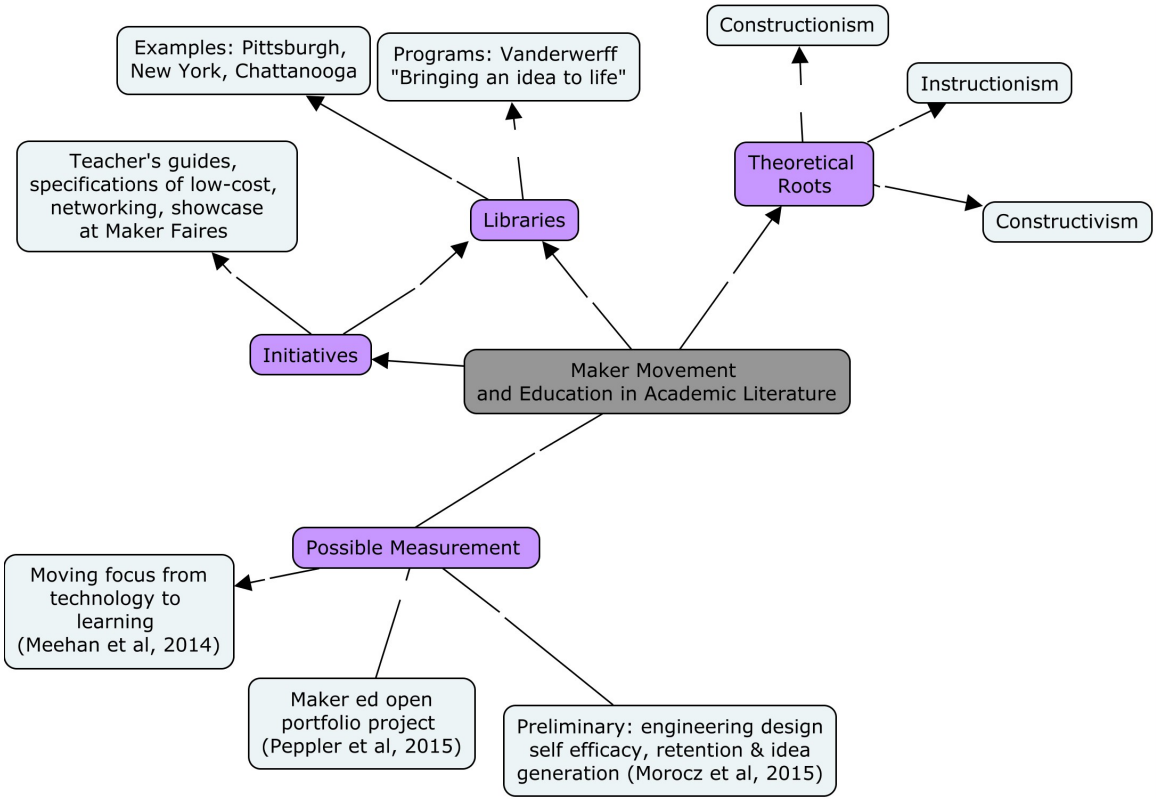

Figure 3. Makerspaces and education in academic literature

Makerspaces and education in academic literature

The second review that we embarked upon looked at work in academic literature that focuses on Makerspaces and education as is elucidated in Figure 3.

The work covered three main areas, (1) initiatives being taken to use Makerspaces for educational opportunities, (2) of which work at libraries and museums forms a big part, and (2) speculative work on possible measurement tools.
Stephen Abram[25] writes about the opportunities for Makerspaces in libraries, forwarding the example of Aaron Vanderwerff of the Lighthouse Community Charter School in Oakland who has published guides for projects of a 6-month time frame to be taken up in Makerspaces, for teachers and librarians. Museums at Pittsburgh, New York and Chattanooga[26] are great examples for this kind of work in museum settings.
For measuring the educational outcomes of these spaces, Maker education has launched the Maker Ed open portfolio project[27]. This is an investigation of self-reported data from Makerspaces across the United States on prompts related their engagement with educational standards such as the Next Generation Science Standards[28]. In a design based research by Meehan, Gravel & Shapiro[29] it was noted that in a particular card-sorting task that was studied, the participants' focus moves from the task to the technology used. At the 122nd ASEE Annual Conference, Morocz et al.[30] shared plans of measuring impacts of their university Makerspace "through engineering design self-efficacy, retention in the engineering major; and idea generation ability."
Halverson and Sheridan[31] in their comparative case study on different Makerspace invoked work by Papert and Dewey as the theoretical underpinning of the Maker movement and its relation with education.

