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Building Strength in Chicago: Setting the Local and National Computer Science Agendas

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Abstract

We used Manna's theory on borrowing strength to examine the influence of local and national idea champions seeking to broaden the participation of K-12 students in computer science. Concepts from Manna's model were applied to analyze interview data gathered from idea champions at the national and local levels. We identified examples of borrowing strength that not only highlighted the importance of individual policy entrepreneurs but also elevated the importance of community building. We introduce the concept of building strength to highlight how idea champions strategically supported capacity-building activities at a different level in the federal system prior to borrowing strength.

Keywords: *Computer Science; Policy Agenda; Federalism; Entrepreneurship*

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Building Strength in Chicago: Setting the Local and National Computer Science Agendas

Introduction

Developments in American education policy are strongly affected by the nation's decentralized and fragmented system of educational governance. Federalism and the associated intergovernmental relations among relatively autonomous institutions shape and constrain the policy agendas of actors operating at the federal, state, and local levels of the system. Most research on developments in education policy has focused on federalism only to the extent that it serves as the context within which policy changes occur, rather than examining how the federal system itself offers a potential leverage point to be used by savvy policy entrepreneurs. The research that we conducted for this article addresses the paucity of scholarship on processes employed by idea champions working within the fragmented system to increase the agenda status of specific education policy areas. Building on the foundational research of Manna (2006), who developed a theory explaining how policy entrepreneurs play a key role in shaping agendas across different levels of the federal system, we use the K-12 computer science (CS) movement at the local and national levels to help expand the knowledge base on policy entrepreneurship and agenda setting.[1]

Purpose

From 2012–13 to 2020–21, the number of Chicago Public Schools (CPS) high school students taking an introductory CS course rose from approximately three thousand per year to approximately fourteen thousand per year. Our research for this article examined the advocacy work that helped drive the rapid expansion of CS in CPS, within the wider context of the "broadening participation in computing" (Aspray, 2016, p. v) movement at the national level.

This research was originally devised to gain insights into the roles of idea champions, working within and across different levels of the education system and government, in setting the *policy agenda* (the interests and actions of policymakers) for CS. Interviews with prominent CS advocates and other policy subsystem actors—including district leaders, federal funding agency program officers, university professors, and leaders from nonprofit organizations—provided us with insider perspectives on the unfolding of events and shed light on how idea champions from various organizations worked to achieve their parallel and overlapping objectives.

Summary of Approach and Findings

The interview data that we gathered were analyzed using a framework from policy process literature: Manna's (2006) theory of *borrowing strength*. This theoretical model was conceived to explain a process of agenda setting in a federal system of government. Specifically, borrowing strength offers a framework for understanding how policy entrepreneurs at one level of government push their agendas by leveraging arguments and capacity from other levels of government. We applied Manna's theory to help conceptualize how actors at the local level

[1] In this paper, we use the terms policy entrepreneur and idea champion somewhat interchangeably. Though Manna's description of policy entrepreneurs (see pg. 6) fitted well when describing the majority of participants in this study, some of the people interviewed emphasized to us that they championed K-12 CS broadly but not specific policies.

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borrowed the justifications and capabilities of actors and organizations at the national level to advance their CS agenda in Chicago. The data analyzed also revealed how national actors sought to leverage the successes of Chicago advocates to help further the national movement.

A major topic discussed by multiple interview participants was the extent to which the CS movement at the local and national levels relied on community building. This finding led us to reexamine and expand on the borrowing strength model, which typically focuses on the influence of individual policy entrepreneurs. The accounts of CS advocates provided examples of borrowing strength that not only highlighted the importance of policy entrepreneurs but also elevated the significance of community building and collective advocacy. We propose the term *building strength* in this article to describe the approach to advocacy that characterized the local and national "CS for All" movements.

Research Questions

The following research questions guided the research design and the development of our research instruments:

- To what extent did local idea champions draw upon interest and capacity at the national level (e.g., the federal government's initiatives and funding streams) to push CS higher on the local policy agenda in Chicago?
- To what extent did idea champions in the federal government and other national organizations draw upon the movement at the local level (e.g., district initiatives) to push CS higher on the national policy agenda?
- What does the CS movement in Chicago reveal about policy entrepreneurship and the agenda-setting process?

Background, Literature, and Assumptions

Computer Science Education in Chicago and Nationally (2008–2016)

Local Movement Leading to Graduation Requirement

In February 2016, the Chicago Board of Education approved a policy that made CS a graduation requirement for all high school students. This decision by CPS's main policy-making body followed years of advocacy by a coalition of CS teachers, district leaders, university faculty, and education researchers in Chicago (Reed, Wilkerson, Yanek, Dettori, & Solin, 2015). The advocacy efforts of this group originated with a cadre of motivated CS teachers connecting with several university faculty members in the city who shared the same commitment to expanding access to CS in the K-12 space (see Figure 1). These advocates established a local chapter of the Computer Science Teachers Association (CSTA) and allied with a district leader who was, likewise, advocating for expanding CS within CPS. The local advocates began communicating with individual school leaders about offering CS in their schools and elicited support from a major CS nonprofit to help train more CS teachers. Then, beginning in 2012, with funding from the National Science Foundation (NSF), the local group of actors engaged in a series of collaborative activities to institute and champion new professional development

