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EXPERIENCE REPORT

A carnival learning party: crossing cultural borders through coding literacy

Annette VEE
University of Pittsburgh

Luciana Espíndola CORRÊA
University of Technology – Paraná

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EDITED BY
- Roberlei Alves Bertucci (UTFPR)
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EVALUATED BY
- Lara Frutos Gonzalez (USP)
- Diana Santos (UiO)

ABOUT THE AUTHORS
- Annette Vee
  Writing review and editing, supervision, conceptualization
- Luciana Espíndola Corrêa
  Conceptualization, writing-original draft.

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ABSTRACT

This experience report aims to describe the conceptual and logistical features of Coding Carnival, a Brazilian-American collaboration on teaching computer programming as literacy. It is a descriptive study, with a qualitative inquiry into the Eisner methodology approach (2017). In the fall of 2019, through a sponsorship from the Brazilian government, Corrêa came to study concepts of coding literacy with Vee, an English professor at the University of Pittsburgh. They elected to design a reading group focused on teaching coding in K12[1] contexts. Readings included Brazilian and American scholars of literacy and coding, alongside hands-on activities. The culmination of the reading group was a "Coding Carnival," two public all-ages events with a theme of Brazilian carnival to demonstrate hands-on coding activities and to help families learn coding literacy together. The power and identity relationships inherent to literacy, as well as its symbolic and technological features, connected "coding literacy" with Brazilian literacy theory--in particular, the potential of individual transformation and emancipation described by P. Freire (1981). D'Ambrosio's "ethnomathematics" helped us to see how cultural, physical, and social conditions shape the mathematical thinking embedded in coding practices (D'Ambrosio, 2002). The coding literacy theory, presented by Vee (2017), in conversation with Bers' ideas of teaching coding as a second language, helped us to bridge the gap between

[1] K–12 is an abbreviation of kindergarten (K) for 5– 6-year-olds through twelfth grade (12) for 17–18-year-olds, corresponding to the first and last grades, respectively, of free basic education in the USA.

teaching in the humanities and understanding technical concepts in programming through a carnival learning party.[2]

RESUMO

Esse relato de experiência tem como objetivo descrever as características conceituais e logísticas implementadas no Carnaval da Programação, dois eventos ocorridos no mês de janeiro de 2020 com o apoio da Universidade de Pittsburgh. Trata-se de um estudo descritivo, com uma abordagem qualitativa, fundamentada na metodologia proposta por Eisner (2017). Em 2019 Corrêa foi para a universidade de Pittsburgh pesquisar sobre *coding literacy* sob a supervisão da professora Vee. Vee e Corrêa decidiram expandir as discussões sobre o tema por meio de um grupo de leitura sobre ensino de programação na Educação Básica Americana (K12) a partir da perspectiva de teorias de letramento. As leituras incluíram autores brasileiros e americanos bem como atividades práticas analógicas que abordavam os princípios do pensamento computacional. A ideia de transformação e emancipação defendida por P. Freire (1981) tornou-se central nas discussões do grupo e no design das atividades analógicas. A etnomatemática D'Ambrosio (2001) ajudou a compreender como as condições sociais, materiais e culturais que moldam o pensamento matemático integrado nas práticas de escrita de códigos computacionais. Os diálogos entre as teorias de *coding literacy* e as ideias de ensino de programação como uma segunda língua de Bers (2018) pavimentaram o caminho para construir pontes entre os saberes das humanidades e a compreensão de conceitos técnicos computacionais. Pontes essas, materializadas em uma celebração carnavalesca do conhecimento.

KEYWORDS

Coding literacy. Intercultural collaboration. Critical Literacy. Surveillance Capitalism. Transdisciplinarity.

PALAVRAS-CHAVE

Coding literacy. Colaboração intercultural. Letramento crítico. Capitalismo de Vigilância.

RESUMO PARA NÃO ESPECIALISTAS

Esse relato de experiência tem como objetivo descrever as características

[2] This study was approved by the University of Pittsburgh Institutional Review Board under the number STUDY19100176.

conceituais e logísticas implementadas no Carnaval da Programação, dois eventos ocorridos no mês de janeiro de 2020 com o apoio da Universidade de Pittsburgh. No contexto de uma bolsa sanduiche de doutorado, cedida a Corrêa em 2019, as autoras decidiram expandir as discussões sobre letramento em programação, ou *coding literacy*, por meio de um grupo de leitura sobre ensino de programação na Educação Básica Americana (K12) a partir da perspectiva de teorias de letramento e alfabetização. As leituras incluíram autores brasileiros e americanos bem como atividades práticas analógicas que abordavam os princípios do pensamento computacional. Os diálogos entre as teorias de *coding literacy*[3] e as teorias estudadas pavimentaram o caminho para construir pontes entre os saberes das humanidades e a compreensão de conceitos técnicos computacionais. Pontes essas, materializadas em uma celebração carnavalesca do conhecimento. Descrever um evento que une famílias, estudantes, professores universitários e pesquisadores em torno da aprendizagem da programação abre a possibilidade para democratizar um saber que estrutura vida cotidiana contemporânea, altamente digitalizada. Essa contribuição pode servir como inspiração para outras iniciativas análogas bem como para aprimorar ações pedagógicas de educação tecnológica tão necessárias nesses tempos de desinformação.

