School and Community Infrastructure Networks: What Might These Look Like?

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Abstract This chapter asks, 'How might school and community infrastructure networks be conceived, and what might they look like?' Through an exploratory review of the literature, the relationships between school and community infrastructures are investigated and connections and boundaries between different forms of infrastructure for community use are discussed. A network theory approach is adopted to explore emerging insights into how school facilities and other community assets (buildings and landscaped areas) might better support whole-of-community development, education, and wellbeing. Historically, the opposing design objectives of connection and security have challenged the development of schools as locations for community use, often resulting in facilities that are inadequately planned or resolved in their design to meet the needs of multiple user-groups. Might the reappraisal of school planning and design enable new and improved connections with other community infrastructures? Might planning and designing community facilities with school users in mind improve their utility? Drawing together various discourses in the literature, a network model is proposed to represent relationships between school and community infrastructures. This is intended to encourage planning authorities to explore potentially better integrated, more effective, and financially more efficient models of infrastructure provision for community use—especially in fast growing areas on the edges of Australia's largest cities where demand for community services and infrastructure is high, but resources are stretched.

Keywords School facilities · Community infrastructure · Infrastructure networks · Social networks · Network theory · Urban planning · Urban design

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Introduction

In recent years there has been a push from Australian state governments for schools to act as community hubs (e.g., Audit Office of NSW, 2018; Department of Education and Early Childhood Development, 2008; Department of Education and Training, 2020; Department for Education SA, 2017). This ambition stems from a desire to better integrate, or co-locate, community services and programs on or near school sites to make them more accessible to young people, families, and other community members, in the belief that connecting schools with the broader community will be beneficial (Black et al., 2010; Cleveland, 2016; Glover, 2020; McShane, 2012).

In this context, the language of 'schools as community hubs', and synonyms including 'full-service schools', 'extended service schools' and 'community schools', represents a multifaceted and nuanced conception of the school as an important anchor organisation in local neighbourhoods. Black et al. (2010) suggested such language refers to connections between a school and its local community through the provision of shared facilities and/or services, often accessed by both adults and children outside of school hours.

Despite wide acceptance of these ideas by state governments across Australia, little data has been collected to monitor how shared infrastructure, such as sporting and recreation facilities, multipurpose halls, and health service facilities on or near school sites is being used by community members. A better understanding of the use of shared facilities by school and community members is needed to inform the planning and design of shared infrastructure for the delivery of schooling *and* community services and programs.

The literature on schools as community hubs tends to focus on community services being delivered from school sites (e.g., Calfee et al., 1998; Dryfoos, 1994; Dryfoos & Maguire, 2019; McShane et al., 2012). This chapter proposes a shift in focus; from paying attention to what schools can provide to communities, to viewing school campuses as sites within a broader integrated network of community infrastructure. If the relationships between school and community facilities are mutual, what opportunities (and challenges) arise?

Below, the relationships between school and community infrastructures are investigated through an exploratory review of the literature. The focus of the research is largely spatial and facility-based, yet also inherently social. A transdisciplinary approach to reviewing the literature, exploring the connections and boundaries between school and community infrastructures reveals the value of scholarly works from the fields of urban planning, infrastructure policy, human geography, social psychology, architecture, education, and network theory.

The key question being addressed is 'How might school and community infrastructure networks be conceived, and what might they look like?' The literature review draws attention to current and historic discourse about; social and community infrastructure; emerging ideas about infrastructure networks; conceptions of community (including the inconclusive meanings of the term); the connections between schools and communities; and studies into child friendly neighbourhoods.

Finally, these threads of inquiry are drawn together to inform a proposed network model. This represents potential relationships between school and community infrastructures and is intended to progress debate about the role of school facilities in supporting broader community outcomes, as well as the role of community facilities in supporting the educational objectives of schools.

Social and Community Infrastructure

Community infrastructure fits within a broader conception of social infrastructure and is largely provided by local government authorities (LGAs) (McShane, 2006; Miles, 2020). Social infrastructure serves sectors such as healthcare, education, recreation, arts, culture, justice, emergency services and social housing and is defined by Infrastructure Australia (2019) as "the facilities, spaces, services, and networks that support the quality of life and wellbeing of our communities" (p. 1). Infrastructure Australia (2019) further identifies social infrastructure assets as "the buildings and spaces that facilitate the delivery of social services by governments and other service providers" (p. 1).

