Smart and Connected Communities for Learning

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Questions, or want to add to this topic or to a new topic? Contact CIRCL.

Overview

Smart and connected communities for learning (SCCL) leverage networks and technology to foster lifelong, lifewide learning that spans multiple settings or locations. Successful efforts to bridge learning experiences across settings demonstrate marked improvement in (a) participants' awareness of opportunities for learning in their locale, (b) their ability to engage in and sustain related learning experiences within and across multiple places, and (c) their experience of their community as interconnected in support of learning.

SCCL often happens in **more than one place** (across communities) and **leverages technology** (such as cyber physical sensors, Internet of Things, wearable technologies, mobile systems, and big data) to provide continuity across settings. SCCL takes place in both formal or informal learning environments, across neighboring communities, in a "smart city", or even across the country or world. Another key element of an SCCL is that it addresses needs or **solves problems that come from the communities**. A goal should be to make "more livable, workable, sustainable, connected communities" with citizens who are able to contribute and continue to improve their world. Smart and connected also involves **distributed human and social capital to solve problems**. In SCCLs, a team of educators, community representatives, researchers, and others design, implement, and evaluate potential solutions to a problem identified by the community (e.g., local environmental concern, food desert, workforce issues).

An example of an SCCL might be an program that links outside of school activities with in-school activities to allow learners to make meaning of or apply what they have learned in school (e.g., use math practices introduced in school to visualize data on a local environmental issue), and reach out to the community to share their learning and potentially impact on a related community issue. The New York Harbor School's Billion Oyster Project is an instance of this: schools, businesses, nonprofits, and individuals are working together (10 partners) to restore 1 billion live oysters to NY Harbor and restore the ecology and economy of their local marine environment.

As Eamonn Kelly reminds us (Kelly et al., 2016), in working with communities, it is important to remember all of the connections they have, and that they are part of a larger, complex system that involves citizens, a need for privacy, natural disasters, changing politics, and other issues. A change to one part of the system may affect other parts of the system in ways that are unanticipated. The intervention activities undertaken in a community will likely need to be iterative, flexible, and collaborative; unintended consequences should be documented, accounted for, and or addressed as possible.

Research on SCCLs should lead to new "powerful and resilient models and solutions, efficiencies in resources, advances in science and engineering knowledge and practices, and STEM education practices and research" (Kelly, STELAR webinar). Qualitative and quantitative indicators that allow researchers to quantify subjective outcomes including "personal quality of life, community and environmental health, social well-being, educational achievement, or overall economic growth and stability" (NSF DCL) are necessary. Models should include community roles and capacity-building for educators. Finally, SCCLs need to document their progress and share data and methods to help the field build new models and scale impact. Smart and connected communities for learning is a natural progression and could partner with projects on smart cities as well as work on learning across settings (or "crossover learning"; Sharples et. al., 2015). Gianni & Divitini (2015, p. 30) note that "While the role of technology in Smart Cities has been widely recognized and addressed, there seems to be no established field of research that connects Smart Cities to Learning." In the article, they go on to outline the learning theories and research methods, types of research and technologies used in articles linking learning and Smart Cities. The also note that Internet of Things is not well explored in the research. The methods and learning theories in the Smart City Learning literature could inform SCCL. What seems to make SCCL distinct from Smart City Learning is SCCL's focus of connecting people across settings to enhance learning.

Related Work

Related CIRCL Primer: The Cutting Edge of Informal Learning
The ideas behind SCCLs come from the growing body of research on smart cities and from research on the relationship between learning across settings.

Smart Cities. As populations continue to increase in urban areas, with a projected 70% of the population of the world concentrated in cities by 2050, there is a huge challenge, need, and opportunity to make cities

"smart." Smart Cities work began around 2005, but the definition of what "smart" means is still being debated (Angelidou, 2015). Many of the approaches include a focus on energy-efficiency for green cities, smart technologies to improve or monitor water use or conditions, transportation options that are more convenient and accessible, urban manufacturing, and urban farming to improve housing, jobs, quality of life, and sustainable growth; and security for data and people.