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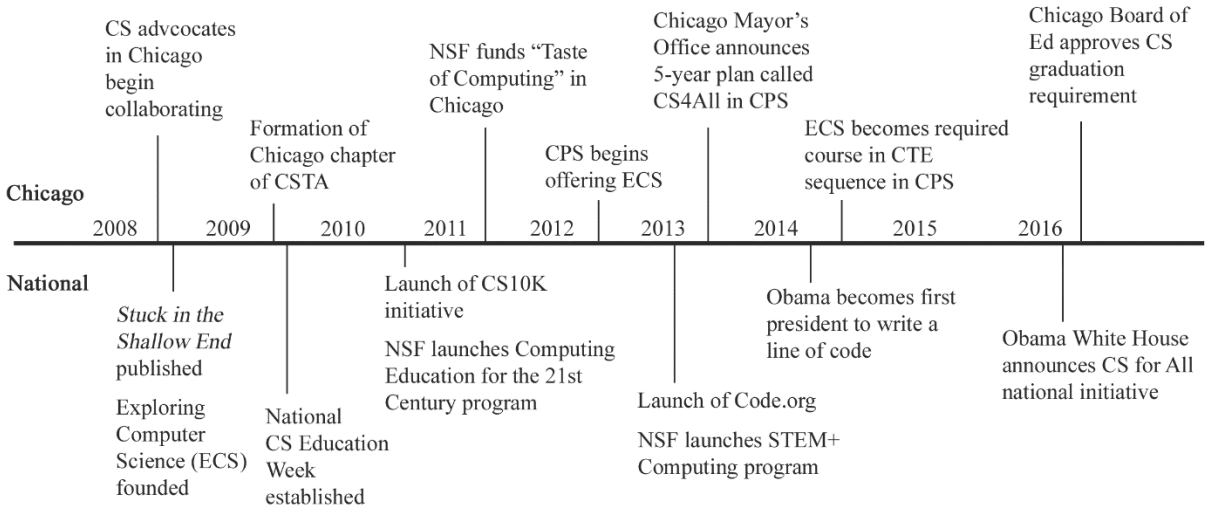
opportunities for CPS CS teachers and a new curriculum (*Exploring Computer Science* or ECS) that was designed specifically to increase the participation of high school students in CS.

Figure 1.

Abridged Timeline of Chicago and National Computer Science Movements, 2008–2016



While the group of local advocates was engaging in efforts to broaden participation in CS through teacher professional development and the adoption and implementation of ECS in schools, it became apparent that developing a sustainable CS program at scale across the district would require a district-level policy change. Previous advocacy had involved trying to effect change by meeting with principals and advocating for CS on a school-by-school basis. These meetings had limited success and were time- and resource-intensive. In addition, the voluntary nature of offering CS led to inequities in who had opportunities to take a CS course (Barrow et al., 2020). The local advocates therefore shifted their focus and began championing the elevation of CS to a core subject, which would mean that all students had the opportunity to experience an introductory CS course. The local policy entrepreneurs advocated for the Chicago Mayor's office to make CS a graduation requirement for all high school students. And in 2013, three years prior to the adoption of the CS graduation requirement, the mayor's office and CPS, in partnership with several CS nonprofits, announced a new commitment to implementing a five-year plan for CS that included a goal of allowing CS to count as a core math or science graduation requirement (City of Chicago Office of the Mayor, 2013). The plan also allocated $1 million each year to CS in the district. Although the five-year plan stopped short of advocating for CS as a standalone graduation requirement, it brought further attention and resources to the issue of expanding access to computing education. Following on from this initial success, local advocates continued to push for a graduation requirement and, in 2016, the Board of Education unanimously approved the policy change that they had been hoping to achieve.

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The National CS Movement

The rise of CS in Chicago that culminated with the graduation requirement is an interesting case to study, especially as it began as a teacher-led effort, but it is important to recognize that these local events occurred within the wider context of a national movement to broaden participation in CS. Approximately two weeks prior to the Chicago Board's graduation requirement announcement, President Obama announced the launch of a federal initiative named Computer Science for All (Smith, 2016). This initiative called for additional federal funding to help expand access to high-quality CS instruction, including approximately $125 million from the NSF. The federal CS for All initiative also called for greater engagement with policymakers and CS advocates at the state and local levels to bolster CS efforts already underway. In much the same way as the CPS CS graduation requirement policy followed years of entrepreneurship at the local level, this federal CS initiative can be viewed as an event within a longer trajectory of CS advocacy efforts: The NSF began funding initiatives to increase participation in CS in the early 2000s with a series of multi-year programs, including Broadening Participation in Computing (BPC, 2006–2010), Computing Education for the 21st Century (CE21, 2010–2014), STEM-C (2014), and STEM+C (2015–2020) (Aspray, 2016). These NSF programs created a consistent source of funding for efforts to increase participation in CS across the country at the state and local levels.

Intergovernmental Relations, Borrowing Strength, and Policy Entrepreneurs

This study is situated within the scholarship on intergovernmental relations and education policy. In the words of Rhodes (2012), "Any discussion of education policymaking in the United States must begin with an appreciation of the influence of federalism on the governance of schooling" (p. 26). The American education system is structured to spread responsibility for delivering schooling across three levels of government: local, state, and national (Shober, 2012). Scholars have noted that the role of each level of government and the relationships between them have shifted over time (Grissom & Herrington, 2012). Historically, educational governance in the U.S. was the responsibility of state and local agencies, with the federal government playing a more peripheral role (Cross, 2014). Yet, starting in the 1990s, federal policies such as the Improving America's Schools Act (1994), the No Child Left Behind Act (2001), and Race to the Top (2009) saw a shift toward a more central role for the federal government in education as federal policymakers helped to drive an agenda focused on educational excellence and standards-based accountability (Manna, 2010; Marsh & Wohlstetter, 2013; McDonnell, 2005; McGuinn, 2012). More recently, the Every Student Succeeds Act of 2015 slowed this decades-long trend by devolving some authority over accountability systems back to the states (Saultz, Fusarelli, & McEachin, 2017; Shober, 2015). With the evolving education policy landscape as the context, scholars have explored the implications of changes in intergovernmental relations by examining how institutions and education advocates are impacted by and respond to shifts in influence among different levels of government (Cohen, Golden, Quinn, & Simon, 2018; Manna, 2006; Trujillo, 2013).