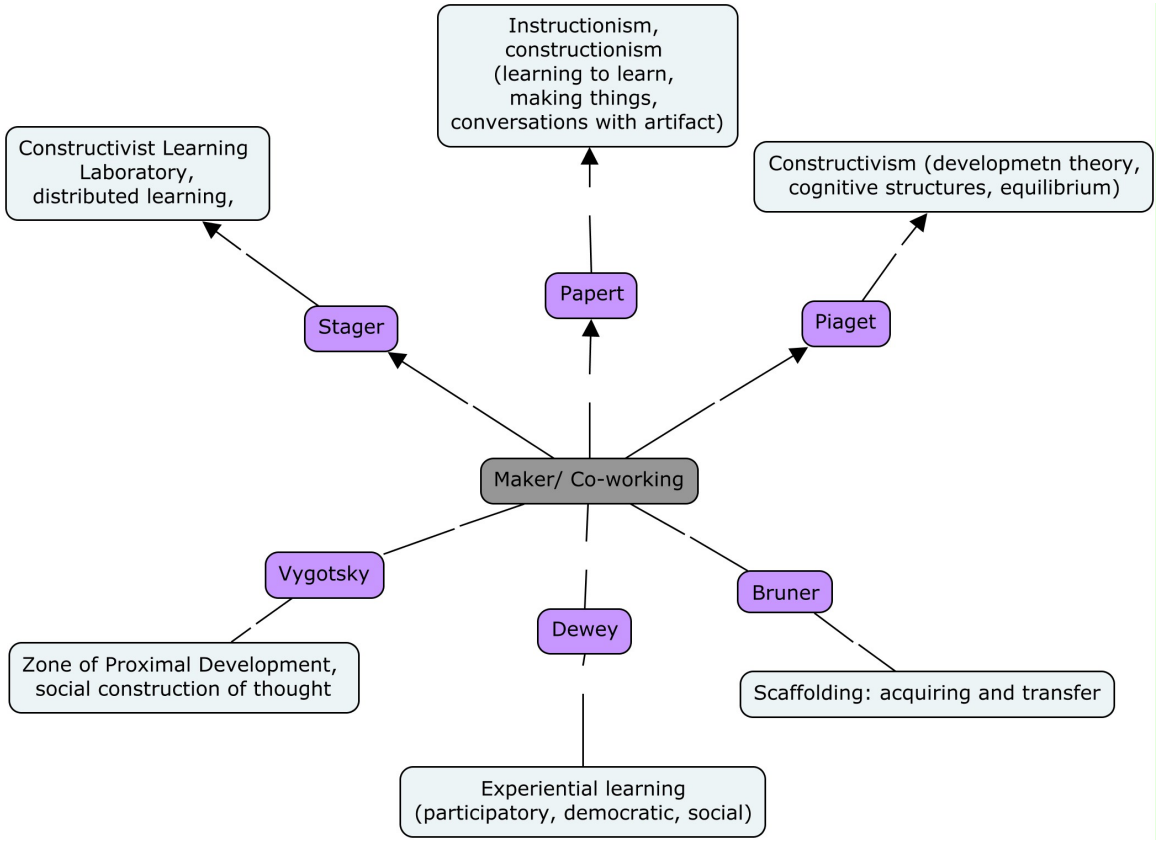

Figure 4. Educational and developmental theory

Educational and developmental theory

The allusion to the theories of thinking and development in the academic research literature encourages our inquiry into these theories and how they are and can potentially be related to the educational aspects of Makerspaces. Figure 4 shows these connections in the form of a concept map.