Introduction

Designed to make coding concepts accessible and fun for university students, children, and their families, the *Coding Carnival* was a two-hour open house event held on 17 and 18 January 2020 at both the University of Pittsburgh and the MuseumLab at the Children's Museum of Pittsburgh. Modeled on the multigenerational, community-based Samba Schools in Brazil, the Coding Carnival provided spaces for informal learning, play, and performance for more than 200[4] people of all ages, educational and social stratification (Moraes, 1958). Drawing on physical computing and CS Unplugged approaches, and combining practical and theoretical insights from literacy pedagogy in Brazil and the United States, the

[3] Segundo Vee (2017) *programming* refere-se ao uso estritamente profissional da linguagem de programação e *coding* remete às práticas sociais que envolvem a escrita numérica. Esse relato de experiência adota a postura de Correa (2021, p. 31) que optou por não traduzir o termo *coding literacy* a fim de manter a diferença entre p*rogramming* e *coding* apontada por Vee (2017).

[4] Because it was a free event, without any participation certification, the Creativity Center of the University of Pittsburgh made an RSVP inscription, having only an approximate number of people who went to the Coding Carnival.

various stations of the Coding Carnival focused on binary encoding, sequencing directions, iterative processes of machine learning, and general computing principles. Kids came to stations with adults, learning together about how computers work through hands-on and interactive activities supported by volunteer facilitators. The six volunteers for the event, all participants in a reading and practice group focused on K-12 computer literacy education, learned ways of translating theoretical concepts such as literacy into practical and culturally relevant applications, inviting people of different ages and backgrounds. Our main event idea was to blend coding learning, Samba poetry, and fun. The lines below were drawn to describe this party learning ambiance.

In the back corner of the room, Vee stood in a giant box, a "computer" decorated with colorful pom poms, stickers, ribbons, and paper, her hands reaching out periodically to output images of various cats based on the written descriptions a kid was handing to her. Sitting at a table nearby, Corrêa was surrounded by bins of pony beads in different colors and guiding an array of students, stringing them into patterns based on their names. Robots sporting the Brazilian flag were twirling and promenading down a course on the other end of the room while their kid programmers looked on, eager to see if their directions worked as they intended. Colorful flyers featuring samba dancers or computational concepts were scattered strategically across tables. The room was messy and full, with the smells of Brazilian cheese bread and coffee beckoning from an adjacent room.

This experience report outlines some of the conceptual and logistical details of this unique collaboration and successful public humanities event. The focus on describing an experience defines it as a descriptive study. Our study also relates to Eisner (2017) when he states that qualitative research applied to education concerns itself with qualities that arise through observation of educational actors. The author defines as quality everything that can be experienced through the senses. For him, qualitative research, in the educational context seeks to comprehend the meaning of the experience of the researchers in schools, universities, or another educational field.

As American universities endeavor to dispel popular misconceptions about how education is practiced and the kinds of knowledge produced on their campuses, there is an increased urgency for public humanities projects such as our Coding Carnival. Moreover, the transnational contexts in which our student's faculty, and communities live, and work call for generative, cross-cultural collaborations and translations accessible to a broad public. COVID-19 has put a finer point on these projects, as the pandemic has decreased funding for community-based organizations, including those that have supported STEAM-centered pedagogies and digital literacies. Our Coding Carnival represents a successful bridge across divisions between the humanities and STEM, the university and communities, multiple generations of learners, and national, linguistic, and cultural borders. We begin this paper by outlining the context of our collaboration, then describe the Brazilian and American pedagogical theories behind our event design, and finally provide a map to the specific activities of the Coding Carnival and a blueprint for those who might want to run a similar publicly-engaged event.

1. Initial Design and Context for a Reading Group on Programming in General Education, k-12+

The Coding Carnival grew organically out of a ten-week Reading Group in which volunteers encountered both American and Brazilian theories of literacy and learned hands-on activities that support culturally relevant pedagogy in computing. The engagement from volunteer facilitators, the theoretical sophistication of the approach, and the relatively smooth translation of computing principles into fun, hands-on activities all stem from the discussions and trial runs in the Reading Group. This section describes the logistical and theoretical context behind Corrêa and Vee's design for this Reading Group and the Coding Carnival.

When the two of us sat down to decide what Corrêa's course of study would look like and how we would structure our collaboration, we decided that we would like to open up our conversations on coding literacy To open up our academic collaboration and conversations on coding literacy to other students and faculty who might be interested, we put together a syllabus that included both hands-on and written materials to engage with every week, all geared toward coding literacy and related theoretical frameworks in K-12+ education. We invited faculty and graduate students in education, computer science, and English to this independent group. We offered no credit or financial compensation for participation; as a result, the core group was small but independently motivated.

We drew on our academic and professional backgrounds for the theoretical and practical sessions. [5] Corrêa's prior work on ways to improve Basic Education teachers' experience in the programming teaching-learning process also informed our discussions (Louro, 2019; Corrêa, 2021)[6]. In the context of Basic Education, Corrêa has argued for the importance of analog computational thinking materials in teaching teachers about coding principles, especially in under-resourced areas where she had done teacher-training (CORRÊA, 2021). For the practical sessions of the Reading Group, we did activities Corrêa had designed and implemented in kids' after-school programs and Basic Education teacher training in Brazil, putting them in context with Brazilian and American literacy theories. Corrêa (2021) designed analog materials to teach computing principles through themes familiar to Brazilian school teachers: fairy tales, craft art, and local folklore. Our hands-on activities used everyday life examples, literature, and cultural contexts. The theoretical and practical sessions were linked through *coding literacy* and understood coding as inflected by culture and social contexts (Vee, 2017).

The power and identity relations inherent to literacy, as well its symbolic and technological features, connected "coding literacy" with Brazilian literacy theory--in particular, the potential of individual transformation and emancipation described by Paulo Freire (1981) and Soares (1988, 2015).