The Victorian Planning Authority (VPA) offers a useful definition of community infrastructure, describing it as "the buildings and spaces that provide services, activities and opportunities" (2021, para. 1), and suggests it can be "provided by government, not-for-profit organisations and the private sector" (ibid.). Similarly, McShane (2006) uses the term 'community facilities' to identify "recreational, cultural, educational, health and civic facilities available to the public" (p. 269). Morphet (2016) argues that social and community infrastructure is "essential for the functioning of society, including the economy" (p. 90) and "includes all aspects of caring for individuals and contributing towards community life" (p. 90).

Community facilities in Australia have historically been stand-alone facilities. Many were initiated with community investment—both financial and emotional—and were paid for and built by sporting clubs and local groups (Lewi et al., 2010). Over time, LGAs took over the management of these facilities and shifted the focus from facilities for specific purposes to creating the multi-purpose facilities that are common today (McShane, 2006). However, these multi-purpose facilities largely operate independently from each other, with separate management structures and booking systems, rather than as complementary networked operations.

Infrastructure Australia (2019) included 'social infrastructure' in the *Australian Infrastructure Audit* for the first time in 2019, reasoning that its inclusion "responds to the growing recognition of the role effective social infrastructure assets and networks play in supporting our nation's wellbeing" (p. 388). The audit describes buildings and facilities as 'assets' and suggests that "while assets are often considered individually, our social infrastructure networks as a whole play a nationally significant role in supporting Australia's economy, liveability and sustainability" (p. 388) and affirms that "the network of social infrastructure contributes to social identity, inclusion and cohesion and is used by all Australians" (p. 338).

Throughout the Infrastructure Australia (2019) report 'social infrastructure networks' are referred to frequently, yet without specific explanation or definition. While it seems logical to think about social infrastructure as a network, how do these networks occur and how do they function in practice?

Given the range of sectors associated with social infrastructure, some components of these networks may be more clearly identified than others. For example, Infrastructure Australia (2019) suggests that creating a network of green connections, such as high-quality shared cycling and walking paths, may "provide opportunities for a series of individual small projects to deliver a large-scale impact when woven together to form a new landscape across an urban area" (p. 433).

Can this logic of connections and networks also work in the context of smaller community facilities? While smaller facilities are commonly seen in isolation, if they are considered as 'woven together', can such projects have a large-scale impact if they are to operate as a network?

A recent report released by the Greater London Authority (2020a) in the United Kingdom (UK) outlines the importance and potential of social infrastructure, specifically in the context of social integration. The report describes social infrastructure as "an ecosystem of local organisations, networks and services, supported by different types of buildings and physical spaces" (p. 15). This 'ecosystem' is further defined as "a mix of 'hard infrastructure' – buildings and other space – and 'soft infrastructure' – the groups, networks, online forums and individuals that bring the physical facilities to life" (p. 87). The report includes a helpful diagram (see Fig. 1) that sets out a continuum of 'hard' and 'soft' infrastructures, as well as identifying roles across a spectrum of 'formal' to 'informal'.

While this research is largely focussed on the role of hard infrastructure in supporting communities, it is important to recognise the reciprocity of the physical and social components of infrastructural arrangements, as highlighted in the Greater London Authority (2020a) report.

Networks and Infrastructure Networks

As infrastructure networks are ill-defined in the literature, it is important here to firstly define what is meant by a 'network' and subsequently to explore what might constitute an 'infrastructure network'.

Rogers et al. (2013) define a network as "a set of nodes and the paths linking them together" (para. 1). Working in the field of human geography, Mayhew (2015) identifies a network as "a system of interconnecting routes which allows movement from one centre to the others" (para. 1). She suggests that networks are made up of "nodes (*vertices*), which are the junctions and terminals, and links (*edges*), which are the routes or services which connect them" (para. 1).

