

Early childhood online education in the COVID-19 context. Behavioral Patterns for User Interface Design

Cristina Dreifuss-Serrano
Facultad de Ingeniería y Arquitectura
Universidad de Lima
 Lima, Perú
 cdreifuss@ulima.edu.pe

Pablo C. Herrera
Universidad Peruana de Ciencias
Aplicadas
 Lima, Perú
 pablo.herrera@upc.edu.pe

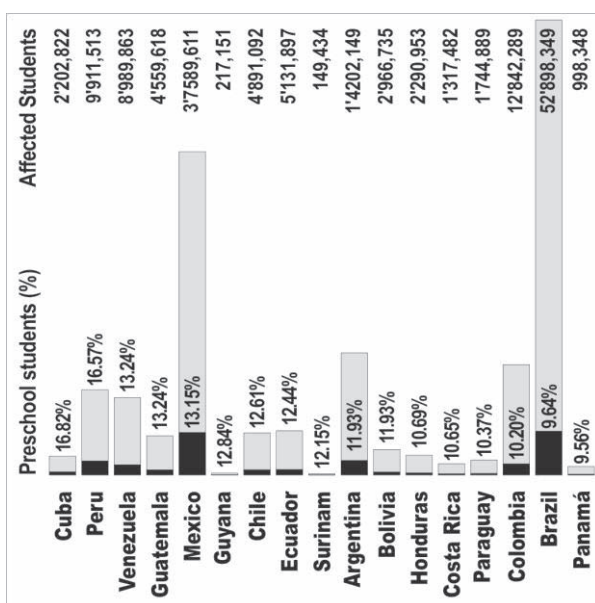
Abstract—The outcomes from the lived experience descriptions show that tested indicators for the evaluation of both MOOCs and preschool education are insufficient or inexact for the assessment of our current condition. Most of the main online platforms, based on universities or as products of local entrepreneurship have ignored the preschool group. The already proposed generic solutions do not meet preschool education’s needs. Considering Behavioral Patterns we propose a model useful for both the evaluation of ongoing experiences and the organization of new content.

Keywords—preschool, behavioral patterns, online education, distance education, assessment.

I. INTRODUCTION

Ten years ago, 2009-H1N1 reached 212 countries, with 18,449 deaths [1]. Between December 2019 and April 2020, COVID-19 has reached 213 countries, 5’308,190 total cases, and 340,075 deaths [2]. IHME [3] projected, by August 2020, 143,357 deaths in USA. Without a vaccine, the only way of minimizing transmission and propagation is the non-pharmaceutical intervention (NPI): social distancing, hand washing, isolation of the infected individuals, use of masks, etc. [4, 5]. First, these measures affected the schools, which were forced to migrate from face to face to remote teaching in just a few weeks. By May 2020, 69% of the world’s student’s population has been affected by the closing of schools [6].

TABLE I. PRESCHOOL STUDENTS IN LOCKDOWN



In 18 countries from Latin America and the Caribbean that have closed schools due to the emergency, there are currently 162’904,195 affected students. The percentage of preschoolers in each country vary between 17% and 8% (Table 1) [7].

The survey on National Education Responses to COVID-19 School Closures [8] by UNICEF defined four contexts for distance education: radio, television, online learning platforms and printed activities to take home. The survey COVID-19 and Early Childhood Education Workforce, by UNESCO New Delhi Office [9] added Mobile text (SMS), Mobile Messenger (WhatsApp, Messenger) and Social Media (Facebook, Instagram, Twitter).

At the beginning of the lockdown, online learning used the existing platforms (Google Classroom, Moodle, etc.), with quick solutions and haste training programmes for teachers and staff [10]. Few weeks later adjustments were made. Some schools could afford more private spaces, with smaller groups,