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[5] We were hosted by the Center for Creativity at the University of Pittsburgh, a newly formed space in the basement of the University Bookstore that was well-supplied with 3D The invitation and syllabus can be found here: <https://docs.google.com/document/d/1HfIrNCXcw42cuVuMoI5Wu Jpaw3_9seSpE1t65IRXEM/edit >

[6] These analog materials were developed before Correa's international experience at the University of Pittsburgh, and are described in Correa's Ph.D. thesis (CORREA, 2021).

D'Ambrosio's ethnomathematics helped us to see how cultural, physical, and social conditions shape the mathematical thinking embedded in coding practices (D'Ambrosio, 2002). Our discussions led us to put together a community-focused, public event where we might be able to put into practice the synthetic work, we'd been doing around coding literacy and Brazilian and American approaches to education. In our reading group and Coding Carnival event, we bridged the gap between teaching in the humanities and understanding technical concepts in programming.

2. Coding Literacy in Theory: a sociomaterial education for life approach

We designed the Coding Carnival with the idea of coding as literacy, drawing on a wealth of literacy theories originating from both Brazil and the United States. In Coding Literacy, Vee (2017) traces several rhetorical justifications for literacy education, including fulfilling citizenship requirements, individual potential, and its capacity to foster thinking. We brought these social, cultural, and ideological frameworks to the Coding Carnival alongside community-based literacy education approaches. We used the event to approach coding literacy from a perspective that interweaves social, individual, multicultural, and material components through influences by power relations, social values, and cultural features. In this section we trace the interwoven threads of literacy that supported our Coding Carnival design.

Vee (2017) argues, along with diSessa (2000), Bers (2018) Rushkoff (2010) and others, that computer programming is a kind of literacy in contemporary society, at least in the West. She draws on diSessa's schema of material, social and cognitive pillars of literacy to describe a socio-material approach to computer programming (DISESSA, 2000). The social pillar is the cultural, personal, and ideological forces that make some communication technologies essential to communication. The material pillar is the set of tools used to implement the technology, such as papers, books, or alphabets that shape ways of thinking, the culture, and social relations within a society. Computer programming's broad and infrastructural use, which supports, circulates, and sometimes undermines textual reading and writing, means that learning this communication technology is as important as textual reading and writing nowadays.

As diSessa (2000) argues with the example of how much clearer Leibniz's notations for calculus are than Newton's, the material methods of expression can affect the circulation of a form of technology: calculus is broadly taught in part because Leibniz's notation makes it easier to understand. In this same spirit, approaches to teaching computer programming that illuminate the basic concepts more clearly are more likely to help communication technology circulate more broadly.

Given our broad goals for the Coding Carnival, we carefully considered both the social and the material contexts of the event: it was held in open, community-based spaces for all ages. It presented tactile and accessible approaches to basic concepts in computing. This venue and our approach to computational literacy also align with our understanding of Ubiratan D'Ambrosio's theories of ethnomathematics (D'Ambrosio, 2002). D'Ambrosio (2002), a Brazilian math historian and educator, argued for consideration of the social and cultural contexts of math. Far from the idea that math is "facts," the practices of math--

like literacy--are shaped by cultures and histories. Consequently, math education should be responsive to student cultures and experiences. We extended this idea to computer programming, another discipline that is often taught as simply technical. Coding, math, and literacy are all socio-cultural activities, and their pedagogical practices should reflect that truth.

Teaching coding as literacy, the standing point of this theoretical framework, implies a transdisciplinary approach (Nicolescu, 2014), going between, through, and beyond other knowledge fields such as math, computer science, and storytelling. The transdisciplinary eye also allows building bridges between cultures, traditions, and science, because its goal is to bridge knowledge by fortifying social and personal bounds between all people and beings who construct collectivity (Nicolescu, 2014). A transdisciplinary approach opened up multiple modes of pedagogy as we considered the ways we could connect participants through learning and playing with coding. In fostering a collectivity working towards transdisciplinary knowledge we also considered ideas of literacy connected to citizenship.

Vee's (2017) arguments about the pertinence of universal access to coding draw on Paulo Freire's idea of a literacy as a human right and a passport for full citizenship (FREIRE, 1981). Freire is an influential literacy educator in both the United States and Brazil and so his work formed an ideal theoretical bridge for our cross-cultural literacy discussions. In Brazil, Freire (1981) is one of the most important theoretical references in Education: his work paved the path for the modern Brazilian literacy theories concerning the access to writing and reading for everyone. In 2012, he received the postmortem title of Brazilian Education Patron (Brazil).

Literacy for Freire (1981) is learned in the community as part of a process of critical consciousness. Literacy can liberate oppressed peoples from the structures that constrain their potential, helping them see and name the world from their perspective rather than their oppressors. The urgency of teaching coding as a universal literacy, trespassing the sanctity of computer science as a solely professional and specialized field, is also underlined by US technology theorist Shoshanna Zuboff (2015). She sounds alarms on "surveillance capitalism" engendered by big data manipulation of algorithms created by technological corporations such as Google or Facebook. Because people do not know how personal information is stored, distributed, and manipulated by encoding systems, they cannot perceive its potential to shape behaviors, emotions, and ways of life (ZUBOFF, 2015). While our Coding Carnival did not take on such deep work in its short sessions, we are inspired by the idea of literacy as liberation in terms of coding. Douglas Rushkoff argues that people should "program or be programmed" and, indeed, issues of representation and algorithmic bias are clear indications that a broader population should be contributing to our code-based technological infrastructure.