In his book *Community*, Delanty (2018) defines networks as "heterogeneous sets of relationships between nodes" (p. 90). He outlines that social networks facilitate communication, saying "networks are both based on and make possible conduits

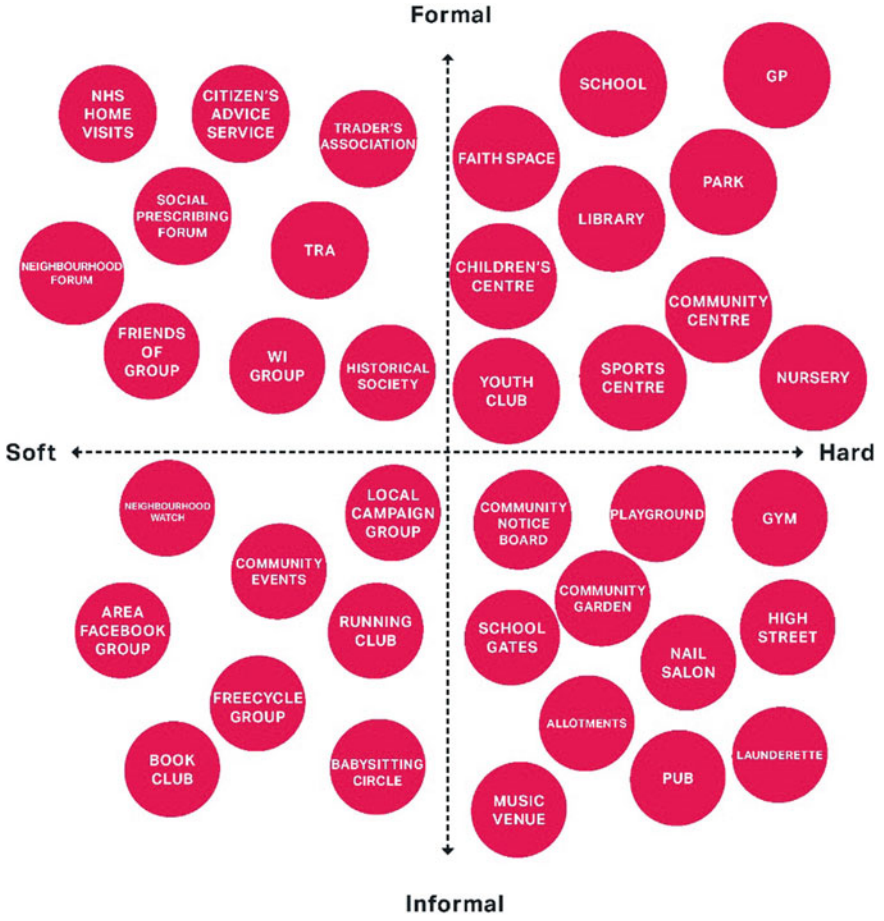

Fig. 1 Understanding different types of social infrastructure (Greater London Authority, 2020a, p. 51)

of communication between otherwise different centres" (p. 91). Further, Delanty (2018) argues that flows of information are "crucial in explaining their capacity to bring about social change" (p. 91).

The network diagrams shown in Fig. 2, adapted from Baran (1962), show different ways networks can operate. These types of representations were developed to explain communication networks but have relevance here in showing how all types of networks can be considered. The first network type, 'centralised', includes one central node linking to each end node. Baran explains that this network type is "vulnerable" (p. 3), whereas the 'distributed' model is preferable as it allows the network to continue to operate even if one node is not operating. Barabasi (2003) explains how Baran's proposal of the 'distributed' network contributed to the design of the world wide web, offering multiple pathways for information to flow between nodes.

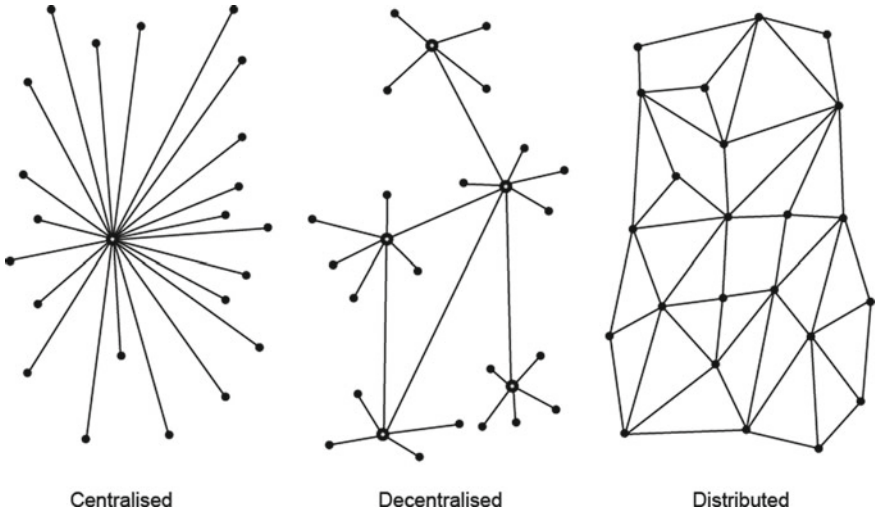

Fig. 2 Network types, adapted from Baran (1962)

In practice, most networks include both centralised (star) and distributed (mesh) elements (Baran, 1962).

