International Society of the Learning Sciences

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

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

Introduction:

With nearly 100,000 after-school programs in the Greater Chicagoland area, there is no shortage of funding or program availability within the city (Cashin, 2022). However, this number of programs fails to guarantee equity in access to programming or diversity in programming type. Segregated housing and redlining policies in the city throughout the 20th century have 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 are overserved and have abundant programming, other communities lack programs that are critical to the career and personal development of Chicago's youth (Cashin, 2022).

Research into OST ecosystems support this notion of program inefficiencies — programs are rarely 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 then 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 proposal, 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 network analysis is conducted using survey data regarding collaboration between Chicago OST providers, with the goal being to develop methods for understanding the impact that individual providers or neighborhoods have on their local communities. This is pertinent as many OST ecosystems represent scale-free networks — the network is 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 castaway these smaller nodes from the analysis. However, smaller, community-facing organizations often have a better pulse on their local ecosystems — highlighting and identifying these actors is essential to understanding community stakeholder desires and impacting community health (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 investigates 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 to the node's overall connections. We can observe the application of this within a network in terms of attributes like STEM OST program type: In the figures below, we can see a measure of 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 can begin to understand why measures of local uniqueness such as this one are so crucial to understanding the nuances of local communities within the context of 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 robotics provider is difficult to identify amongst a sea of other 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. Providers that are essential to their local communities (high linchpin scores), such as the aforementioned robotics provider, are highlighted through their node size and identifiable throughout the network.

Figures 1-5 (left to right):
Colors represent provider type

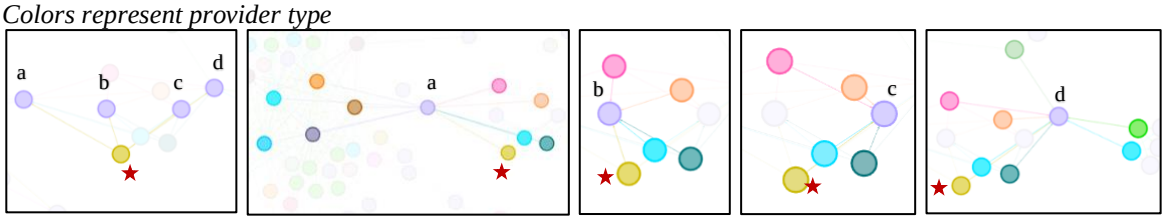


Figure 6:
Node Size — Degree

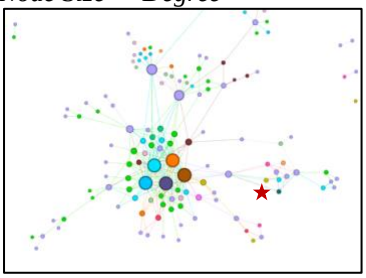
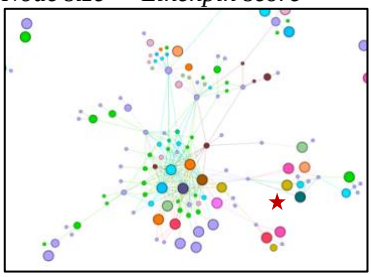


Figure 7:
Node size — Linchpin score



Discussion:

Combining network wide analysis with a focus on individual communities allows us to not only derive stronger micro-level conclusions regarding provider interactions, but also allows us to provide key information to the providers and communities that they would not typically have access to.

Consider the fact that a program is not always aware of its second-degree partners – the partners of their partners. As such, programs that have high linchpin scores, meaning that the network would be left vulnerable if the program were to dissolve or leave, are not aware of this fact. Communities can leverage linchpin data to provide additional resources that shore up vulnerable spots for their overall community. Furthermore, a program's individual knowledge that they have a high linchpin score gives them agency to request additional funding on the premise that they hold a particularly important role within their local 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 and regions that may not 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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