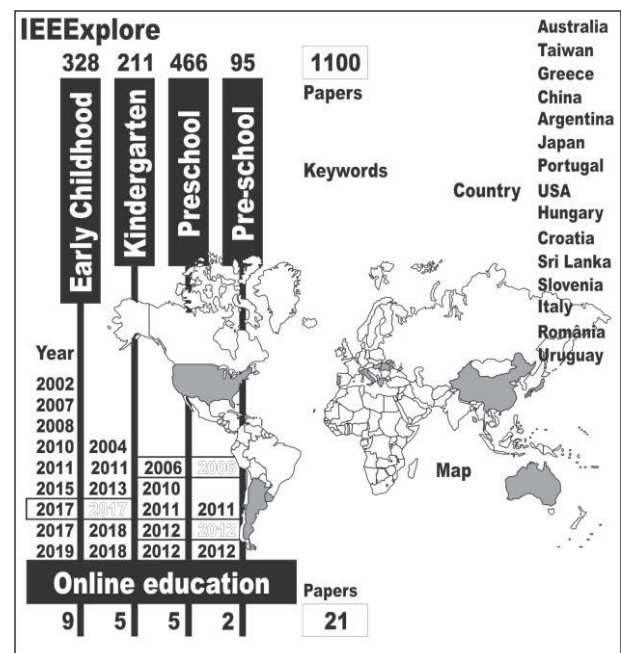


Fig. 1. Papers published in IEEEExplore using keywords related to online preschool education (early childhood, kindergarten, preschool), considering year of publication and country.

aiming to attend students’ needs almost individually. Government programmes and strategies were developed, directed to a broader population. Preschool education has been affected the most, with parents withdrawing their children from nurseries and kindergartens, because of both economic and pedagogic reasons.

Before COVID-19, scientific literature, and experiences on online learning with K-12 children were scarce [11]. Experiences in the use of Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs) in early childhood online education focused on platforms for school labs (Fig. 1). The current situation has forced to a remote connection with children, in a massive scale never seen before.

There are several reasons why educators and parents are reluctant to explore distance education: for some, innovation can be damaging to the profession and to the traditional way of learning; it does not really aligns with local culture or reality; or it cannot work from a practical point of view, considering children's' needs and resources [12]. The COVID-19 outbreak forced the implementation, regardless of the conditions in the region or the willingness of parents and educators to do it.

The research focuses on preschool learning experiences in lockdown, in the capital of a developing country (Peru), considering the parents' and the educators' points of view. We identify Behavioral Patterns for future Interface Design, in early childhood online education, physically separated, but interacting through platforms proposed by private schools and nurseries. The aim is to propose a guide for educators in developing countries, involved in synchronous and asynchronous online learning experiences, based on the observation of patterns.

It is believed that the effects of isolation might continue through 2020, with a projected return to classroom learning for the first trimester of 2021. The study of patterns and the transition process to online learning (MOOCs, SPOCs and other experiences) in unpredictable situations will allow us to analyze its impact in education, in the history of distance learning. Such evaluation will become necessary for new updated policies and the implementation of resources for the first years of children's education.

II. THEORETICAL FRAMEWORK

Since the 18th century [13, 14], epistolary experiences moved to television, incorporating a new group of students: children. Experiences like Sesame Street (premiered in 1969), Learning Time with Timmy (2009), or other government issued programs with educational contents, have been a constant ever since. The Internet made way for a new type of courses, focused again on higher education. Even though many children and teenagers learn new skills online or use the web as a complement to regular education, most MOOCs target adult students: professional learners and universities [15].

When mentioning the impact that MOOCs can have in K-12 education, most aspects refer to indirect benefits, through courses taken by teachers that could affect the students' learning processes. The only aspect in which a direct relationship with children is considered, is as a complement to the regular classroom teaching [11].

A. Preschoolers and online learning

Because of the specific characteristics of preschool children, in terms of development and cognition, most characteristics shared by MOOCs present difficulties in their application as an alternative to classroom education.

Taking these particular aspects into considerations could help the transition to effective SPOCs and MOOCs for preschool children.

B. Challenges in the region

The challenges in Latin America and the Caribbean for the Development of the First Childhood (DPI), considering children under 8 years old, and the Early Childhood Development Index (ECDI), children from 3 to 4 years old, focus on four aspects: learning, physical development, socio-economical realities, and literacy and numerical knowledge. The last aspect is where children in poorer environment can suffer from delays in the development, due to lack of proper access to institutions, and having less educated caregivers [16].

The developing world presents a set of challenges in terms of implementation. Not all regions have an internet connection, or the access to devices or electricity. Technologies of the fourth industrial revolution (big data, cloud computing, IoT, AI), which begin to be part of online platforms' management in other regions, are not yet part of this context. Despite some governments including in their emergency policies the provision of services, Latin America has not yet overcome the problems of connectivity, Internet and devices accesses, and infrastructure costs, limiting our short-term access to the advantages of said revolution.

