Equity of Learning Opportunities in the Chicago City of Learning Program

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ABSTRACT

A novel method for understanding the equity of extracurricular learning opportunities within a regional learning ecosystem is presented. We apply the ecosystems concepts of abundance, richness, and evenness to understand the distribution of learning opportunities within the Chicago City of Learning. This analysis highlights the differences in learning opportunities across different neighborhoods the city. This article includes discussion of the ways these analyses can be used as a starting point for understanding city-wide informal learning communities.

1. INTRODUCTION

This work uses computational approaches to understand the spatial distribution of informal learning opportunities available to youth within the Chicago City of Learning (CCOL), a unique partnership and infrastructure built around supporting youth access to learning opportunities outside of school. Local organizations list their program offerings on the CCOL website and place them in one or more of eleven learning areas such as sports, science, or design. Youth access the site to browse and sign up for these programs. Our aim is to understand the degree to which these afterschool and summer opportunities are accessible to youth. The accessibility of programs relative to where youth live is a matter of *spatial equity* [4].

This research reports on the first year of efforts by CCOL members to document summer informal learning opportunities in Chicago, which resulted in over 4500 searchable learning opportunities. We developed a novel theoretical framework, inspired by concepts from the study of biological ecosystems, that draws on concepts of species richness, abundance, and evenness, and extends these concepts to characterize learning opportunities in a geographic space. We developed data mining approaches for operationalizing these concepts, drawing on data collected through the CCOL system. We present the theory, data mining approaches, and results on a specific question of interest: How are learning activities distributed across different neighborhoods in Chicago?

2. THEORETICAL FRAMEWORK

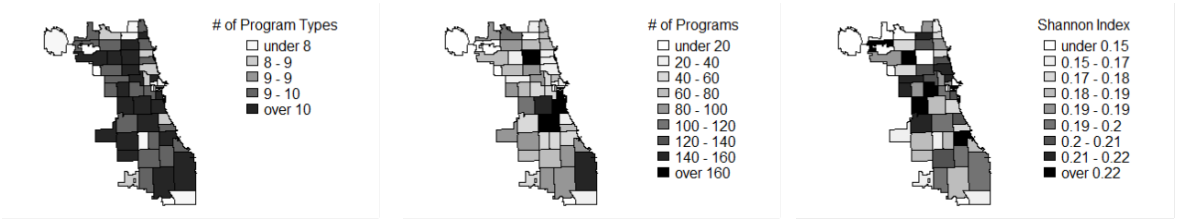
This framework extends Barron and colleagues' descriptions of learning ecologies as linked contexts that provide youth opportunities for learning (e.g. [1]). Human and ecological systems are constantly adapting to changing conditions, including conditions brought about by human activities. Resilient natural ecosystems - that is, ecosystems that have the capacity to adapt to a wide range of unexpected changes - are ones that have both an abundance of organisms and diversity of species [5]. Abundance refers to the number of organisms of a particular species in an ecosystem. Species diversity can be measured in two different ways: species richness and species evenness. Richness is a measure of the number of different kinds of organisms present in a particular area. Evenness measures the relative abundance of each species, or how close in numbers each species in an area are to the others.

These ideas about ecosystems have direct relevance to the study of youths' learning opportunities at the scale of a city. Young peoples' learning pathways are embedded within larger ecosystems of opportunity (e.g. [2]), and these concepts help describe those ecosystems. As in nature where all individual organisms are unique, each program is unique in the learning opportunities it provides to young people. Here, richness, abundance, and evenness refer to program offerings in different neighborhoods, where each individual program is analogous to an individual organism in an ecosystem, a program type is analogous to a species, and a neighborhood is considered a distinct ecosystem.

3. DATA SOURCES AND ANALYSIS

Our team analyzed programs offered through the CCOL website during the summer of 2014, from June 1st to September 30th. We extracted two pieces of information about each program: the program type and the program location. Program type refers to the eleven categories assigned within the CCOL system. Program location is the address of the program as entered by the hosting organization. We normalized the address of each program into a consistent format. We analyzed 3,931 face-to-face scheduled programs at 755 unique locations within the city limits of Chicago.

Program richness provides us with a way to characterize the diversity of opportunities, namely the degree to which program offerings of many different types are accessible from a particular neighborhood. This is determined for each zip code by counting the number of program types that have at least one program hosted in that area. Program abundance refers to the total number of unique programs within a given zip code. Program evenness allows us to measure the degree to which programs of a particular type may predominate



(a) Richness (b) Abundance (c) Evenness

Figure 1: Heatmaps of richness, abundance, and evenness metrics for zip codes in Chicago

in a neighborhood. This measure considers both the types of programs that are accessible and the overall number of programs of each type. We calculated evenness using the Shannon index, the same formula for species evenness in the study of ecosystems [3]. The Shannon index gives an evenness score from zero to one.

4. RESULTS

Figure 1a shows the richness metric - the number of program types with at least one program offering - for each zip code. Our analysis shows that many zipcodes exhibit high richness, with 39 out of the 59 zipcodes having programs spanning 9 or more of the 11 possible program types. Only one zipcode had a single program type being offered.

While many zipcodes exhibit richness, program abundance and program evenness tell a different story. Figure 1b shows the abundance - the total number of program offerings across all program types within each zip code. Here, we see that many of the programs are clustered in certain areas within the city. The large number of programs just south of downtown in particular highlights a hub of programs at cultural institutions such as museums. Other areas, such as the lakefront zip codes north of downtown, host fewer local programs on the CCOL site. Figure 1c shows the program evenness - demonstrated by Shannon index metrics - for each zip code. The indecies in all zip codes are relatively low (0 - .234), showing that all areas' offerings are skewed towards certain categories, rather than hosting a strong representation of programs of all types. In addition, program evenness has a degree of variance between zip codes in the city. Areas west of downtown show slightly better evenness scores than many of those to the south. This metric helps shed further light on the abundance figures shown in 1b. Though the area immediately south of downtown has high measures of abundance, the evenness scores in those same zip codes are lower than scores found in other parts of the city.

5. DISCUSSION

This work establishes a strong understanding of the distribution of learning programs across the city of Chicago. In some areas, cultural institutions are providing many programs in their area, which can skew the evenness metrics in those areas. In others, there are simply relatively few programs being offered. These results illustrate the utility of a data-driven ecological framework for analyzing the distribution of informal learning opportunities within a large urban environment. As the abundance, richness, and evenness heatmaps illustrate, no one metric is sufficient, as each captures different aspects of the larger ecosystem. These three measures, when visualized through the heatmaps in figure 1, provide a concise way to understand distribution of different learning opportunities across the city.

It is important to note the limitations of this approach. First, we used zip codes as our distinct ecosystem boundaries. Some zip codes cover large spaces and have odd shapes, so the presence of a program within that zip code is only a rough proxy of accessibility. Local transit infrastructure can have a significant impact on how well a learner can access a program, even if that program is hosted on the other side of the city. Also, this analysis covers only the first summer of operations of the the CCOL. As such, it is very likely that many learning opportunities taking place in churches, community centers, and other locales are not yet represented in the system. Thus, this analysis presents a single snapshot of only a portion of the total opportunities available to youth in the city.

6. ACKNOWLEDGMENTS

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