The borrowing strength model is firmly rooted in the conceptual landscape of America's divided system of government. The process of borrowing strength involves actors at one level of government seeking to influence policy agendas by "leveraging the justifications and capabilities

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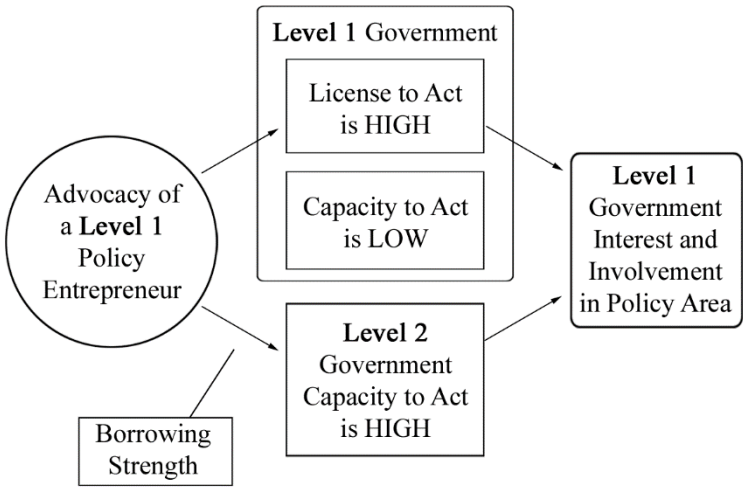
that other governments elsewhere in the federal system possess" (Manna, 2006, p. 5). Rather than depicting intergovernmental relationships in education as being either top-down or bottom-up, the borrowing strength model recognizes that the influence of policy entrepreneurs is dynamic and multidirectional, with actors at the different levels sometimes borrowing strength from each other simultaneously.

Policy Entrepreneurs

The concept of policy entrepreneurs is core to Manna's (2006) theory of borrowing strength. Manna described policy entrepreneurs as being "individuals inside or outside government who champion particular ideas and attempt to increase the agenda status of policy areas they care most about" (p. 15). According to Manna, the process of borrowing strength occurs when policy entrepreneurs at one level of government seek to push their agendas by leveraging the *license* (justifications for action) and *capacity* to act that exist at other levels of government (see Figure 2). For example, a local government (Level 1) with high license to act can borrow the capacity to act from the federal government (Level 2), with the help of a policy entrepreneur.

Figure 2.

Diagram of the Borrowing Strength Model (Adapted from Manna 2006)



The original use of the term entrepreneur, in an economic context, has been traced back to the early 18th century and the Irish-French economist Cantillon (Filion 2011). Cantillon conceived of entrepreneurs as economic agents who incur risk by buying goods at a known price while planning to sell the goods at an unknown price in the future. Another French economist who influenced subsequent understandings of entrepreneurship was Say. Say used the term entrepreneur to depict enterprising people vying for opportunities and profits in the marketplace. A footnote in a translation of Say's (1880) *A Treatise on Political Economy* described an entrepreneur as being "the person who takes upon himself [*sic*] the immediate responsibility,

risk, and conduct of a concern in industry…. For want of a better word, it will be rendered into English by the term adventurer" (p. 78).

One of the first scholars to apply the term entrepreneur when describing actors in a public-sector context was political scientist Dahl (Sheingate 2003). In his text *Who Governs?*, first published in 1961, Dahl (2005) referenced Machiavelli's *The Prince* in order to convey the types of cunning and resourceful behaviors associated with his notion of political entrepreneurship. As observed by Sheingate (2003), "Since Dahl, the figure of the political entrepreneur has appeared in a variety of contexts and has been used to explain a myriad of phenomenon [*sic*]" (p. 187), including policy innovation. For example, Kingdon's (1995) foundational work on agenda setting, *Agendas, Alternatives, and Public Policies*, which was originally published in 1984, used the term policy entrepreneur to describe individuals who attempt to manipulate information in order to promote particular solutions to policy problems. A useful definition when thinking about the focus of our study, the CS movement, was provided by Sheingate (2003), who characterized entrepreneurs as being "individuals whose creative acts have transformative effects on politics, policies, or institutions" (p. 185).

Common to the various accounts of entrepreneurship outlined above is the implication that the instigators of change—whether economic or political—are enterprising individuals. As outlined in the findings section of this article, our qualitative analysis found evidence to support the important role that entrepreneurs, or idea champions, play in elevating the agenda status of policy areas. Additionally, our study of the CS movement served to highlight the importance and efficacy of community building and collaborative advocacy—elements not emphasized in Manna's original model.

Manna's (2006) borrowing strength model of agenda setting was developed to explain how when one level of government within a federal system lacks the necessary license (arguments to justify governmental action) or capacity (ability to act), entrepreneurs seek to leverage these ingredients from other levels of government to elevate the agenda status of policy issues that they care about. A major goal of our research was to map out how the CS movement unfolded at the national and local levels of government in the years leading up to the CPS CS graduation requirement policy and identify specific examples of how actors at different levels imitated ideas and borrowed strength from each other. Consistent with Manna's description of policy entrepreneurs, our analysis included the advocacy of actors and groups inside and outside of formal government institutions when seeking to identify influencers of policy.

The Broadening Participation in Computing Movement

President Obama's interest in CS played a critical role in shoring up the national movement to broaden participation in CS (Beres, 2014). Also at the national/federal level of government, idea champions within the National Science Foundation (NSF) had a major impact on the movement by creating opportunities for entrepreneurship. Surprisingly little has been written about federal funding agencies' influence on education policy agendas. Although federal agencies like the NSF are not directly involved in crafting policy or proposing legislation, they can influence the direction of research and development, which then impacts issues of policy

interest (Earle, 2011). As we outline in the findings section of this article, NSF programs played a significant role in helping to build capacity and license to act for CS advocates in Chicago and across the United States.