Papert's[32] theories on instructionism and constructionism present themselves rather explicitly in Makerspaces as participants learn to learn, make things to learn, and connect to the artifacts that they make.

Piaget's[33] theory of development centered on constructivism can be observed too as participants construct knowledge while going through processes of cognitive disequilibrium and equilibrium.

As Making is a social activity which participants take part in together, development via the Zone of Proximal Development, social construction of thought and making meaning of things via language and experience, all of which are core tenets of Vygotsky's theories[34,35] can be observed amply in these spaces.

Makerspaces also present themselves as great sites for Dewey's theory of experiential learning[36]. The interactions in most of these spaces are participatory, democratic and social, which align well with Dewey's work and agenda.

From a perspective of building transferable skills in Makerspaces, which is one of the biggest acknowledged challenges[37] of learning in context, Bruner's work[38] on scaffolding of knowledge i.e. acquiring and transfer, can be applied to learning in these spaces.

Discussion: Claims of educational benefits

After the three-phase inquiry into how Makerspaces present themselves across cultures, in academic literature, and the connections with theories of learning and development, we synthesized a list of the claims of educational benefits of these spaces. We identified and made connections between prevalent practices as informed by the inquiry in cyberspaces, claimed and speculated benefits from the inquiry in academic literature and identified opportunities for the educational benefits for these claims from a lens of educational and developmental theory.

The use of technology presents itself as a great benefit for educational spaces in Papert's[32] work on the use of technology for learning, particularly the Constructivist Learning Laboratory. This focus on technology in Makerspaces is seen across spaces in different cultures and also forms one of the core areas of discussion in blogs and other documents associated with Makerspaces and the Maker culture.

Self-agency and experiential learning go hand in hand in most of the reported spaces. With human initiative being at the core of many co-working spaces and more evidently in start-ups that are incubated in these spaces, the leaders, entrepreneurs, hobbyists and facilitators associated with Makerspaces exemplify self-agency. As the participants, the space and social interactions define the activities in these spaces; they also present themselves as great sites for experiential learning.

The idea of communities of practice to accentuate learning is not new[39]. The communities that Makerspaces pro mote and also the connection between different spaces which many a times span continents can be great sites for rich learning experiences within communities of

practice. The networks and resource sharing over blogs, websites, and other published documents also promote a community of learning within diverse groups of Makers.
We identify three major ways in which outcome based education presents itself in Makerspaces; (1) in the day to day functioning of a Makerspace, results are prompt and most participants make artifacts to serve a purpose or need, (2) with the final aim of many Makers being to create profit making enterprises as initiated by start-up ideas, and (3) the underlying motivation behind governments sanctions that support Makerspaces being the revenue generated by manufacturing and other innovations.
Vygotsky's[34,35,40] theories encompassing social constructivism, the zone of proximal development and meaning making can be invoked to make sense of the ideas and resources generated via the Maker movement. Articles, manifestos and blogs comprise the social spaces created by the Movement that aid the construction of knowledge. These spaces also provide for interactions and learning between participants of varying competency levels and thus they learn as they cross the Zone of Proximal Development.

Conclusion and future work

After the initial three-phased inquiry, and grouping together claims as potential sites for benefits in terms of educational and developmental theory, the study culminated by analyzing the gap that exists between the work (academic, theoretical and practical) and the claims of educational benefits made from this work.
We identify three agencies that would potentially have to work together to close this wide but important gap i.e. research, policy and practitioners.
With many questions unanswered and linkages yet to be completed, the need for more research in this field, particularly studies that analyze and create educational benefits from Makerspaces is explicit. Also the developments lead by practitioners and enthusiasts on field should be taken in a stride and used to strengthen, test and accentuate these benefits. Further still, our larger agenda of democratizing education with its far reaching intended consequences can only reach a breadth of the population if it makes its way to the policy makers' agendas and future propositions.

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