We also based our practical implementation of coding literacy on US-based Argentinian scholar Marina Umashi Bers's (2018) idea of coding as another language. In this approach, children can think about coding from a multilingual angle, with all of the social and family associations with human languages. For Bers (2018), teaching coding with a language approach opens the opportunity to present ethics and values to children through a multicultural eye, where tradition, literature and science finds a bridge materialized by coding experience. Contemporary Brazilian literacy scholar Magda Soares similarly approaches literacy-learning through affective relations as a path through the heart (SOARES,

1981). Soares (2015) considers writing a technology and argues that initial reading and writing instruction should guarantee the fundamental ability to manipulate the alphabet, considered by Vee (2017) one of the possible material components of literacy. For the Brazilian scholar, the social practices related to communication technology are literacy. Thus literacy, for Soares (1981), should be understood as the entry into literate culture and society. This social admission, through literacy, is made through a path through the heart, becoming a powerful tool of self-transformation and empowerment that can change power, social and individual relations (Soares, 1981). To investigate ways of teaching coding as a literacy for everyone, including all marginalized social groups, we put in conversation the socio-material perspective of Vee (2017) with the community and language-based approach of Bers (2018) and the transformative and loving approach of Soares (1981).

Because coding is literacy, the access to this knowledge should be universal and its pedagogy should embrace the concept from Edgar Morin (2015) about teaching people how to live, which goes beyond preparing people for job demands. Edgar Morin (2015) believes that life is like a fabric made of poetry and prose. Poetry is everything that lifts the human spirit and makes life worthwhile, like friendship, art, music and love. Prose is all activities focused on survival and daily life needs. Learning how to live is knowing how to balance those two threads of life (Morin, 2015). Approaches of literacy across the lifespan similarly emphasize the potential value of reading and writing for all ages. These approaches often focus on adult learners in the context of their communities. We considered these approaches of life-enhancement, community, and mixed age groups in our design of the Coding Carnival.

For the approach to community, life-enhancement, and collaboration across mixed-aged groups, Brazilian Samba Schools were our model. Samba Schools in Brazil are mixed-aged collectives that focus on preparing a float, a samba song, and a dance for the Brazilian Carnival festivities that happen on the weekend before Ash Wednesday. The Portuguese word "Carnaval" comes from the Latin "carnevale," which translates as "farewell to meat" (Moraes, 1958). During the festivities, women, men, and children are (ostensibly) equals, independent of their social, economic, educational, family, gender orientation, or ethnicity (Damatta, 1997). Samba Schools act as teams to prepare for the events, and Brazilians carry fierce loyalty to their schools. The carnival is a friendly competition as each School is rated on its performance in the parade. For those who are involved in those communities, samba is more than music, dance, and costumes; it is a collaborative and community-centered approach to life (Araujo, 2012).

Through the Carnival theme choice, we planned an event to welcome and accommodate a broad range of people. DaMatta (1997) argues that Carnival allows an inversion of roles and places in society, opening space for exercising freedom, intercultural exchange, and transgression of social structures. We chose the Carnival theme to use its metaphor to offer people a place where everyone is welcome to be themselves, sharing ways of life, know-how, and ideas without the weight of social masks. Coding Carnival was idealized to offer an opportunity to learn not only programming but also to make connections between people, cultures, traditions, and different ways of building knowledge. We intended to show participants that coding is indeed accessible to all. In this spirit, we designed and distributed four flyers and banners with cultural and historical information on the Brazilian Carnival (described below).

This need for balance between the poetry of Samba in Brazilian Culture and the prose of learning coding in contemporary society in both Brazil and the US inspired us. In the next section, we describe the practical approaches we took using Brazilian Carnival culture to help our participants experience their potential to express themselves through coding.

3. Coding Carnival: Balancing Samba and Coding

The Coding Carnival took place on January 17, 2021 at the Center for Creativity of University of Pittsburgh and on January 18 at the MuseumLab of the Children's Museum of Pittsburgh. These two-hour open houses offered four, hands-on and "unplugged" activities designed to teach a few basic principles of computing--that is, computing activities that did not rely on screens or computers. Although both open houses were focused on all-ages groups, we anticipated more individual participants and undergraduates at the Pitt open house and more family groups and younger children at the Children's Museum. Stations were run by Corrêa, Vee, and six volunteers from the Coding Literacy Reading Group. As described in the previous section, we designed the open house with theoretical approaches to literacy and community-based pedagogy. For both volunteers and guests, we hoped to balance the mixed-age fun of Brazilian Samba culture with practical computing knowledge.

During each open house, guests were invited to explore several practical coding activities. They could learn about binary coding patterns by designing carnival masks at one station and necklaces or bracelets at another. In the machine learning station, guests could feed cards to a "computer" (a volunteer in a large, decorated wardrobe box), iterating until they taught the computer to recognize a cat. They also had the chance to code a Robot Carnival Parade using Botly robots. These experiences were divided into four learning stations: *How computers read* (Binary Masks), *How computers write* (Binary Necklaces or Bracelets), *How computers learn* (Input and Output Box), and *How computers can "have fun"* (Carnival Robots). Each station had a volunteer to lead the experience and could receive up to five people at a time. The stations were structured so that they could be understood and enjoyed by a wide range of ages. Stations were accompanied by flyers and explanations of each relevant underlying computing principle. Other flyers around the stations described the history and cultural practices of Samba in Brazil.