C. Educators' context

National programmes for early childhood education have as one of the main competences the incorporation of information technologies [17]. However, experiences are focused on web sites and software as complements to basic math skills or literacy activities. Experiences like "English in Early Childhood: Language Learning and Development" from the British Council show that technology in an immersive and synchronic environment is not common [18].

Educators point out the lack of formal education on distance learning and online platforms in most regular undergraduate programmes. The subject is almost completely absent, with only 10.1% of the professor who took the survey had taken classes on online education. By the time the crisis came, teachers lacked skills or experience in online platforms, and 40.7% of the participants ask for training on distance education.

III. METHODOLOGICAL ASPECT

Van Welie et al. [19] argue that the capture of knowledge, rules, and patterns in successful experiences have an important role in the improvement of users' interactions. Tidwell [20] considers that "patterns are structural and behavioral features that improve the habitability of something (...) and can be a description of best practices within a given design domain". The classroom objectives are organized according to Woodbury' methods [21], including Name, What (action), When (context), Why (benefits), How (mechanics). These are the indicators we use to describe and analyze the observed actions in online experiences for early childhood education.

Data is compared with the perceptions of educators (n=31) and families (n=23), collected through three different surveys (teachers, directors, and parents) and in-depth interviews (n=5). The individuals are representative of the different ages in the group. Surveys explored previous experience on online platforms, and the main difficulties in the implementation of

