

Navigating Scale-Free Out-of-School Time (OST) Provider Networks Within Afterschool Ecosystems

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Abstract: Centralized resources within afterschool program ecosystems risk overdependency on singular funders and overlooking local community providers. By combining opportunity landscaping data with social network analysis, we introduce new methods of understanding funding allocations and identifying vulnerabilities within after-school ecosystems.

Introduction:

With nearly 100,000 after-school programs in Chicago, USA, there is no shortage of program availability within the city (Cashin, 2022). However, this abundance fails to guarantee equity in access to programming or diversity in programming type. Segregated housing and redlining policies throughout the 20th century contributed to the development of markedly different educational opportunities with wide variation for residents of the South Side of Chicago. In more recent years, selective closure of schools has led to further fragmentation and hoarding of opportunity — while some communities have a wealth of programs, other communities lack programs that are critical to the career and personal development of Chicago's youth (Cashin, 2022).

Research into OST ecosystems supports this notion of program inefficiencies — programs are seldom built from the perspective of community-wide benefit, and often compete to attract youth (Reisner, 2007). Moreover, attempts to spearhead change through policy overlook the need to drive program infrastructure based on an understanding of community stakeholder desires and subsequent policy alignment (Goodlad, 2004). Community health is directly tied to strength of OST program infrastructure, but many instances of collaboration between OST providers are ad-hoc and lack formal support (Russell and Smith, 2011, Norris, 1994, as cited in Russell and Smith, 2011). In this paper, we aim to develop a pathway towards identifying these vulnerabilities and inefficiencies within the Chicago OST ecosystem using social network analysis.

Context and Methods:

Our analysis is conducted using survey data mapping collaboration between Chicago OST providers, with the goal being to develop methods for understanding the impact that providers have on their local communities. This is pertinent because many OST ecosystems represent scale-free networks: networks that are dominated by a few nodes with a high number of connections, while a majority of nodes have few connections (Russell and Smith, 2011). When observing the network at large, it can be easy to overlook and discard these smaller nodes from the analysis. However, smaller, community-facing organizations often have a better pulse on their local ecosystems — highlighting these actors is essential to understanding community stakeholder desires (Kania, 2021).

To highlight smaller nodes in the network, we look to identify their local uniqueness, building on a social network measure known as linchpin score, which captures the tendency of a provider to represent a unique service to its first-degree neighbors (Nemesure et. al, 2021). If the removal of a node from a network severs the surrounding nodes' ability to access that attribute, it represents a unique link; the score produced is the proportion of these unique links as compared to the node's overall number of connections. We can observe the application of this concept within a network in terms of attributes such as STEM program type: In the figures below, we measure the relevance that a robotics provider has to its direct network. In Figure 1, we observe that our robotics provider, in gold (*denoted with a red star*), has four direct collaborators within its network (*denoted a-d*). In Figures 2-5, we can see the connections of those four collaborators — the second-degree connections of our robotics provider — and notice that for each of those collaborators, they are not connected to any other robotics provider. Thus, if the robotics provider were to dissolve or leave its local community, all of its connections would lose access to a robotics provider in their community. In this case, the robotics provider obtains a linchpin score of one — four unique connections out of four total connections.

By zooming out, we begin to understand why measures of local uniqueness are crucial to understanding the nuances of individual communities within a city-wide network. In Figure 6, node sizes represent degree centrality, the number of overall connections that a provider has throughout the network. Here, our low-degree robotics provider is difficult to identify amongst a dense set of alternative providers, as the network is dominated by high-degree actors, characteristic of a scale-free network. In Figure 7, node size is determined by linchpin

score. Organizations that provide a unique service to their local communities (high linchpin scores) - such as the robotics provider - are highlighted through their node size and identifiable throughout the network.

Figures 1-5 (Left to Right):

Colors represent provider type

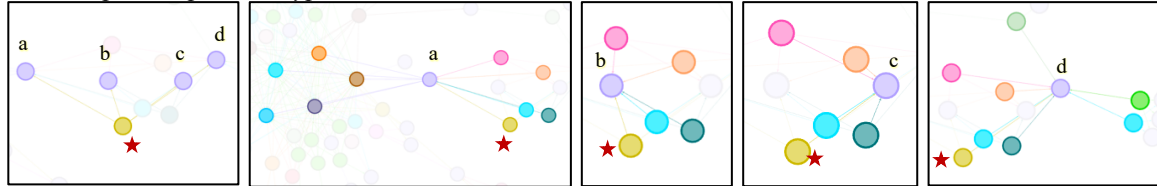


Figure 6:
Node Size — Degree

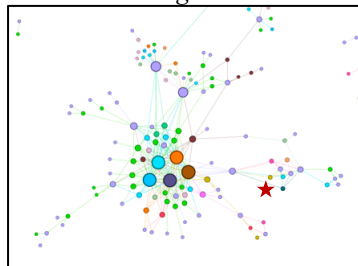
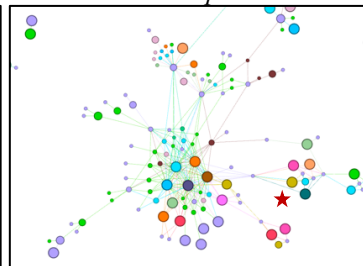


Figure 7:
Node size — Linchpin score



Discussion:

Combining network-wide analysis with a focus on local communities allows us to derive stronger micro-level conclusions regarding provider interactions, as well as provide information to providers and communities that they could not typically access. Consider that programs may not be aware of their second-degree partners, the determining factor in deciding a program's uniqueness. In this case, programs that have high linchpin scores, meaning that their network would be left vulnerable if the program were to dissolve or leave, would not be aware of their own importance. Communities can leverage linchpin data to provide resources that shore up vulnerable spots within their community. Furthermore, a program's knowledge that they have a high linchpin score gives them agency to request funding on the premise that they hold a particularly important role within their community. On the contrary, the realization that a program has a low linchpin score — their neighborhood is infrastructurally capable of handling their departure — may provide them with the freedom to move to new neighborhoods that don't share the same luxury. At a city-wide level, the recognition that certain neighborhoods have higher linchpin scores, meaning that they are more siloed and closed off, can be leveraged to foster cross-neighborhood initiatives.

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