Although our research was focused on events beginning in 2008, it is important to understand that the current broadening participation in computing movement is part of a decades-long effort led primarily by the NSF. Aspray's (2016) text *Participation in Computing: The National Science Foundation's Expansionary Programs* provides a comprehensive history of NSF programs that were intended to broaden the participation of girls and women, people of color, and people with disabilities within the field. Of particular relevance to the period of time covered in this article, Peter Freeman's arrival as the new head of the NSF's computing directorate in 2002 led to a shift from focusing mostly on research to fostering action (Aspray 2016). Freeman's Broadening Participation in Computing program of the mid-2000s (the first awards for this program were made in 2006) was action-oriented and it kickstarted an era of successive NSF programs that helped build a national movement: BPC; CE21; STEM+C; CS for All RPP. These programs provided some of the context for what we mapped out as being the policy trajectory in Chicago.

In the Chicago case chosen for our analysis, there were multiple individuals and groups working in and around the education system who participated in advocacy work championing the broadening of opportunities for participation in CS. These entrepreneurs engaged in parallel and coordinated efforts, which, ultimately, were successful in raising the status of CS in CPS and/or nationally. In this article, we describe ways in which idea champions working in different sectors and levels of government (local government, the school district, higher education, nonprofit organizations, and the federal government) played a role in setting the agenda. Moreover, we provide examples of the ways in which actors at the local and national levels borrowed strength from each other.

Assumptions

The theoretical framework used for this analysis contained some assumptions, or things that we took as givens, that should be made explicit for the reader. First, policy agendas do not take shape on their own. Rather, governments become involved in certain areas as a result of policy entrepreneurs working to bring attention to issues. Second, we took an expansive interpretation of what counts as capacity within the borrowing strength model—including grant funding. Third, while Manna's theory on borrowing strength focused on entrepreneurs borrowing license and capacity from other levels of government, we also included examples of local entrepreneurs borrowing justifications and resources from non-governmental organizations (e.g., national nonprofits).

Methods

Our qualitative research included a thematic analysis of interview data and an analysis of documents from various organizations. We developed interview protocols to address the research questions outlined above and piloted them with individuals who shared some of the same knowledge as the selected interview participants. Interviews were conducted face-to-face or over video-conference calls, and all interviews were audio-recorded and transcribed. Where

necessary, organizational gatekeepers were used to help gain access to prominent actors. In addition to gathering interview data, we gathered documents from the different organizations in order to conduct a parallel document analysis.

Following the data collection, we conducted an iterative thematic analysis (Miles, Huberman, & Saldana, 2020) of the interview transcripts. A prespecified coding framework was developed based on the borrowing strength model. During the analysis process, we examined the interview transcript data using this framework while simultaneously refining the framework using an inductive coding process focused on interpretive codes (Miles et al., 2020). The codes identified within the data were compared, condensed, and categorized using NVivo software. These initial categories were used to identify meaningful patterns and themes across the interview data.

Our analysis of documents involved identifying key events and creating a timeline (Figure 1). We also analyzed the documents for examples of how the justification for increased participation in CS was framed. Findings from the document analysis were triangulated against the thematic analysis findings in order to check for trustworthiness. During the analysis phase, members of the research team met regularly to compare interpretations gleaned from the interviews and documents and, when necessary, revised the coding framework.

Data Sources

Interview participants in this study were individuals with expert knowledge of events who had been involved in the movement to broaden participation in CS. We interviewed 11 people, representing the individuals and groups that we had identified as being key idea champions, or policy entrepreneurs, at the local and national levels. The positions of the participants in the sample are listed in Table 1.

Table 1

Interview Participants by Level and Position

Participant Number	Level of System	Position
1	Local	District computer science teacher
2	Local	District leader
3	Local	District leader
4	Local	University computer science professor (Chicago)

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5	Local	Mayoral office advisor
6	National	NSF program officer
7	National	Presidential administration advisor
8	National	University computer science professor (Not Chicago)
9	National	University computer science professor (Not Chicago)
10	National	Nonprofit organizational leader
11	National	Nonprofit organizational leader

In order to improve the trustworthiness of the findings, the interview data were triangulated with various other data sources that had been gathered for a parallel document analysis. These additional data included CPS and federal policy documents, mayoral addresses and press releases, presidential addresses and press releases, and promotional materials published by Code.org and other nonprofit organizations.

Findings

Manna's (2006) theory of borrowing strength describes how when license or capacity to act is low at one level of government, entrepreneurs borrow strength from another level of government within the federal system to promote their policy agendas. The interviews with CS advocates operating at the local and national levels revealed numerous examples of the multi-directional influence of advocacy efforts between these two levels. In the following sections, we provide an overview and illustrative examples of local and national actors borrowing strength.

Our analysis of the data helped us identify a major theme that we termed *building strength*. The interview participants spoke to us about the importance of community building as a key element in the movement to broaden participation in CS; moreover, they outlined a process used for increasing and leveraging community capacity within the federal system. Thus, the theme (and concept) of building strength encompasses both the efficacy of collective advocacy and a strategy for strengthening agenda-setting efforts. Our findings related to building strength add a new dimension to Manna's (2006) account of entrepreneurship and his model of borrowing strength.

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Borrowing Strength

How Computer Science Advocates Borrowed Strength

Advocates at both the national and local levels described activities that indicated they were engaging in the process of borrowing strength to increase interest and involvement in the policy area of CS. In this section, we provide examples of national-level advocates borrowing license from the local level along with instances of local-level advocates in Chicago borrowing license and capacity from the national level.