Studies of social networks may offer leads into the operation of infrastructure networks, including mapping techniques and ways of understanding links between nodes. For example, network diagrams relating to social networks are often called 'sociograms' (see for example Carrington & Scott, 2011; Korom, 2015). These show individuals or organisations as the 'nodes' and their relationships as the lines (Carrington & Scott, 2011). In addition, Social Network Analysis (SNA) (see for example Borgatti et al., 2009; Marin & Wellman, 2014; Scott, 1988) offers methods for determining social relationships. Such techniques may be useful in developing insights into the relationships that exist between infrastructure assets, where individual facilities may be identified as 'nodes', but what are the 'links/edges' in infrastructure networks? Deeper consideration of the 'links' in infrastructure networks appears necessary, however, it seems reasonable to believe that links may take multiple forms: the physical flow of people between assets; operational connections; indirect connections via broader social networks; and the sharing of data via digital networks could all be playing a role.

Community

The term 'community' is frequently used in government publications about infrastructure, but rarely defined—and as observed by Williams (2002), "unlike all other terms of social organization (state, nation, society, etc.) it seems never to be used unfavourably" (p. 66).

Parker (2006) identifies that "despite years of research and inquiry, definitions of 'community' are unstable and fluid" (p. 472). Clay (2007) argues that "the word itself has become almost devoid of precise meaning" (p. 12) and Head (2007) comments that "the term 'community' is notoriously vague and value-laden" (p. 441) and overused without interrogation in the political realm to imply harmony and unity. Head (2007) argues further that 'community' is often used in a symbolic way, as a 'spray on solution', to suggest that all members of an area or group have one voice, or one set of needs, whereas in fact each community is made up of both individuals and smaller communities. Chaskin (2008) offers multiple definitions of community, including "community as a network of relations" (p. 67).

In their book *Community: Building modern Australia*, Lewi and Nichols (2010) agree with such discourse and describe how definitions of community "have been multifarious and elastic" (p. 8). They offer a broad definition, suggesting that community "encompasses a group of people bound together by common threads, including geographical location, ethnicity, socioeconomic status, sexuality, or circumstances" (p. 8).

Working in the field of sociology, Delanty (2018) offers a history of how the word 'community' has been used and contested. He argues that although 'community' has been—and remains—contested, we "cannot do without" it (p. 3).

As the literature outlined suggests, it is important to be aware of the limits and intended meanings of the term 'community', and the biases often associated with its use. For example, it is acknowledged that the concept of a singular 'school community' is false, as there are commonly many smaller communities associated with a school. For the purposes of this research exploring connections between the built environment and social networks, 'community' has been taken to describe the various populations who share an association with a place or space, and places and spaces are identified as the links that provide the potential for relationships and connections to be made between people, and social networks to be formed.

Connecting Schools and Communities

This chapter proposes a shift in how we view the operation of both school and community facilities. How—and to what extent—are various populations within communities accessing school facilities to support community outcomes? Conversely, how are Australian schools utilising community infrastructure to extend their activities beyond campuses to achieve educational outcomes?

Anecdotal evidence suggests that many schools share facilities with 'outside groups' (at least to some extent) and that it is common for schools to use community assets, such as sporting fields, swimming pools and libraries that are managed by local government authorities and other organisations, to enable a range of curricular and extra-curricular programs and activities. However, such phenomena are under researched and little data exists on the extent or value of such sharing arrangements.

Before connecting schools with community infrastructure, it is important to understand why this may be a useful endeavour. Efficiencies in land use, financial investment, and asset utilisation have been identified as benefits of shared infrastructure (VCEC, 2009). A variety of additional stakeholder objectives can also be found, including those of multiple levels of government, educators, and health service providers. As identified in Canada, these include improving the range and quality of support services to students and families; strengthening relationships between school administrations, community partners and the public; providing a platform for improved service delivery to communities; maximising the use of public infrastructure through increased flexibility and utilization; and reducing the costs of operating facilities for schools and government (Pelletier & Corter, 2005).