Smart approaches in Smart Cities engage citizens in unobtrusive ways through the Internet of Things, sensors, wearable technologies, and mobile systems, leveraging infrastructure to integrate and use the data across agencies, schools, and informal settings. Nam and Pardo (2011) discuss three dimensions: technological (the integration of infrastructures and technology-mediated services), human (social learning for strengthening human infrastructure), and institutional (governance for institutional improvement and citizen engagement). Buchem and Pérez-Sanagustín (2013), take a humanistic perspective where smart cities are thought of as ecosystems that include technologies and technological infrastructures but go on to support the transformation of people into smart, engaged citizens who are learning and participating. The focus on people is purposeful; if just a technological focus is taken, it may result in passive people who live in the city rich with technological infrastructure. People are crucial for solving societal, environmental, political, and economic challenges. The humanistic perspective is essential to help us understand how technology can foster lifelong, lifewide learning across settings in communities.

Learning across settings and connected learning. Through engagement in activities based on personal interest and with others, connected learning strives to foster critical thinking and collaboration between learners and others in the community (Ito et al., 2012). Connected learning can also be seen as context-aware and ubiquitous learning; Yang, Okamoto, Tseng (2008) identify mobility, location awareness, interoperability, seamlessness, situation awareness, social awareness, adaptability, and pervasiveness and key characteristics. Regardless, learners and their interests are the main focus, and digital media and networked systems are used to engage diverse youth in authentic experiences that provide new pathways to learning. Three principles of connected learning are that it:

1. Is **production centered**. Because the work is production centered, it allows for active, engaged, hands-on learning. When the production involves digital tools and media, the work can be easily shared, remixed, and curated.
2. Has a **shared purpose**. The shared purpose or common goals of the work naturally help foster intergenerational and cross-cultural interactions with experts and interested others; artistic

expression, civic projects, or other collaborations or competitions are ways of creating meaningful shared purposes.

3. Is **openly networked**. Openly networked means that youth can more easily make connections to resources and cross boundaries between school and informal settings with their work.

Connected learning tries to create multiple points of entry to meaningful participation in areas of youth interest to help prepare youth for both formal work and a social life that includes civil society, family, and community life. Connected learning aims to be at the intersection of youth personal interests, academic focus of schools, and peer culture, connecting these three areas purposefully and selectively to further learning goals (related to the 3 principles above) by (a) connecting youth with resources in different settings and with institutional support, (b) helping them make connections from their interest to academic relevance, and © helping them make social connections with peers or adults who can further their learning. As Ito and colleagues (2012, p. 76) summarize, “Learning is most resilient when it is linked and reinforced across settings of home, school, peer culture and community.” Technology can help achieve this goal for learning because of the ways it can help connect people, classrooms, community, and home, and help learners create and contribute.

Issues

- How to design for community-scale learning using emerging technology affordances?
- How to connect learning across settings while leveraging the context in each setting?
- What projects, communities, and people should be involved in each project?
- How to measure and reward learning for individuals, groups, and communities?
- How to use data to continuously improve smart and connected learning communities while insuring data privacy? What issues may arise?
- How can different institutions with overlapping goals establish sustainable partnerships for SCCL?
- How might institutions of knowledge, places for learning, and the roles of mentors develop and evolve within connected learning communities? What are ways projects can connect to each other?
- What new research about learning becomes possible in smart and connected learning communities?
- How do we ensure that youth get exposed to points of entry in smart communities? (Maybe a “smart situation” could help more youth find their interests, make potentials connections, and create more opportunities?)

Projects

Examples of NSF Cyberlearning projects that overlap with topics discussed in this primer.