National advocates borrow license. Several of the national-level advocates described how they drew on the progress that had been made at other levels (both state and local) to bolster their arguments for policy action. One advocate who worked for a national CS nonprofit noted that policymakers in the federal government are often interested in what is working at the state and local levels and explained how he had leveraged this interest into a compelling argument for federal action. This national advocate employed the marketing term "proof points" when describing using evidence of success at the state level to raise interest at the federal level, stating,

> You always want proof points. Nobody really wants to take a flying leap; you want to know that it is working. And whenever you're working at the federal level, they're going to ask [what is going on at] the state level. I was providing the White House with detailed memos on "Here's what the states have done in the past six months related to computer science policy."

As an example of national advocates borrowing license from the local level by showcasing successes, one of the district leaders in Chicago reported that she was often invited by one of the idea champions who worked in the federal government to speak at workshops and meetings around the country, including at the White House. This district leader shared that her message when she was speaking to policymakers was "If it works here [in Chicago], it can work anywhere." This sentiment was backed up by an advocate who worked in the federal government as an advisor to the Obama administration, who commented that "the Chicago model is foundational to this whole idea of a city or major school district making it a priority." The same federal advocate further noted, "I think that what made the success of [the federal Computer Science for All movement] was all the foundational work that had been done in building an infrastructure and a community of people that could actually run with it."

Local advocates borrow license. Our analysis of interview data revealed that license to act at the district level was strengthened by the entrepreneurs' framing of CS as an equity issue. Moreover, the local entrepreneurs' discovery of *Stuck in the Shallow End: Education, Race, and Computing* (Margolis et al. 2008) was central to this framing. This book highlights how existing structures, practices, and belief systems in three Los Angeles high schools perpetuated inequities in K-12 CS. Margolis et al.'s text added to the moral suasion behind the local movement and generated a greater sense of urgency. As a CS researcher from outside Chicago noted regarding how the book had been used locally,

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> I think that *Stuck in the Shallow End* was the research data that told a story, that put a frame around the problem that people could hold on to and understand. And I think the book had a profound impact on bringing the notion of equity and what it was and the segregation in computer science. The book made it so that people were talking about equity and realized they had to address it.

Stuck in the Shallow End's portrayal of inequities in high school CS prompted Chicago advocates to use the text as a tool to build consensus about the importance of broadening participation in CS across the district. For example, a district leader explained that it was used to help convince school leaders about the need to increase access to CS:

> Reading *Stuck in the Shallow End* was a revolution. It's a revolution. I just became this evangelist. We made it required reading for the principals when we did principal training. [The book] was very instrumental in my thought processes and really trying to change the pedagogy around how you even looked at bringing CS into a school.

The research upon which *Stuck in the Shallow End* was based was funded by the NSF. In the acknowledgments section of the text, Margolis et al. (2008) referenced the support provided by officers at the federal funding agency, which, in addition to providing funding for the research, included "community building, galvanizing a diverse grouping of scholars across the nation in the Broadening the Participation in Computing program… [and introducing the authors] to other scholars across the country, both computer scientists and social scientists" (x-xi). Essentially, the NSF's broadening participation programs helped produce research and a book that could foster a shared understanding of the justification for increasing CS in K-12 schools and helped create a community to propagate this understanding.

The equity argument for broadening participation in CS was not the only framing used by local advocates to strengthen their license to act. As described by Sheingate (2003), the potential for entrepreneurial success is significantly enhanced when political entrepreneurs can consistently present their single innovations "from multiple perspectives and points of view…[thus] building robust coalitions in support of institutional change" (p. 193). To help build the requisite license to act at the school level, local advocates framed the benefits of CS from different perspectives according to the audience. A district leader provided the following account of attending to multiple perspectives:

> Instead of having one way of doing things, I would go to a principal and say, you know, "How can I make this work for you?" So, instead of a systematic pattern, I had, maybe, 22 patterns out there because this principal would allow it if we did it this way. This teacher would teach it if I gave her, you know, candy in the afternoon. I'm making it up, but you know what I mean. So, I had all this, "What can I do for you? How can I make this work?" I learned to be a salesperson. I'm not a salesperson, I'm a nerd, I'm an engineer. But I would say, "Okay, tell you what, if they do this, math teacher, they're going to be more interested in math. They are. Their scores are going to be better." "Literacy? Yes, you know, if they do this, they're going to be more interested in

> researching and learning and they're going to read more. Literacy scores are going to go up." If you're a principal, it's, like, "You need those kids to come to school, right? They're going to have so much fun; it's going to be riveting…. They're going to not miss class!" So, whatever it took, I stopped trying to really explain computer science. I explained the benefit to them in their areas.

Though the interviewed district leader spoke about there being multiple "sales pitches," there were two main arguments used for broadening participation in CS identified in the interview and document data. In addition to deploying the primary equity arguments for increasing CS in the district, local advocates borrowed messaging about the importance of CS that was developed by Code.org (a national nonprofit focused on CS). This messaging emphasized the value of CS for future economic opportunities. A district leader shared that, initially, advocates had been struggling with how to communicate with other stakeholders in the district about the importance of broadening participation in CS—until they discovered a video produced by Code.org that distilled the argument into a compelling, persuasive message:

> We were talking about CS to people, and they couldn't get it. They were, like, "What is it and why?" And we couldn't articulate it in a way that people could understand. And that video that Code.org did was a rallying cry, and people were, like, "Oh, I get that."

By borrowing the Code.org-prepared messaging on economic benefits and the *Stuck in the Shallow End* messaging on equity, district advocates increased local license, strengthening their argument that the district needed to act to broaden participation in CS.

Local advocates borrow capacity. Local advocates struggled with a lack of local capacity to implement broad-scale CS programming in Chicago, particularly during the early years of the movement. This lack of capacity was primarily due to the challenges of funding the adoption of CS across the district. The district was facing multiple years of budget cuts, and funding for CS (including money for providing computers and other technology to schools) was not seen as a priority. As one district leader shared,

> Principals don't necessarily want to change their programs, especially with limited dollars. If the dollars had flowed, I think a lot of people would have been easier about [implementing CS]. But there was no money coming in, and every year we were getting budget cuts, budget cuts.