Connecting schools and communities has also been linked to a range of more complex social benefits, including gains in social capital (Fisher, 1998). While acknowledging that social capital is somewhat difficult to define, Fisher (1998) states that it seems to be "dependent on a number of values—trust, reciprocity, networks and community cooperation" (p. 10). Subsequently, he laments that due to concerns of safety and liability, school designs have continued to remain separated from their surroundings, stating that:

> The concern for safety and security in society is seen uppermost in the design and placement of schools—the idea of trust, networks, reciprocity and collaboration is seemingly deliberately designed out. Thus, opportunities for students and staff and parents and the community to 'learn' social capital are extremely limited and in fact in many cases almost physically impossible. (Fisher, 1998, p. 11)

These conflicting desires of safety and security, versus openness and connection, remain a challenge more than twenty years later for the development of schools as community hubs—in Australia and many other developed nations, including the UK, Canada and the USA (Chandler & Cleveland, 2020, 2021, 2022; Jahangiri, 2018; Stevenson, 2019).

So, how can both safety and connection be achieved? In her book, *Infrastructure Delivery Planning: An Effective Practice Approach*, Morphet (2016) argues that "planning for school places needs to be part of an integrated process for all infrastructure" (p. 95). She and others (e.g., McShane & Wilson, 2017) have identified that school planning and community infrastructure planning have largely been undertaken in isolation from each other. Few authors discuss interactions between urban planning, school planning, and community infrastructure planning, apart from to comment that productive connections between these processes occur too rarely. For example, McShane and Wilson (2017) discuss the barriers in Victoria to better integrated planning, identifying the responsibilities of different levels of government as a structural impediment, with the State government generally overseeing school provision and development, while local government authorities provide community infrastructure.

A study on facility sharing by the Victorian Competition and Efficiency Commission (VCEC, 2009) stated that "of the 1577 Victorian government schools, as many as two-thirds might share their facilities in some way" (p. XXVIII). The VCEC (2009)

report goes on to suggest that "better connections between what is wanted and what is available is a starting point for improving the benefits of shared facilities" (p. 33). It then goes on to suggest that "information can help identify sharing opportunities of which groups may have been unaware and help bridge the gap between available facilities and user groups looking to access facilities" (p. 33). Such thinking aligns with Fisher's (1998) who stated that "schools are now seen as not simply buildings but are organisations and networks of relations and communications" (p. 6).

How have such ideas translated into physical, organisational, and operational changes related to how schools connect with their surroundings, and communities connect with schools?

It is clear there are many potential benefits to increasing connections between schools and communities. The literature above shows that the potential is more complex than simply co-locating shared facilities on school sites. As Morphet (2016) discusses, the factor of integration is not addressed adequately in current planning policy (in the UK) but adopting improved integrated planning approaches could drive real change.

Child Friendly Neighbourhoods

Research into child friendly neighbourhoods (Ergler et al., 2017; Gleeson & Sipe, 2006; UNICEF, 2018) has much to offer school and community infrastructure planning and projects, reminding us that communities are comprised of all ages and abilities. Accounts of children's explorations of urban environments have appeared extensively in Australian and NZ scholarship (e.g., Clement, 2018; Kearns et al., 2003; Malone, 2002), highlighting the importance of activating the connections between schools and community amenities.

Carver et al. (2014) argue that children's independence should be prioritised in both the design of community facilities and the connections between them. Here, the connections between facilities (i.e., the links in the infrastructure networks) as much as the facilities themselves (i.e., the nodes) are important. According to the Greater London Authority (2020b, p. 23):

> It is not enough to just create a lot of activities for children and young people - they must be able to move between these different activities, school and home. Only when children and young people can easily and safely move from place to place, do you have a child friendly environment.

The importance of activating connections between community settings and schools is highlighted (Smith et al., 2021). Freeman (2006) states that without walkable neighbourhoods "children's lives become a fragmented mosaic of places - school, childcare, club, shops and playground" (p. 86). Just as community infrastructure networks can provide adults with walkable, integrated, accessible facilities, including schools in these networks opens possibilities for children to extend their independence and participation in the life of their neighbourhoods. How do the

boundary conditions of the school and the library, plus the footpaths and crossings between them, effect the social capital and child-friendliness of a neighbourhood?