Corrêa designed the computing activities based on the theoretical framework we had explored together in our reading group and her own experiences teaching coding in underresourced schools in Brazil (Corrêa, 2021). In that context, Corrêa had often used "unplugged" computer science activities for several reasons. "Unplugged" CS activities are used all over the world and are perhaps best represented by a group and website called "CS Unplugged" (2023), which describes them as "providing physical, kinesthetic experiences as part of learning computing." CS Unplugged teaches the principles of computational thinking (Wing, 2006) without students needing to learn programming first. Even young children can engage in tactile and collaborative activities focused on algorithmic thinking, logic, and abstraction. While Corrêa (2021) did not draw directly on CS Unplugged activities for her training sessions with Brazilian school teachers, the learning principles behind her work and theirs are similar.

Materially, without significant computer resources, Corrêa (2021) found it easier to run sessions drawing on paper, imagination, and other ready resources. Computers that were available often did not have the right software or were not updated enough to install it (Corrêa, 2021). But more importantly, the teachers were not comfortable with computers. Beginning with storytelling and crafting, Corrêa (2021) could help teachers work through their resistance to computers and teach basic computational concepts such as sequencing, encoding, and loops. Once teachers could assimilate these new concepts to a context in which they were already familiar, Corrêa (2021) could work with them to see how the computer drew on the same concepts. Teachers could then use the same tactile and kinesthetic activities with young children in their own classrooms (Corrêa, 2021). The "unplugged" approach was friendly to all-ages contexts, used ready resources, and leveled experiences among participants with more and less direct experience with computers. For these reasons, unplugged activities fit well with our theoretical framework for the Coding Carnival.

Most of the reading group participants chose to volunteer for the Coding Carnival event (others were unavailable for those dates). One week before the event, Corrêa invited volunteers to test and experience the learning stations in the Center for Creativity, where we had held our weekly sessions. Volunteers were already familiar with the theoretical framework and had experienced similar hands-on activities during our weekly meetings. The practical training enabled them to run the hands-on coding activities that they would be responsible for leading. After knowing all the learning stations, each volunteer chose one of the four learning stations to lead during the event. Corrêa was available to run the others and to float among the stations.

Guests were welcomed as they came into the space and told about the different stations and themes. We had advertised both events widely as all-ages activities related to coding and carnival, and noted on the flyers that food was served and that the Pitt event was free. The event at the Children's Museum was free with admission to the Museum. By hosting the event with food and making it as materially accessible as we could, we considered people invited to our event as guests instead of students. Because guests came freely to experiment with the coding challenges, we did not evaluate their learning from the event's stations. But we did talk with them at each station and reflect back to them what computing principle they had encountered there, then offered a handout with the computing principle explained for them to take home.

We adopted a learning station pedagogical strategy from Schweitzer (1995) to provide an active learning experience to Coding Carnival guests. Schweitzer (1995) defines learning stations as sites with one or more problem situations to be solved with its physical materials. We used two of the three of Schweitzer's criteria to idealize these stations (Schweitzer, 1995). The first is the problem solving contextualization made through questions and challenging instructions. The second is the balance between the activity and different learning levels. The third is the explicit explanation of the key concepts at work in the station. We adapted the criteria to the Coding Carnival features and themes, as discussed above.

The "How Computers Read" learning station was focused on binary encoding. Guests were challenged to decorate and cut a Carnival mask by following a binary pattern on a gridded piece of paper. We prepared a written algorithm with instructions and a template coded in 0 and 1 squares to guide

this experience. The squares marked "0" were meant to be cut or left empty; the squares marked "1" should be decorated to build the mask. Sparkly stickers and cut-out shapes were available for decorating the "1" squares and the participants were free to exercise their creativity in decorating their mask (see fig.1). Alongside the mask activity, participants were asked: How does the binary 0 and 1 principle work when applied to digital technology? How can you simulate computer behavior by following an algorithm? The binary mask was designed for a large age range, including parents, kids, teenagers, and adults; in practice, families worked together to design their masks.

FIGURE 1 - Binary Mask output example.
Source: From Corrêa's personal file

The “How Computers Write” learning station also focused on binary encoding, but involved a more complex translation. Using ASCII (American Standard Code for Information Interchange), guests were shown how to translate the letters of their name into decimal numbers and then translate those numbers into binary, which computers can read. They then used those numbers to build a binary necklace or bracelet representing their name. To attend to a range of ages, Corrêa designed two activities: the Binary Necklace was meant for children and adults who could read and the Binary Bracelet was designed for pre-literate children (see fig.2). The goal was to help them understand how letters can be encoded using different systems such as ASCII and binary, effectively "translating" between the written language we read and the numbers computers can read.

For participants over 8 years old, or those who could read, we presented an adapted ASCII table, showing equivalents between 26 alphabetic letters and decimal numbers (e.g., O = 15). The station leader explained to guests that computers can only read binary, that is, only 0 and 1 and asked guests

to consider how they might make a computer understand their name written with letters. After some discussion, the participants would come to realize, with the station leader's help, that they could write their names in binary. The station leader then explained that this translation is what the compiler does. Then guests were directed on how to translate decimal numbers to binary using the positional notation principle. Guests were given a blank template to write the letters in their name, the ASCII number equivalent, and then the binary equivalent. Translating yet again by assigning colored beads to the 0 and 1 pattern of their name (e.g., red=1; blue=0), participants then strung a binary necklace with the help of this template. For younger participants, we adapted a table with lower numbers and offered them bigger beads. Therefore, they had the same activity with the option of writing just the first letter of their names.

This station drew on the popularity of name necklaces among young children and helped them literally see themselves in computing principles. We presented the learning station by asking: How does the compiler work inside the computer? How does it translate symbols such as letters into numbers (0 and 1) that it can understand? What are different ways that we can encode information such as letters? The station thus helped to teach computer science principles of encoding and abstraction.