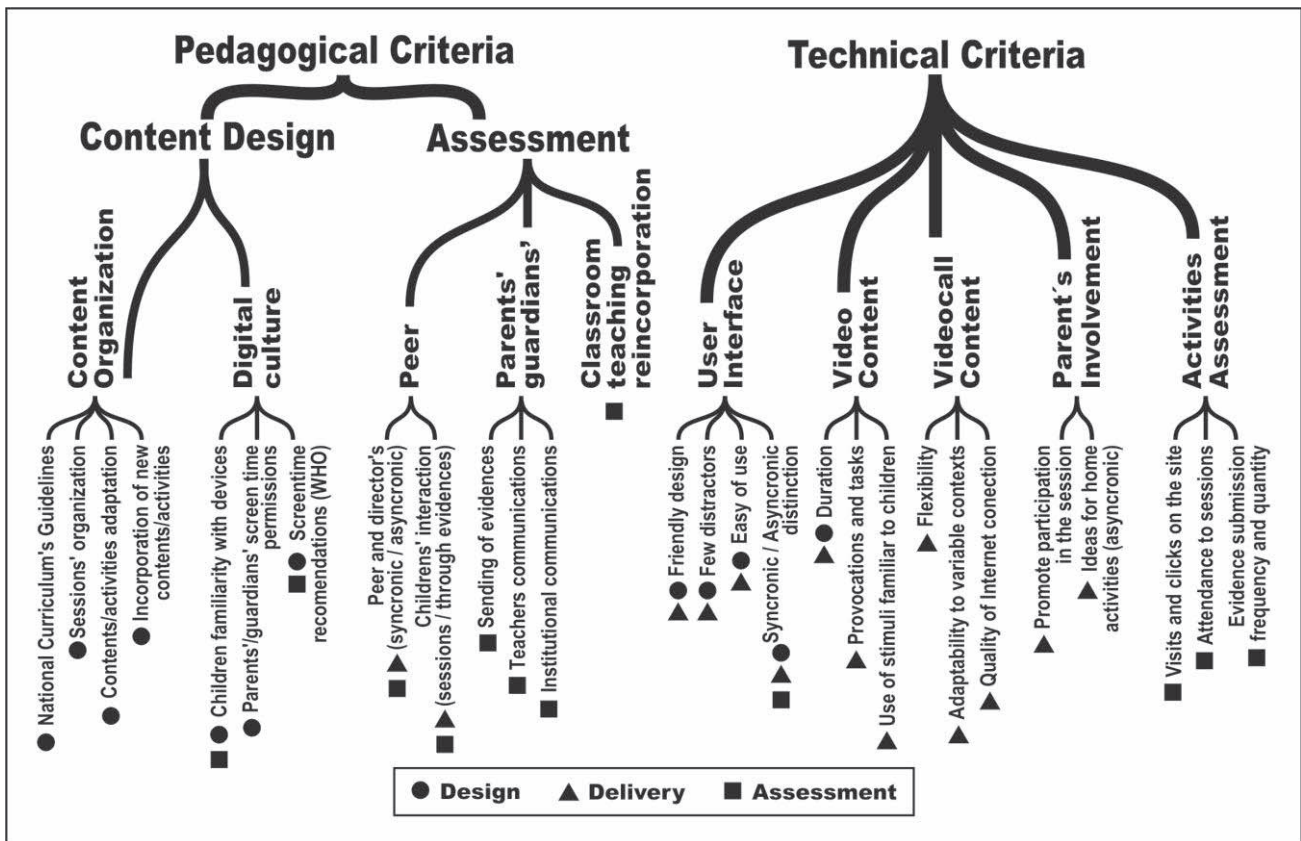


Fig. 2. Model of pedagogical and technical criteria for the design, delivery and assessment of online pedagogical experiences in preschool (children under 6 years of age).

distance education experiences during lockdown, from pedagogical and technical points of view.

IV. RESULTS

The outcomes from the lived experience descriptions show that tested indicators for the evaluation of both MOOCs and preschool education are insufficient or inexact for the assessment of our current condition. Daradoumis et al. [22] (evaluation of experiences and strategies). Yousef y Woznitza [23] offer a model for the evaluation of MOOC's success, which distinguishes between pedagogical and technical criteria. Based on the flexibility of both models, we propose a classification of behavioral patterns, which in turn help the organization of activities and the user interface design (Fig. 2).

Considering surveys and interviews information, data from relevant institutions and direct observation, we identified

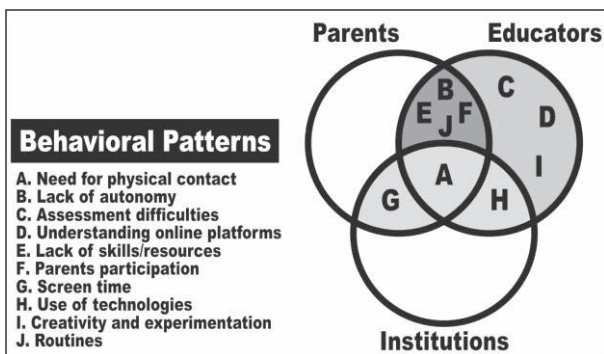


Fig. 3. Behavioral patterns, as reported by Parents, Educators and/or Institutions.

the following behavioral patterns impacting preschool online education. Fig. 3 shows that some of the patterns were shown by one or two groups of individuals, while others, like the need for physical contact (pattern A), were a consensus between educators, parents, and institutions.

A. Need for physical contact

What. Research has shown the importance of physical touch in early childhood as an essential precondition to physical growth and development progress [24].

When. Identifying the main problems in the new online experiences, 92.6% of the teachers name the lack of physical contact as a very relevant difficulty, followed by the complications of an effective assessment of the children's learning processes (81.5%).

Why. The lack of two-way communication shifts the content of the course from dialogue-based [25] and hands-on experiences, forcing teachers to imagine provocations that have to be transmitted online. One of the risks of this problem is that it might affect one of the main curricular areas for children this age: communication [17].

How. While this aspect is the most difficult to overcome, strategies can be proposed during the design and the delivery phases, through the organization of synchronous sessions and asynchronous activities. Parents have an important role to play, providing not only company and assistance, but also physical contact and movement experiences, that can be suggested by the proposed activities.

B. Lack of autonomy

What. Autonomy is one of the main features of MOOCs. It has affective, motivational, and cognitive dimensions, essential to learning experiences, and it is forged on dependence on the support of others [26]. Its acquisition is gradual, during the children's development.

When. Small children depend on their parents or guardians for logging in and following the proposed online activities, and when problems occur.

Why. 92.5% of the teachers and all directors consider the lack of autonomy as an important or very important difficulty in the delivery of the experiences. Free exploration and interaction are constrained by physical limitations and by the lack of skills to properly navigate the platforms. Parents agree on the need of their presence during the synchronous and asynchronous activities and point out difficulties on children's comprehension of what is expected from them.