It is important that children's voices are included in the processes of planning and designing the facilities and landscapes that supposedly cater to their needs (Ferguson, 2021). Children are increasingly acknowledged as having the right to participate in such decisions:

> For children and young people, the rights to play, to gather and to participate in decisions that influence them are enshrined in the United Nations' Convention on the Rights of the Child. (Greater London Authority, 2020b, p. 17)

Techniques to consult with children include interviews, focus groups, photo-elicitation and diary-keeping (Barker & Weller, 2003). Another technique to capture children's experiences is community mapping. Ergler and Freeman (2020) discuss children and mapping, stating that "participation often carries the connotation of rights, empowerment, and justice and describes various forms of social engagement" (p. 155). The discourse associated with research into child friendly neighbourhoods makes it clearly apparent that children's perspectives be considered when mapping community infrastructure networks.

Mapping Community Infrastructure Networks (Including Schools)

As noted previously, there is a gap in the literature about school planning in relation to the surrounding urban environment (e.g., McShane & Wilson, 2017; Morphet, 2016), including with respect to schools contributing to and benefiting from local community infrastructure. There is also a need for further research into the operation of social infrastructure networks. The benefits and importance of social infrastructure networks are now acknowledged (Infrastructure Australia, 2019) but more research is needed into how they function and what they look like. The Greater London Authority offer a starting point for mapping connections:

> Engagement processes should start with observational research and mapping of both quantitative and qualitative elements of environments, including barriers to independent mobility and wider connectivity and networks. (Greater London Authority, 2020b, p. 58)

Using the network models proposed by Baran (1962) as a starting point (see Fig. 2), we can speculate as to how a community infrastructure network may emerge. Documenting the connections between facility nodes, both existing and potential, builds a picture of how a network model could operate. Figure 3 offers a speculative community infrastructure network map, showing a hybrid of the 'decentralised' and 'distributed' network models offered by Baran (1962). The map imagines a neighbourhood network, connecting schools, sporting facilities, outdoor recreation areas, specialist institutions like music and performing arts centres, local halls, aged care facilities, and public facilities such as libraries and museums. If a school, aged care,

and early learning centre were connected to a performing arts hub, with walkable connections, what benefits could be afforded to local neighbourhood communities?

In considering how the network of community infrastructure could be 'woven together" (ibid., p. 433), a new social infrastructure landscape could be uncovered.

Conclusion

Australian schools are under pressure from surging enrolments. Infrastructure Australia (2019, p. 26) notes that "school enrolments are projected to increase by almost half a million students between 2019 and 2027". In this context, planning schools as part of community infrastructure networks (a sub-set of social infrastructure networks) could offer significant benefits. Conceptualising schools as assets within 'woven together' infrastructure networks that include a variety of facilities in geographically related areas may help deliver more fiscally efficient assets that can be shared to deliver more benefits to more people. For example, if a community infrastructure network included a large indoor sporting facility there may be no need to build another. Instead, attention could be paid to the urban connections between assets and the creation of shared facility management systems.

Understanding schools' existing networks may be a first step towards strengthening such connections and relationships (GLA, 2020b). Mapping the 'nodes' and 'links/edges' of existing (potentially underutilised) networks could offer valuable insights into the types of relationships that that exist and their value to different user groups. Such mapping exercises could, for example, expose opportunities for schools to develop stronger relationships with LGA-run facilities within close geographic proximity, bringing a host of potential benefits to school children, their families, and community users of various facilities and services.

The literature reviewed above also indicated that thinking equally about the 'links/edges' as much as the 'nodes' is important. Ensuring urban planning and design addresses the safe movement of adults and young people of all abilities between infrastructure assets appears critical to ensuring connections between facilities are effective. For community infrastructure networks to be conceived to include schools, a focus on accessible, walkable connections and integrated operational models is needed. Schools should not be considered in isolation, but as critical community infrastructure, offering more than education facilities to school-aged students. Partnerships and willingness to cooperate between multiple levels of government, and across different government departments, is needed (McShane, 2012) to unlock the potential of schools as connected community assets.