FIGURE 2 - How Computer Write station, binary Necklace, and Bracelet materials.
Source: picture courtesy of the Children's Museum of Pittsburgh.

The “How Computers Learn” station focused on the iterative processes of machine learning in computers. Guests played the role of programmers challenged to "teach" a computer to recognise a black cat. The station leader played the role of a computer and simulated computer behavior about information processing and feedback. The station leader stood in a large cardboard wardrobe "Input/Output" box fancifully decorated by volunteers and with a cutout slot in the center at chest level. Cards featuring pictures of various colored cats and dogs were stacked on a nearby table and served as "inputs" to the box and the station leader had a stack of cards with images and text to offer guests as "outputs" in response. When they arrived at the station, guests were given instructions for an algorithm to train computers to recognize black cats, to distinguish them from other animals and cats of other colors. Guests would hand animal cards to the station leader, who would respond based only on the information she had been given by handing them an output card (see fig. 3). Guests quickly learned that this Input/Output box could not make inferences and needed to be given patterns of black cats and non-black cats in order to "learn" to recognize the differences between them. After the guests

learned how the Input/Outbox box responded to input, the station leader guided them to a flyer on the table explaining the machine learning principles behind Artificial Intelligence, which Vee had designed using Janelle Shane's playful work about AI behaviors. She and guests then discussed these principles in relation to the experience.

FIGURE 3 - Vee plays the role of a computer with a guest by accepting a card as "input".
Source: picture courtesy of Children's Museum of Pittsburgh

Finally, at the "How Computers Have Fun" station, we challenged guests to make programmable robots perform the Carnival Flag-Bearer Dance. The flag-bearer dance is considered a love ritual where the samba-host courts the flag-bearer, who then gracefully replies to the gallantry. The flag-bearer dance is one of the most important aspects of the Samba School's Parade and figures significantly in a school's rating during the Carnival parade. By translating the description of the Brazilian Flag-Bearer Dance rules into an algorithm for a programmable robot, guests applied computational thinking principles to make a robot Carnival parade. This station taught principles of sequencing and programming as participants lined up various directional cards and loops to instruct the robot to travel down a parade route, spinning and "dancing" as it went. Guests often adjusted their sequencing, or "debugged" their program as they watched their robots veer off path or not follow their dancing vision. We used Botly robots, which could be programmed using only directional cards and a remote control. The Botly robots held a tiny Brazilian flag and guests also were invited to decorate the robots by making Carnival

costumes out of paper and stickers available at the station. This station was designed to receive everyone, from very young children, their guardians, college students and teachers, and in practice, groups worked together across ages to design their robot and dance. (see fig. 4). The collaborative spirit at this station thus reflected the multigenerational collaboration that happens in Samba Schools in Brazil--the same collaboration that Papert (1980) had admired as a support for learning.

FIGURE 4 - How computers have fun learning station.
Source: picture courtesy of Children's Museum of Pittsburgh.

4. What the Coding Carnival taught us and others

Our main goal for this event was to show that computing principles can be perceived in daily life and that digital culture is accessible for everyone. By using the Rio de Janeiro Carnival party as a cultural background, we hoped to show that coding is fun, culturally inflected and can be broadly learned. Thus, we intended to give a practical application of the coding literacy concept (Vee, 2017). As Vee (2017) describes it, coding literacy implies an interwoven relation between coding, writing, and culture (Vee, 2017). In addition, by contextualizing the coding practice in a cultural and social framework, we followed the learning approach of problematization, contextualization, conscientization, and emancipation from Paulo Freire (1981). The event was largely successful, as measured by positive feedback from participants, the rich experiences of volunteers, and effective partnerships with university

organizations and community nonprofits. We bridged cultures, languages, community-university spaces, and humanities-STEM divides in the Coding Carnival.

While we did not collect formal surveys from our guests, we heard directly from some of them during the event that it was enjoyable and helpful to them. One of the guests, a Pitt Computer Science major, told Corrêa after the Binary Necklace experience: "You took 45 minutes to help me understand what my teacher couldn't do in one year of computer science class. Now I know how ASCII works…". A mother also revealed to Corrêa during the coffee break that she was more comfortable learning coding with her kids, once she could participate in the process without feeling mismatched regarding other students, usually younger, with computer backgrounds. One week later this mother asked Corrêa to teach her more about the binary system and Corrêa gave her a private lesson about how to teach her kids to play with the binary system. Later, the same mother came with her children to other workshops Corrêa gave at Assemble, a community STEAM site. These are just small and concrete examples of how the open and time-limited event helped to foster more extended engagement with coding principles, as well as other community organizations.

Guests were generally engaged in the activities, and kids, adults, and college students worked alongside each other on the activities. We had designed the learning stations to be inclusive of ages and experiences, which translated into them being accessible in other ways as well. A college student who was blind visited the event and asked for assistance from our volunteers; with that assistance, they were able to navigate the stations successfully and showed a great interest in participating in them. Many of our flyers included not only text and images, but QR codes to direct guests to websites; using a screen reader, it was possible to hear more about the computing principles and cultural contexts we featured at the event. Although we did not prepare the activities specifically for guests with visual or other impairments, the multilayered sensory experience, tactile nature of the learning stations, multiple modes of information delivery, and hands-on guidance from volunteers meant that we could seamlessly support this student's experience of the Coding Carnival. This guest and other reactions highlight how coding can be universally learned when presented with a literacy and transdisciplinary approach.

