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Hyperlocal Learning Network 'La Campana-Altamira'

Using low-cost technologies to support maker education during lockdown times

Lay-Wah C. Ching-Chiang[†]
Escuela de Humanidades y Educación
Tecnológico de Monterrey
Monterrey, NL, MX
lay.chingchiang@gmail.com

Noé A. González-Nieto
División de Ciencias de la
Comunicación y Diseño
Universidad Autónoma Metropolitana
Ciudad de Mexico, Mexico
ngonzalez@cua.uam.mx

Mark Gaved
Institute of Education Technology
The Open University
Milton Keynes, UK
mark.gaved@open.ac.uk

Derek Jones
School of Engineering & Innovation
The Open University
Milton Keynes, UK
derek.jones@open.ac.uk

Nicole Lotz
School of Engineering & Innovation
The Open University
Milton Keynes, UK
nicole.lotz@open.ac.uk

Alejandra Díaz de León
Tecnológico de Monterrey
Monterrey, NL, MX
A00286678@itesm.mx

Rafael Machado
Insitu
Monterrey, NL, MX
machado.gamez@gmail.com

Juan M. Fernández Cárdenas
Escuela de Humanidades y Educación
Tecnológico de Monterrey
Monterrey, NL, MX
j.m.fernandez@tec.mx

ABSTRACT

The Covid-19 pandemic worsened access to education and socio-economic development opportunities for marginalized communities around the globe. 'Hyperlocal Learning Network La Campana-Altamira' has used low-cost technologies to target this challenge in a city in the Northeast region of Mexico. With the collaboration of academics from Mexico and the United Kingdom, the project in progress has aimed to build hyperlocal and creative learning networks under a socio-constructivist and grounded approach that could empower individuals (children, parents and general community) and nurture makerspace characteristics at home during lockdown. The project established a hyperlocal learning network in La Campana-Altamira with 11 families, using a combination of craft kits and low-cost digital networks to enable making, reflecting, and sharing in the neighbourhood while schools and makerspaces were closed. This paper presents initial findings of the research process and seeks to open a debate on innovative methods and transnational collaboration during pandemics.

CCS CONCEPTS

•Applied computing~Education~Collaborative learning•

KEYWORDS

Learning networks, Maker movement, Educational technologies, Constructivist learning

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1 Introduction

The Covid-19 pandemic marked a before and after for humanity. The world has had to learn new forms of educational practices and communities and create a new sense of belonging with the help of technologies. Due to lockdown regulations designed to minimise health risks,

working and learning online and from homes became a new norm. However, marginalized communities, already disadvantaged across many dimensions prior to the pandemic, have found their community challenges being exacerbated. The assumption that digital and networked technologies would bridge the gap in educational and social provision during the pandemic for all neighborhoods is faulty, particularly in lower resourced settings, who are left significantly behind in digitalization and more vulnerable to an increase of social isolation.

'Hyperlocal Learning Network La Campana-Altamira' is a project that aims to create equitable access to quality education and socio-economic development opportunities through hyperlocal, creative learning networks in a community setting using a combination of hands-on making kits and low-cost networking technologies to support sharing.

This project is highly relevant in this deprived neighborhood as the digital divide in Mexico mostly affects people with low income and educational levels: people with only primary schooling have a 42% probability of using the internet, while this percentage goes up to 98% if people hold a postgraduate degree [1]. Furthermore, during the Covid-19 pandemic, educational opportunities for students in Mexico have been limited. For instance, recent studies show that one in four students in Mexico have thought about dropping out of school; moreover, only 35% of teachers nationwide managed to communicate effectively with their students in this time [2]. This highlights the need for learning networks to more widely reach all communities, regardless of their social or economic conditions, and the potential of low-cost technologies to reach more marginalized communities.

Our work is informed by constructivist learning [3, 4], where learning is considered an experiential process of 'making sense' of our interactions with the world by relating them to our existing ideas and knowledge. This 'construction' through making sense is most obvious in active learning settings, such as art and design education studios [5].

Critical to constructivist learning is the student and their personal and contextual experience, making it a strongly student-centered learning model. According to Papert [6], learning must be self-directed, following an iterative process so that students can discover for themselves the mediations that best support the exploration of their curiosity. An extension of constructivism and social empowerment is the idea of social constructivist learning [7, 8]. Here, the social or interpersonal setting is considered as important as the individual experience or apparent setting. This is most obvious in terms of the relationship between teacher and student, where the 'proximity' of the learner to the activity being learned informs the construction of the experience

itself. Whilst this is most obvious in early years education (Vygotsky's focus), it is also evident in any social setting and without a teacher/expert being present [9].