While the arguments put forward above may be viewed as aspirational, the challenges to linking different services across multiple facilities are acknowledged. For example, Cummings et al. (2011) outlined challenges experienced in full-service schools in the UK related to strategy, consultation versus participation, funding and sustainability, accountability, and facility management. Nevertheless, they concluded that while making connections between schools and outside organisations is a

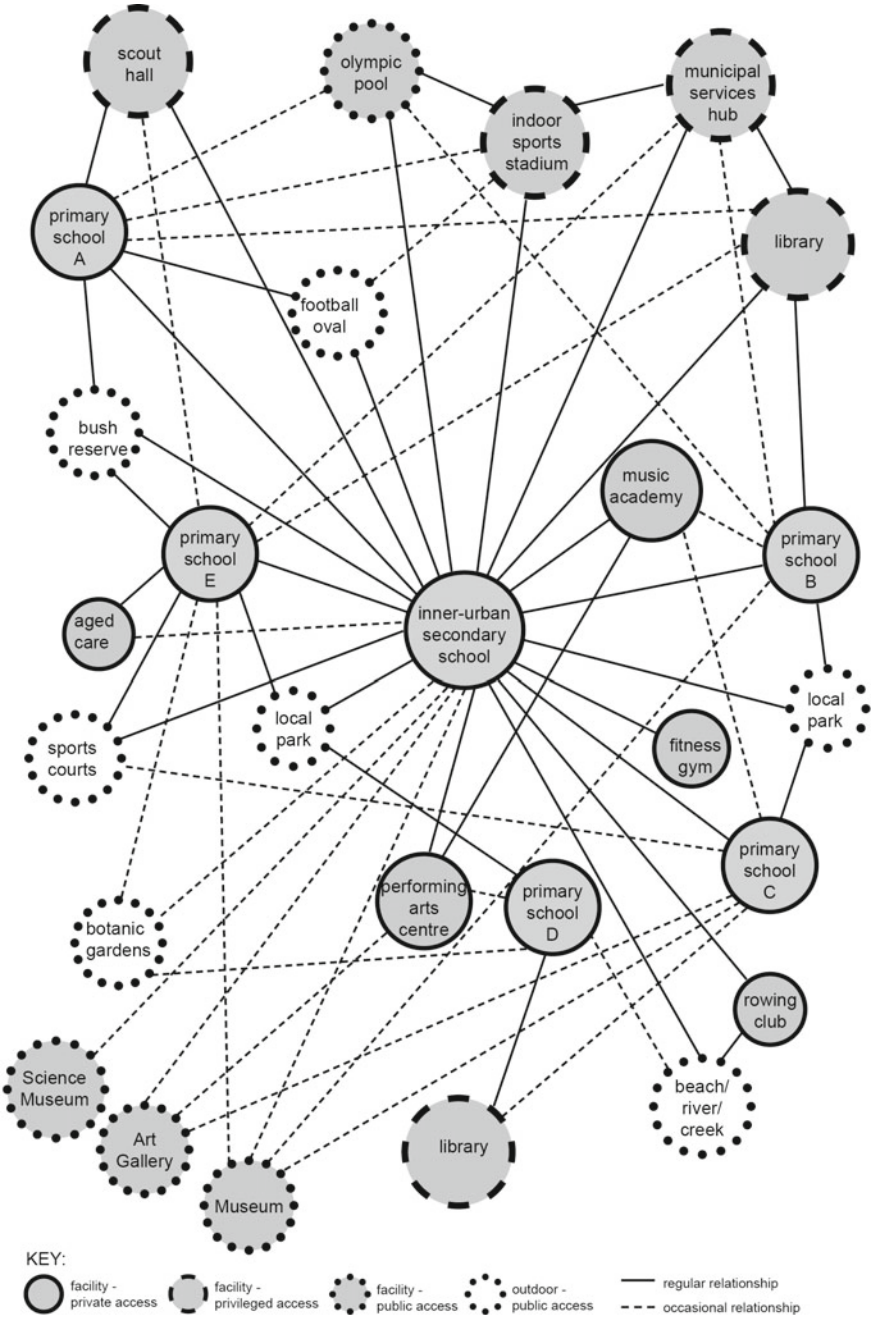

Fig. 3 Community infrastructure network map (Miles (2022) https://doi.org/10.26188/2011328)

complex undertaking, the physical, social, and environmental benefits make it worth the effort.

Collecting data and developing deeper insights into the ways community infrastructure networks, including schools, operate, is needed to help inform future infrastructure asset planning, especially where opportunity exists for LGA-led community facility planning and state-led school facility planning to be integrated and considered from a networked perspective.

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