How. While some experiences could be designed to enhance autonomy, most of it depends on technical features, such as the design of the platform, the ease of use, and the content of the material. Some schools have provided platforms where students can choose out of a set of experiences which one to follow, while seeing their progress in the expected skills [27]. The same strategy can be proposed through different TV or radio programs, in more than one channel.

C. Assessment difficulties

What. Preschool assessment through pedagogical documentation.

When. 81.5% of the teachers argue that difficulties in assessment make the process much more complicated, since it depends on what they can see during the brief online encounters and the evidences sent by parents.

Why. The evidences are sometimes insufficient, and there is also the problem of parents' interference, "helping" the children with the correct answer, misunderstanding the activities' goals.

How. Pedagogical documentation, which according to Malaguzzi captures what children do and say during interactions, is necessary for valid assessment. Usually materials are collected in the delivery phase, to be analyzed afterwards [28]. The recording of online sessions during delivery, and the archive of evidence could help for a thorough assessment, balancing the limitations of the media.

D. Understanding online platforms

What. Preschool children have difficulties understanding the reach and the limitations of platforms.

When. Observed experiences show children's difficulties to distinguish between videocalls and videos, or a lack of understanding of limits and possibilities during synchronous and asynchronous experiences.

Why. Small children lack the knowledge and skills to understand the platforms and their limitations. Some teachers and parents show an inherent mistrust towards online learning, regarded as less effective than classroom experiences. 60.9% of the parents who took the survey identify with this statement while, in other contexts, parents have protested the new distance experiences, asking for reductions in tuition, arguing that students receive less content from online experiences. There are also the real problems caused by faulty Internet

connections or inadequate devices. Teachers consider that a better connection is the most important thing they need to improve their performance; parents rank it third, after more skills and resources for activities at home.

How. Solutions to these problems start with technical aspects: guaranteeing Internet or TV access, and devices for children and educators. Platforms should be easy to understand, mostly graphic, and simple [29], with low energy and Internet consumption.

E. Lack of skills / resources

What. Lack of training on distance and online education (88.9% of teachers), adequate devices (44.4%), Internet connection (51.9%) or teaching resources (40.7%).

When. During design and delivery, this also includes problems finding a suitable place at home for videocalls or recording material (48.1%), and even personal resources in addressing the children through the camera, as observed by teachers and directors alike.

Why. Some of the problems are due to insufficient training in skills that are not usual in undergrad curricula, such as the ability to communicate through videos. Others are related to teachers' personal situations.

How. There is a need for systematic solutions, in terms of access to resources, both pedagogical and technological. Interface design of online platforms and the provision of home kits for recording, such as devices and screens, could help educators in the designing of material.

F. Parents participation

What. As already explained, parents are more involved with their children's education.

When. In preschool education, they have to play an active role, in practical aspects (guaranteeing connection and materials) and in affective and pedagogical aspects, explaining when something is not clear, and giving children a sense of safety in a new, complex situation.

Why. One director explains that, since the experiences have to work with resources at home, learning could become more significant, as part of the children's familiar environment.

How. 71.4% of parents have received information on the use of online learning tools. Sometimes there is a dialogue with parents helping teachers, with platforms and apps, and giving them suggestions on how to better reach the children.

Amongst the difficulties, parents identify at home concern children's behavior, 66.7% indicate difficulties to make children follow instructions, and 61.9% mention children not paying attention, among other problems like lack of patience (85.7%) and lack of time (85.7%). Since most parents are not familiar with pedagogic strategies, platforms and content should also consider an effective communication with them. 47.6% of the parents asked for information about children's emotional well-being, while 28.6% wanted teaching-learning strategies. The role of participation is transversal to the three phases of the experience: design, delivery, and assessment.

G. Screen time

What. WHO recommends a maximum of one hour screen time for children from 3 to 5 years old [30].

When. Although new guidelines issued by government agencies and schools alike limit screen time to a maximum of one-hour sessions, often divided in brief lapses (synchronous or asynchronous), there is a concern of added screen time due to children staying home. Parents or caregivers are working from home and use TV, streaming or apps to keep them entertained.

Why. The excess of screen time in preschoolers (more than two hours a day) has been linked to conduct problems and hyperactivity, among other behavioral symptoms [31].