The experience of preparing for and running the event also had an impact on volunteers who weren't familiar with coding and were just trained before the event. After the event, Eleonor, for example, realized that she became more confident to start a coding course through leading the Binary Necklace and Bracelet learning station. Sebastian, another volunteer, discovered that the experience of facilitating the robot parade station for kids helped him to overcome his fear of machines and physical computers, especially robots. All of the volunteers said that they enjoyed the experience, especially in working with children and families outside of the university.

Finally, the Brazilian Carnival theme brought some fun to the experience, especially in the middle of the gray Pittsburgh winter. Guests and volunteers enjoyed the food, music and cultural education about the Carnival. This integration of education and life, poetry and love as integrated into technical learning experiences (Morin, 2015) sewed the experience together for us. We and our guests learned about Brazilian culture and coding principles at the same time. This experience was a

transdisciplinary materialization of the coding potential to build bridges between traditions, other kinds of knowledge that usually stay within the borders of science, technology, engineering and mathematics, and people from diverse cultural and social perspectives.

We have described a successful collaboration that worked across multiple kinds of borders--university and community, generations, disciplines, cultures and languages--but in putting on the Coding Carnival, we encountered challenges that reinforced those borders.

The university and public bureaucratic systems, ostensibly erected to protect individuals and communities, made some aspects of our collaboration difficult or impossible. Child clearances were necessary to work at the Children's Museum, which required months of processing, staff coordination and a fee (which we used some sponsorship from Pitt organizations to cover). One core volunteer's clearances did not come through in time and so she could not participate. Catering rules at Pitt and the Children's Museum meant that only trusted vendors could be used for events--and neither institution included any Brazilian food or businesses on these lists. Keeping catering costs under a specific amount, paying out of pocket, and making specific arrangements directly with a local Brazilian restaurant allowed us to serve Brazilian food at the university; however, we could only do an American cheese plate and coffee for the Children's Museum event. The event was held just before the COVID-19 pandemic, which has resulted in more stringent regulations on food now; holding any event that includes catering is nearly impossible. Yet food is one key way for people to share cultural knowledge and traditions. These restrictions are not without justification, of course. However, it is important to note that they can hamper cross-cultural collaborations.

Another point about choosing a venue: we were interested in collaborating with a community-centered organization in a predominantly Black neighborhood, especially with the cultural connections of Afro-Brazilian traditions of samba and the desire in such neighborhoods for more culturally relevant education in literacy in technology. But also critical in such areas, given the history of universities taking advantage of Black neighborhoods for research or breaking promises of resources and relationships, is a sustained connection and follow-up. Given the limited terms of Corrêa's fellowship, we were unable to offer a sustained pedagogical program and therefore sought an institution that would be community-facing and yet allow us to offer this one-time event without breaking promises of sustainability. We then partnered with the Children's Museum for the community version of the Coding Carnival. We appreciated the collaboration with this venue, but it did mean that we needed child clearances, could not serve Brazilian food, and the event could not be free to the public because of the Children's Museum's admissions policy.

During the event, we realized the accessibility potential of Coding Carnival for guests with disabilities. This realization wasn't a challenge, but instead an inspiration for future similar events: we intend to implement more inclusive pedagogical actions, anticipating multiple kinds of physical or cognitive special needs, as well as more sustainable initiatives.

As with any event with a significant technical component, issues with breakdown and malfunction were present. For example, we changed our approach to the dancing robots from our original design, which included more sophisticated robots for older participants. We had prepared a Botly robot with

paper cards for 5-7-year-old kids and a papercraft robot animated with a robotic kit for the older ones. This robotic kit was meant to be a Carnival Float. However, technical issues with the robotic kit led us to use only the simpler Botly on both days.

We found the Samba to be a beautiful model for collaborations. But, as with any model, we must recognize that the Samba school model is also an ideal. In reality, Samba Schools are not utopias. The money that funds some of them is suspected of being connected to illicit militants, which also finance political instability in Brazil (Hous; Nogueira, 2018). And despite progress, traditional gender stereotypes reign. In looking to Samba as a model, we can pull the best parts out for emulation, and avoid the parts that should not be replicated.

5. Blueprints for Future Bridges: some final considerations

Writing about this experience during the ongoing COVID-19 pandemic, it felt like a lifetime ago that we were together, sharing tables, materials, and food, and that Corrêa could travel from Brazil with the blessing of both the American and Brazilian governments. We hope to connect again, to break bread and learn more about coding together. In the meantime, we used Zoom to see each other and collaborate on Google Docs. Our experience with the Coding Carnival underscored the relevance of face-to-face encounters to build bridges between people. The virtual events and social media, intensified and celebrated during the pandemic, are structured by algorithms that divide people in bubbles, increasing ideological and political polarization (ZubofF, 2015). Face to face contact could show in practice what Morin (2001, p. 211) named "planet identity,"[7] or consciousness about sharing Earth destiny and, at the same time, embracing the differences between continents, countries, communities, and individuals.

Because of its focus on literacy as a way of self-expression, programming can build bridges between people who do not share the same natural language, working as an international communication technology (Bers, 2018). Also, the problem-solving flexibility offered by coding allows an ethnomathematics experience. For D'Ambrosio (2002) mathematical thinking is materialized through culture that could be defined as the ways of acting and understanding the world of a community. These behaviors are embedded in individual voice and creativity as well as people's cultural, familial, and social environment (D'Ambrosio, 2002). During the Coding Carnival and its preparation, we experienced this coding, ethnomathematics, and linguistic potential to promote the confluence of cultures and life perspectives. For example, the volunteer Sebastian considered his necklace binary manufacture an "a-ha moment " because he would finally understand how cultural diversity could be explored through ethnomathematical practices. Sebastian realized that the binary positional notation system was only one of the solutions that humans discovered to quantify, and it could be used inside and outside computing contexts. Also, Sebastian shared his realization that two people could solve the same problem with different approaches that would reflect their familiar, economic, social, and cultural backgrounds. This

[7] Translated from French original Citation "identité planétaire" (MORIN, 2001, p. 211).

volunteer even regretted that he did not learn mathematics through this ethnomathematics approach during his school years.