Our analysis of interview data revealed two primary means through which local CS advocates in Chicago were able to leverage national resources in order to increase local capacity to act, thereby driving the CS graduation policy higher on the agenda: the Exploring Computer Science program (ECS), which includes a curriculum and professional development for teachers, and grant funding.

In Chicago, pushing the CS graduation requirement higher on the local policy agenda necessitated identifying an appropriate course that could be recommended to principals and district leaders. As one national advocate from a nonprofit organization put it, "If you don't have

programs, then it's hard to pass policy. Nobody wants to get behind the policy that doesn't have a way of being implemented."

Meeting the capacity needs for implementation at the district level would also require substantially increasing the number of CS teachers. Mirroring the state of computing education across the country, CPS faced a serious shortage of CS teachers. Local advocates were very much aware that this was a barrier to their efforts, with one district leader saying, "we realized pretty quickly that the teachers were the bottleneck." Another district leader also noted that increasing the number of teachers was the key to ensuring that implementation of a new policy was possible, stating,

> We had conversations about the types of support that were needed, which was around developing teachers. Because when you have no computer science, you have no demand for computer science teachers, right? So, if we're going to all of a sudden flip the switch and do a bunch of computer science education, then we need teachers, and we have to develop those teachers.

To increase the district's ability to act, advocates focused on bringing the ECS program to Chicago, which included not only an introductory-level high school CS curriculum but also a professional development program that was designed to prepare teachers with or without a background in CS to successfully teach the course. The implementation and scale-up of ECS in Chicago were facilitated through grant funding, which brought much-needed resources to support the local capacity-building efforts.

In 2011, advocates in the district were successful in securing grant funding from NSF as part of the federal funding agency's CE21 program. The program funded by the grant (called Taste of Computing; Figure 1) helped elevate CS on the local agenda by providing for additional teacher capacity. As one local advocate, a CS professor, explained it,

> Without NSF we also wouldn't be here today because we got grants from NSF that paid for the ECS professional development. And enough teachers participated that the higher-ups [in the district] started taking notice of what the teachers were doing. And the evidence suggested that it was effective.

The above examples illustrate how CS advocates in Chicago acted as policy entrepreneurs who borrowed license and capacity from the national level (e.g., messaging from Code.org, messaging/capacity from other NSF-funded projects, and NSF funding for professional development) to build their argument for CPS to broaden participation in CS and then foster action. Their entrepreneurship proved successful in increasing the interest and involvement of local government officials and district leaders in Chicago to pursue enacting a CS graduation policy.

Building Strength

Introducing Building Strength

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A major topic that emerged from our analysis of interview data was an increase over time in the capacity to act. According to multiple interview participants, capacity to act at the district level was initially low. Many of the schools in the district, for example, had limited access to technological resources, including computers. Describing the situation at one large high school on the north side of Chicago, a district leader said,

> What do they have, 3,000 students? They had 90 computers. How are you going to make sure every kid gets that one class in computer science with 90 computers? So, we had to figure out ways to fund getting computers in there.

As already mentioned, another challenge at that time was an insufficient number of CS teachers. This lack of capacity was explained by a local CS professor as also being a product of CPS's limited resources: "There's always been challenges in Chicago in terms of money for funding schools and funding teacher positions." The building of capacity, therefore, became a primary objective for CS advocates working in and around the school district.

The interview accounts revealed that the CS advocates perceived their success in helping to pave the way for the graduation requirement policy as being closely associated with the community that they formed and the collective advocacy that they engaged in. The various advocates that joined the local movement contributed to the effort in different ways. For example, the teachers brought their professional expertise on what would work in Chicago classrooms to the table. At the same time, the involvement of district leaders was essential for coordinating programmatic changes and providing legitimacy. And the local university professors and researchers helped secure the grant funding used for teacher professional development. The years that the CS advocates collectively spent building up the district's capacity to act set the stage for the policy change in 2016. Much of this work was supported, in various ways, through the broadening participation in computing programs of the NSF.

Our findings related to community building included the fact that actors at the national level, having helped support the local movement, were then able to leverage the successes of Chicago to increase license elsewhere. Identifying this process, together with the qualitative evidence gathered on the importance of community building, led us to conceptualize a new type of activity in the borrowing strength model that we termed *building strength*.

Local Community Building

The interviews with advocates revealed that teachers, local university professors, and district leaders came together to form a community of idea champions that worked to collaboratively problem solve and systematically develop strategies for broadening participation in CS. As one university professor from outside of Illinois described it, "Chicago has really… highlighted the community aspect, and the power of community, and the importance of trusting leadership, and all of that slow systemic work that has to happen to think about sustainability before scaling." Recalling the activities and events that led to the formation of this community, multiple interview participants explained how the local movement began as separate, concurrent efforts that later merged.

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Early efforts to increase participation in computing by one district leader began with her advocating for more computers. A major strategy that she initially adopted was focusing on bringing career and technical education (CTE) to more schools. She knew that state and federal funding for CTE would provide additional funding for computers, which could then also be used for CS. Meanwhile, elsewhere in the district, a small group of CS educators and local CS professors was, independently, trying to find a way to bring CS to more students. These idea champions had met during a national CS conference and, having discovered that they shared an interest in increasing the participation of CPS students in computing, formed a chapter of CSTA upon their return to Chicago. The members of this newly formed CSTA chapter identified the ECS curriculum and professional development as being a program that could help spread CS within the district. A local CS professor provided the following account regarding the discovery of ECS:

> Three of us… went to the professional development for ECS in Los Angeles. And we fell in love with it. It was exciting. It was relevant. It was compelling. We thought we need this for Chicago! So, we started working from that point on. I think that was 2009 or 2010.