How. The design of contents is key. Smaller children cannot attend long sessions, and the proposed activities should aim for tasks that involve movement and kinesthetic stimulation [24].

H. Use of technologies

What. Technologies had been part of preschool education as a complement to classroom teaching. The current situation has made them the main media for learning experiences.

When. Most guidelines for early childhood list the early use of technologies as one of the skills to be developed.

Why. Early childhood programs consider information and communications technology (ICT), as a mean to generate learning opportunities in children, and as tools that allow them to communicate, find information, register an experience or being used in a personal project [17].

How. “The data indicates that young children are entering early childhood settings with dispositions that may not have been part of their repertoire of skills in past decades.” “if early childhood educators are to cater for these digital natives, digital experiences need to become part of the everyday practice of centres” [32]

I. Creativity and experimentation

What. The new situation has forced educators to reinvent their practice. Digital technologies allow the exploration of creative and flexible ideas.

When. The crisis might become an opportunity to review and even improve early childhood education, with new spaces and new ways of learning. [33].

Why. Considering the challenges in the region, experimentation and adoption of new ideas for interface design could be an opportunity to close the gap separating us from more developed regions.

How. Digital media allow for better documentation of past experiences, in order to build processes than can be fixed or reviewed along with results and evidences. During delivery and assessment, flexibility and adaptation of material and platforms is fundamental.

J. Establishing routines

What. Routines and habits for small children allow the building of autonomy for the future, while giving them a sense of security, and a conscience of the self by means of care.

When. Teachers and parents have observed that the regular videocalls give children a sense of routine.

Why. Having to share their space with their peers is also a valuable lesson on tolerance and patience, accentuated by the dynamics of the platform (turning off microphones, making sure all the materials are set, etc.) Teachers argue that it is

important to sustain the affective bond with children, in anticipation for their returning to classroom education after the emergency. Online classrooms are now one of the few spaces in which children can work their social skills through the interaction with peers.

How. Programming of experiences in a fixed schedule, with a set of preparation activities easily followed by children; design of sessions with a clear structure, easy to follow, and promoting peers’ interaction. It will be interesting to evaluate the process of going back to classroom education once the lockdown finishes.

The proposed model allows educators a detailed planification of processes, and a revision of existing experiences, considering observed difficulties and resources. In turn, findings will turn into effective user interface designs, following children’s needs and behaviors.

V. DISCUSSION

This research presents recommendations obtained during a specific situation, identifying behavior patterns as a response to circumstances, which will require further scientific evaluation. Our data offers preliminary results contributing to the debate on interface design for early childhood education.

Current social distancing in the world will put into the agenda the intense exploration of solutions for the transition and implementation of distance learning processes.

Online platforms based on universities or as products of local entrepreneurship have ignored the preschool children. The already proposed generic solutions do not meet the needs of a population under 6 years old. Considering the described behavior patterns, preschool online teaching is a new challenge for educators and user interface designers alike.

Most of the behavioral patterns were observed by educators, both teachers and directors. New policies and innovations for user interface design should take into consideration the role of educators as protagonists of learning experiences, in the classroom and online.

The current situation has forced new solutions that should become experimentation processes even when children go back to a classroom education. 30.3% of the teachers and 19% of the parents are willing to support online education after the lockdown. Current experiences might change those numbers. The role of schools, not as passive givers of knowledge, but teaching children how to learn to learn [14], starts in the earlier years.

A careful analysis of smaller experiences will produce information that could help bigger experiences, in order to produce MOOC experiences suited for the specific needs of younger students. Virtual platforms have become a learning tool for children under 6 years of age, and through their evaluation we can trace new learning paths.

Distance education is also an opportunity to reach distant communities and marginal populations. Access to quality education is fundamental, to avoid functional illiteracy, and promote a real participation in our information-based societies [29]. Children can adapt and learn from new technologies, while adults debate on their use and repercussions [34], in a context where online education has become the new normal.

ACKNOWLEDGMENT

This research has been financed by Facultad de Ingeniería y Arquitectura at Universidad de Lima, and Dirección de Investigación at Universidad Peruana de Ciencias Aplicadas. We like to recognise the valuable contribution of educators who shared their experiences on distance learning during the current COVID-19 pandemic.

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