Another thing the pandemic has taught us is the increased urgency for connecting with communities outside the university, breaking down those boundaries, and having the knowledge produced in the university be accessible to families and communities outside. Moreover, our universities and students operate in transnational and multilingual contexts. Embracing these contexts and working with the advantages they offer is key to universities moving forward. We hope that in our interpretation of the Samba school for coding, we've offered just one practical approach to breaking the boundaries between university and community knowledge. International conversations, work with public institutions such as museums, bridging educational contexts across elementary and higher ed, and finding synergy between the teaching in the humanities and computing are all critical components of any future for the humanities. This experience reporter has provided one blueprint for that future.

Additional information

Authors' Evaluation and Response

Evaluation: https://doi.org/10.25189/rabralin.v23i2.2238.R

Roberlei Alves Bertucci
Affiliation: Federal University of Technology – Paraná
ORCID: https://orcid.org/0000-0003-4014-5610

Emanoel Cesar Pires de Assis
Affiliation: Federal University of Piauí
ORCID: https://orcid.org/0000-0001-7377-8540

Rebeca Schumacher Eder Fuão
Affiliation: Universitetet i Oslo
ORCID: https://orcid.org/0000-0002-7658-7704

Evaluator 1: Lara Frutos Gonzalez
Affiliation: University of São Paulo
ORCID: https://orcid.org/0000-0001-5456-3536

Evaluator 2: Diana Santos
Affiliation: Universitetet i Oslo
ORCID: https://orcid.org/0000-0002-3108-7706

EVALUATOR 1

O texto apresenta um relato de experiência para um evento em que a noção de letramento é expandida para a noção de letramento em computação/programação. O evento objetiva estimular o letramento em programação através de atividades relacionadas ao carnaval, dispostas em estandes em museus nos EUA.

O artigo é bastante efetivo em informar o conceito de base para a preparação do evento, através da interrelação entre diversos autores, trazendo uma importante reflexão teórica acerca do tema.

Como sugestão para a reformulação de pontos do artigo deixamos os seguintes pontos:

- Revisão ortográfico gramatical - em especial no que concerne à pontuação.

- Inclusão de informações mais objetivas sobre o número de participantes e público-alvo já na introdução, além de informações de caráter mais técnico que descrevam o evento. A linguagem no início é um pouco abstrata e essas informações aparecem, alguns delas, apenas mais ao final do texto.

- Reformulação da seção em que é descrita uma contextualização anterior, procurando dar ao texto uma linguagem mais objetiva e suprimindo informações contextuais de caráter pessoal não relacionadas diretamente ao evento.

Os apontamentos mais pontuais se encontram no arquivo disponibilizado.

EVALUATOR 2

This paper describes a successful experiment in coding literacy inspired by Paulo Freire's pedagogical ideas and ethnomathematics as defined by D' Ambrosio, dialoging with Bers's ideas of teaching programming as a second language, using the Brazilian Carnival theme to teach binary coding, ASCII, the gist of machine learning from examples, and robot control, for children and their families, in an informal environment with four "learning stations" with food and music.

The paper is well written, well-illustrated, and has interesting comments on the bureaucratic problems that such innovative initiatives have to face.

I have just two small comments: a reference is required for the sentence "Since 2018, extremist far-right movements have tried to discredit Freire's contribution to the field of education in Brasil".

And maybe one should explain in what grounds, if they have written about pedagogical subjects. Or then simply remove that sentence. One can continue to follow a scholar even though others don't.

Another comment is the description about the origins of Carnival, that seems on one hand too detailed and on the other hand not informative enough (one wonders for whom the description was written...) In my opinion, there is no need to introduce what is for most purposes just another word for Carnaval, Entrudo. Carnaval in Portugal and in Brazil represent exactly the same concept and feast, although of course details, organization, and climate widely diverge. Also, there is no reason to talk about Catholicism, since Carnaval existed throughout the Middle Ages and before, so Christianity, or Western Christianity, is the right religious origin if you want to mention it. I wonder whether the mention to the Catholic religion is meant to indicate that only Brazilian Catholics celebrate Carnival? This would be highly surprising, but then worhwhile to mention. But if it is only to explain the origins, the adjective "Catholic" is anachronistic.

Finally, I do not think the abstract really summarizes the contents of the paper. It only summarizes the theroretical stances, not the actual events, so I suggest that its improved. I also do not think that the "sandwich Phd" is something that should be in the abstract.

Conflict of interest

The authors have no conflicts of interest to declare.

Link to Preprint

We sent it to the independent preprint repository authorea.com and await the DOI. Below, we include proof of sending.

Research Protocol and Pre-Registration

After evaluation at Ecuador Network, it was decided not to follow any script on the website, as it is a descriptive and qualitative experience report.

Data Availability Statement

The data and materials that support this study are available on demand in an institutional drive managed by the authors.

Ethics

Not applicable. Even without a formal requirement from the University of Pittsburgh, the authors requested an evaluation from the University of Pittsburgh ethics board. They obtained approval both to describe the event and to interview the participating professors (approval registered under number IRB STUDY19100176).

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