By engaging in a design and making activity, what is learned is far more than the apparent steps that are seen in the activity: the real activity is cognitive, experiential, personal, hence it is largely invisible [10, 11].

Makerspaces provide shared design and making activities carried out in a social setting, in which both experienced and novice participants interact. Questions of what the right or best conditions for such learning might be to take place are still being explored how makerspaces might emerge where it may be challenging to implement and operate them, such as contexts with little or no access to resources, experts, infrastructure, or even a physical 'space'. By taking a purely social constructivist learning approach and providing design and making learning activities, it is hypothesized that characteristics of design or makerspaces will emerge.

Such approaches might be digitally enhanced by networked learning [12], where participants are connected to each other, to resources and to instructional material via digital networks, supporting the co-construction of knowledge. This can overcome constraints of distance, which until recently has focused on globally connecting learners, but now in times of pandemic-enforced social distancing has also been recognized to support hyperlocal community building, which equally benefits more proximate interactions. Furthermore, the availability of low-cost, battery powered devices that can act as WiFi hubs, such as the Raspberry Pi, have enabled networking without the need for internet connectivity or even reliable mains electricity. This offers a realistic option for low resource neighborhoods and enables makerspace style education to continue from family homes, distributed and shared across the neighborhood even when a makerspace facility is closed due to lockdown restrictions.

Finally, this project was inscribed into a social justice agenda that combines a student-centered approach with self-directed learning to empower individuals in a learning context [13]. Drawing from the contributions of Freire and González, Moll & Amanti [14], education must be meaningful and contextualized to motivate people's social transformation. When learners collaborate and build dialogue with educators and other learners to achieve common goals and problematize their own realities. They develop a critical consciousness on how to overcome the 'banking' perspective of education to promote a liberating viewpoint of life. In this sense, 'Hyperlocal Learning Network La Campana-Altamira' was planned to be a place where people could promote different realities through the 'maker movement'. Furthermore, this project has established a horizontal relationship between researchers and

participants, giving both actors the opportunity to learn from each other to improve the outcomes of this experience.

2 Method

2.1 Setting: La Campana-Altamira

La Campana-Altamira District is in the south-central part of the city of Monterrey, Mexico, named after the two hills on which it is built. The first inhabitants of the area were migrants from the interior of the state and from other areas of the country which were looking for economic opportunities in Monterrey. They settled at the crest of the hills with a lack of planning and adequate urbanization including inaccessibility for motorized vehicles, impacting the socio-economic dynamics and opportunities. For example, long walking distances, access to basic services, and higher prices of buying and preparing food due to mobilization costs are part of families' daily lives. Residents of La Campana-Altamira have occupations characterized by low income and precarious working conditions, such as factory workers, domestic workers, and cleaning services.

Before the pandemic, creative initiatives were developed in the area, including the creation of a Fabrication Laboratory [15, 16]. A challenge during the pandemic is to find a way to reach out to community members, and for them to be able to reconnect with fellow learners to maintain a sense of shared learning from the safety of their homes.

2.2 Participants

The main participants are families from the community of La Campana-Altamira in Monterrey, Mexico. Two initial informative meetings were carried out with families from La Campana-Altamira. The call for participants was made through the leader of Distrito TEC and a community leader from the area. Distrito TEC is a social initiative program that develops projects with the community. We had worked with the leader of Distrito TEC during the co-creation process of the Fabrication Laboratory in La Campana [15, 16], and he had worked with the community leader in the distribution of 400 food baskets for families at the beginning of the pandemic. The strong existing relationship allowed Hyperlocal Network La Campana Altamira to be welcomed in the community. After the recruitment meetings, 11 families showed their interest in participating in the project (22 adults and 27 children).

The project was carried out with the participation of a project team made of academics, researchers, social organization leaders and undergraduate students from a private university undertaking community service.

2.3 The Hyperlocal Learning Network

Each family was given a craft kit with the materials to engage in four established STEM learning activities: a code wheel, a creative face mask, soap making and a drawing robot. The kit included materials such as fabrics, molds, sewing kits, craft paper, scissors, glue, batteries, and electrical components. Families were given a smartphone and sim card to (1) access and engage with the hyperlocal network through the MAZI digital platform [www.mazizone.eu], an open-source software toolset running on Raspberry Pis (five shared across the community), and to (2) stay in touch with the students from Tecnológico de Monterrey for technical support and evaluation activities.

Families were asked to make the activities in the order they preferred and at their own pace as long as they completed them by the end of five weeks. While making the activities, they were invited to take pictures and videos and upload them on the MAZI digital platform to share with their nearby neighbors who could log in from their houses.