The group of educators and professors worked to bring ECS to Chicago by applying for small grants from Google that would help fund professional development opportunities for CPS teachers. The CSTA chapter members also began applying for funding from the NSF to support the building of a CS teacher force that could increase access for students. According to a local CS professor, it wasn't until the CSTA members coalesced with the district leader, however, that the Chicago-based effort to broaden participation in computing really took off:

> We found a willing partner in [the district leader] from the CTE Program who was looking for a new foundational course for the CTE Program…. And so, we had a conversation with her and realized that this course, the ECS course, was just the course. It would fit well for that. And ECS is designed to provide breadth first—the experience of computer science for all students. It's not an AP course for just the [college-bound] students. So, [the district leader] started pushing for ECS.

A major development that followed the formation of the alliance between the Chicago CSTA chapter and the district leader was that NSF funding was finally secured for capacity-building activities. According to local and national CS advocates, gaining the support of a district leader was a key factor in the NSF deciding to award grant money to the local idea champions in Chicago. In the words of an NSF program officer:

> They founded a good partnership in Chicago that just kind of took off. And they found [a supportive district leader], who was amazing from the school district's point of view. Because you can run a project in the city and if the school system isn't really behind it, it doesn't go anywhere.

The NSF funding for professional development and research proved to be a vital ingredient that contributed to the later successes of the local policy entrepreneurs in building support and

capacity for the CPS CS graduation requirement. Early research results provided evidence to support the two main arguments related to equity and future employment opportunities. From the beginning, the ECS course enabled equitable access to CS (Henrick et al., 2019) and the cultural relevance of the ECS course inspired students to take additional coursework along CS pathways (McGee et al., 2017).

The interview accounts of local CS advocates highlighted the extent to which the graduation requirement was the product of a sustained, collective effort by like-minded entrepreneurs. The district leader and the group of teachers and academics were working on parallel efforts to broaden participation in CS, but it wasn't until these two efforts converged and a broader community of CS champions formed that the local movement really gained momentum. With the backing of NSF funding, the Chicago policy entrepreneurs were able to build the capacity of the district by offering ECS professional development to a greater number of educators—which helped to build a critical mass of teachers and foster support among district leaders for a policy change.

National Community Building

Our analysis of interview data revealed that community building was also a major focus for national advocates. For example, when asked to describe her own work, an NSF program officer stated, "I think of what I did as being community building…. What I did was build a community of people working around this effort." This community building involved the awarding of continual grant funding for various groups across the country working to broaden participation as well as bringing like-minded advocates together during conferences and workshops.

The idea championing activities described by the NSF program officer did not fit within the conventional framework of borrowing strength and its depiction of policy entrepreneurship. The program officer emphasized that there were no specific policies that the NSF sought to advance. Instead, she explained, the broadening participation in computing movement that the NSF helped to drive was focused on the more general idea that "schools should be teaching computer science." Yet these efforts did have a strong impact on capacity building and subsequent policy entrepreneurship. We found it useful, therefore, to expand on Manna's (2006) borrowing strength model by adding a new concept, which we identified through the thematic analysis, called *building strength*.

The Process of Building Strength

As already discussed, district-level idea champions noted that funding was nonexistent during their initial years of advocacy and that an appropriate introductory CS program had not yet been identified. When the local policy entrepreneurs discovered the ECS program (which was developed with NSF funding) and received direct funding from the NSF, it served to strengthen the district's capacity to act by supporting professional development opportunities for teachers around an equity-focused introductory CS curriculum. Furthermore, the Chicago advocates were able to borrow license by developing a compelling message about the importance of CS based in large part on the equity framing of *Stuck in the Shallow End* (Margolis et al.

2008), which they used with audiences in the district. Thus, the NSF's broadening participation in CS programs helped, directly and indirectly, build capacity and license in Chicago.

Events in Chicago unfolded within the context of a national CS movement that the NSF helped to drive. The NSF program officer provided the following description of her approach to advancing CS in the United States:

> I think [the strategy] was to drive policy and ideas. It was clear how we were driving ideas because we had money to put into good ideas. But it was [also] to build a community of people who were doing that. So, it wasn't just, you know, me handing out money to three or four people, but that I handed out money and those people joined a community and they brought it to other people.

According to the NSF program officer, she first became aware of the nascent movement in Chicago when she was approached by the aforementioned small group of educators following a talk that she had given at a national CS conference:

> As soon as I started talking about computer science education, these four teachers were in touch with me a lot. And, you know, and I was really interested in the idea that they so wanted to change Chicago and how could that happen.

She encouraged the teachers to find some university partners to work with because, in her words,

> It's really hard for groups of teachers to get NSF grants. It's just really difficult to know how to write a grant, to know how to maintain a grant once you've got it, in terms of just the filing requirements and the budgeting and all of that kind of nonsense.

The NSF program officer also encouraged the group to secure the support of a district leader. The program officer said that providing evidence of district support helped bolster the group's grant application for funding because it demonstrated to the NSF that there was local backing for the project. In addition, NSF grant funding requires a research component—which necessitated partnering with local education researchers. Positive results from early research activities funded through the local Taste of Computing program led to securing additional NSF funding in support of the movement to broaden participation in computing across the district.

Figure 3.
Diagram of Building Strength Within the Borrowing Strength Model

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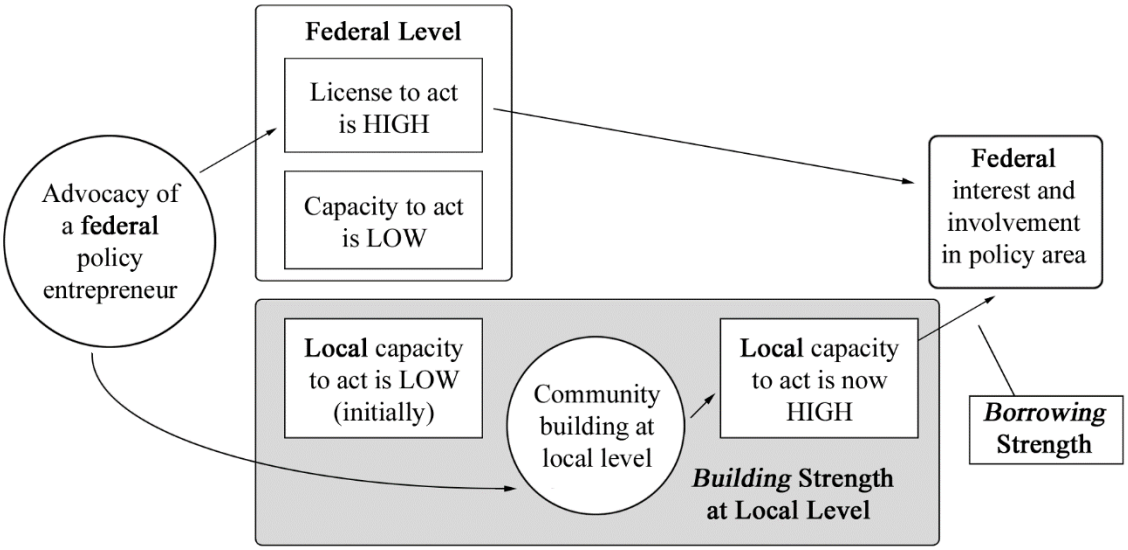

Note: In the figure above, both federal and local capacity to act is low. Federal-level policy entrepreneurs (or idea champions) engage in borrowing strength by first supporting/organizing communities of local advocates as a way to build local capacity to act (i.e., building strength) and then leveraging the local capacity to act that they helped to build (i.e., borrowing strength).

By helping to build and support a community of advocates, the NSF program officer played a critical role in creating the conditions for capacity building in Chicago. When these efforts helped to generate the necessary support for the introduction of a local CS graduation requirement, the NSF was able to spotlight this success to advance the national agenda. Or, in the words of the NSF program officer, "As Chicago went forward it was great to say okay this is a big city and they can do it. You can do it over here, too." In short, the initial and ongoing successes of CS advocates in Chicago created positive feedback that, in turn, provided idea champions at the national level (including the White House) with increased license to act. As shown in Figure 3, we conceptualize this process as building strength before borrowing strength.

Discussion

There have been few applications of the theory of borrowing strength in education policy literature. The research that we describe in this article provided illustrative examples of the influence of idea champions across and within different levels of the education system—as explained to us by prominent subsystem actors with direct knowledge of these events. Our analysis of interview data revealed that local advocates borrowed capacity and license from the national level to advance their policy agenda in Chicago. Likewise, advocates at the national level used the successes of entrepreneurs in Chicago to bolster their license to act and further advance the movement to broaden participation in computing in other major cities. The case explored in our research, therefore, provides evidence that the borrowing strength model of agenda setting can be productively applied to help explain how idea champions in an education

policy subsystem have been able to increase interest and involvement in CS at both the national and the local levels. Moreover, our research suggests that the interactions and influences between officials and policy entrepreneurs at different levels are best characterized as multidirectional as well as dynamic (the direction of influence can change over time). This finding supports Manna's claim that relationships among different levels within the American federal system are best characterized as interactive in both directions, rather than top-down or bottom-up.

The borrowing strength model was initially developed to explain federal-state interactions. However, Manna (2006) called for extending the model by incorporating local governments, to uncover if and how officials at that level also engaged in borrowing strength. By extending the model to local governments, our research answers Manna's call and sheds new light on federal-local interactions.

Manna (2006) identified individual policy entrepreneurs as being a building block of his theory and the driving force behind agenda setting. The findings from our research support the importance of idea champions. We also found that a major strategy for elevating the agenda status of a policy issue was engaging in community building at a different level in the system (*building strength*) prior to borrowing strength (see Figure 3). In the case of Chicago, CS advocates at the local level formed a community that was subsequently strengthened through the capacity-building efforts of national advocates. As these efforts began paying dividends, the national advocates were then able to spotlight Chicago as a proof point to justify their prior investments and continued work in the area of broadening participation. Moreover, according to interview participants, as pockets of similar CS-focused communities formed around the country, national advocates worked to build a national community. Future research should seek to find additional examples of the concept of building strength that fit within the borrowing strength model.

Our findings have implications for the ongoing national effort to increase CS programming in K-12 schools. As part of that effort, national CS advocates have identified specific areas related to the impact of CS that can be spotlighted by educators and policymakers to argue for the need to change policy related to CS (i.e., a CS playbook for advocates at the state and district levels). The national CSforAll organization has led this work and developed the Strategic CSforALL Resource & Implementation Planning Tool (SCRIPT) and the CS Visions Toolkit to help educators and policymakers focus on appropriate rationales and values for CS and develop implementation plans for CS (CSforALL n.d.). In a sense, these tools complement the process of borrowing license that was described above by providing explicit guidance on how local leaders should talk about CS in order to facilitate policy change. As efforts like these continue to gain traction, it is likely that CS will be elevated on the policy agenda in greater numbers of districts across the United States.

In Chicago, local advocates used both an equity frame and an economic frame to communicate the importance of expanding access to CS within the district. This finding suggests that these specific frames of the issue may be particularly salient and effective in other large, urban districts across the country. That is, when building a vision of CS to communicate to

stakeholders within a major district, education leaders and policymakers should give particular consideration to the arguments that CS is an equity issue and that CS can promote economic and workforce development.

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