MAZI was configured as a Hyperlocal hub to show three main spaces which end users could see: Descubre [Discover], Comparte [Share], and Comparte más [Share More]. 'Discover' section was designed as an offline library containing video tutorials and guides. In 'Share', users could share pictures and comments about their activities. Finally, in the 'Share More' users could upload any type of large files such as videos. They could also comment and reply to others. The digital aspect of the network was purposefully a simple hub in its functionality and interactions and designed to enable sharing without internet connectivity, and battery powered, to make it suitable for the poor infrastructure of the neighborhood. The families' experience was like connecting to an internet-based website, but with access just to the Hyperlocal hubs in their proximity, bounded by the range of the immediate Raspberry Pis' WiFi (approximately 20 meters).

2.4 Socio-cultural considerations

Socio-cultural characteristics of the community were taken into consideration through the design process of the intervention. These characteristics were understood through the previous experience the local team had with the community, and the awareness sessions with the social initiatives program leader. Key socio-cultural considerations addressed were:

Spanish language configuration of the MAZI platform: evolving terms to reflect the purpose of the three spaces using community understood expressions and icons.

Differing designs of information sheet and consent form for adults and children. The information sheet for children had drawings, simplified information, and terminology while

their consent form asked them to draw smiley faces to agree to participate.

Design of the activities' video tutorials: the length of the videos, the voice, the naming of the materials and providing printed materials to support the activities.

For the informational meetings, the use of terminology used was fundamental. For example, when explaining the project to the families, the term "research" [investigación] was not used, due to its connotation of something more like an experiment that could make people fear to participate, but rather the term "study" [estudio] was used because it brings more of a positive meaning.

When asking participants for consent, we had decided to audio-record their agreement because locals do not feel confident about signing papers that could compromise them legally and look too formal, creating a trust gap with the research team. However, the created rapport at the recruitment meetings overcame this challenge.

3 Discussion and Initial Reflections

'Hyperlocal Learning Network La Campana-Altamira' is ongoing and data analysis will take place in Summer 2021. However, we offer initial reflections from the research team based on data collection and observations so far, as these hint at several key themes emerging.

Hyperlocal has become a research project that involved different actors who adapted themselves to connect despite the Covid-19 pandemic. Each of them had its own set of learnings and transformations through the project considering their own socio-cultural backgrounds.

A key learning from this process is the need to localize the technology: both linguistically and culturally. The mediating tools (MAZI platform on Raspberry Pi, and smartphone) as well as the guides had to be available in Spanish, requiring discussion and appropriate translation. Furthermore, resources had to be culturally relevant: there was debate about the appropriate level and tone of language that were used for resources including video tutorials (e.g. Spanish allows for both formal and informal terms of address and we had to decide on the right 'voice'), and preparation of the tools stimulated great debate about the naming of the different functions, to ensure we chose terms that would invite participation.

The exchange of traditional learning-teaching roles among families was an extraordinary result of this experience. Cooperation among family members to complete the activities represented a space for them to work to a common goal and negotiate roles. While in some families, mothers led the sewing process for the masks, with children being more engaged in uploading the content into the MAZI platform for recording and sharing, in other cases

children took the teaching role in personalizing the masks and soaps.

For the researchers, the project also required the implementation of pandemic-appropriate strategies to collect qualitative data that did not involve face to face contact while maintaining quality. In this context, researchers faced the challenge of applying distance-based methods to collect data while balancing the need to build *rapport* with participants and to make them feel comfortable with the project.

This project became not only useful for the time it was established but it also represents a seed for the long-term impact in the community. According to the Distrito TEC leader, it has been a win-win experience. Besides being a research project and knowledge opportunity for the families, it represents a shared experience for the community. Hence, the project strengthened trust and rapport with the families of this area which will support Distrito TEC, starting August 2021, to establish new projects with the community, such as a community design of the urban space.

Since the project has been received well locally, there are ambitions to carry the work forwards. Onward engagement with current participants is anticipated, first through reflection workshops and then to consider how we might extend to further neighborhoods and a wider set of civil society actors. The research team will reflect on the efficacy of pandemic-required engagement and data gathering methods, and write up both these, general findings, and reach out to wider actors through a web presence, with the ambition of onward collaborations.

4 C&T 2021 Exhibition Plan

For the C&T 2021 conference we will present (a) a live online demonstration of the Hyperlocal MAZI Interface to illustrate the project's approach and the tools provided to families: this will be enabled via screen sharing (as a backup, a slide presentation will be prepared); (b) a slide presentation describing the context, approach, and outcomes so far, including text, images, and video. These will be generated in standard software formats and can be shared in advance for technical approval.

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