- DIP: ScienceKit for ScienceEverywhere - A Seamless Scientizing Ecosystem for Raising Scientifically-Minded Children
- DIP: Developing Frameworks, Tools and Social Practices to Support Effective Instructor use of Online Social Learning Networks in Blended Learning Models

Science Everywhere is an NSF funded research study aimed at understanding how technology can engage entire communities in science learning.

The Digital Youth Network, an infrastructure for connecting youth to each other in after-school contexts that includes a variety of tools for digital inquiry and expression.

The Chicago City of Learning is an initiative that joins together learning opportunities for young people in a way that allows them to think about, pursue, and develop their interests.

The Remake Learning Network is a professional network of educators and innovators working together to shape the future of teaching and learning in the Greater Pittsburgh Region.

Curriculum and Community Enterprise for New York Harbor Restoration in New York City Public Schools, an NSF TEST/ICER project.

Queens 2020 is an initiative to create a partnership between the museum and the communities it serves.

Creating a STEM Pipeline for Low Income and Immigrant Youth, an NSF ITEST Collaborative Research project.

Several ITEST projects discussed in this STELAR Webinar

Resources

STELAR Webinar: Smart and Connected Communities: An ITEST Perspective. Webinar recording, with presenters Eamonn Kelly, John Cherniavsky, Lauren Birney, and Leslie Rupert Herrenkohl.

NSF Press Release (Sept 2015): Cultivating smart and connected communities.

NSF DCL: Supporting Research Advances in Smart and Connected Communities to stimulate research and new technologies to enable more livable, workable, sustainable, and connected communities.
Connected Learning DML Research Hub

Smart Cities:

Bannan, B. (2015). A Smart City Case Example: Toward an Integrative Learning Design Framework for Research, Design and Analysis (Presentation).

Lapowsky, I. (2016). The White House Wants You to Build Tools to Improve Our Cities. WIRED blog post.
Market Place of the European Innovation Partnership on Smart Cities and Communities,
including Barcelona is the World's Smartest City 2015 and Students in Mechelen, Belgium more at ease than teachers with cross sector approach.

Correa, D. (2015). Tackling Local Challenges through Smart Cities (slides). White House Office of Science and Technology Policy.

NSF Workshop on Smart Cities Dec. 3 & 4, 2015 – Links to pdfs from talks, including the one from Dan Correa.

Smart Cities to Smart Regions workshop from EC-TEL 2015 and promoted by the ASLERD (Association for Smart Learning Ecosystems and Regional Development) links to papers from it are available.

Readings

References and key readings documenting the thinking behind the concept, important milestones in the work, foundational examples to build from, and summaries along the way.

Angelidou, M. (2015). Smart cities: A conjuncture of four forces. Cities, 47, 95-106.

Bollier, D. (2016.) The city as platform: How digital networks are changing urban life and governance. Washington, D. C.: Aspen Institute.

Buchem, I.; Pérez-Sanagustín, M. (2013). Personal Learning Environments in Smart Cities: Current Approaches and Future Scenarios. Learning and Diversity in the Cities of the Future. Proposes Personal Learning Environments (PLE) that are constructed as a person moves in physical and virtual spaces. This merging of physical and virtual extend the experience and bring in new information that is not spatially bounded to allow for flow across times, topics, and locations and to create opportunities for learning to occur networked spaces. Could involve augmented reality, mobile tagging (with QR codes or geotagging), digital badges, mobile social media, smart objects, and wearable technologies. The pedagogical strategies and technological uses need to be designed and studied for effectiveness.

Caldwell, G., Foth, M. Guaralda, M. (2013). An urban informatics approach to smart city learning in architecture and urban design education. Interaction Design and Architecture(s) Journal – IxD&A, N. 17, pp. 7-28

Christopoulou, E., & Ringas, D. (2013). Learning Activities in a Sociable Smart City. Interaction Design and Architecture(s) Journal – IxD&A, N. 17, 2013, pp. 29-42.

Del Fatto, V., & Dodero, G. (2013). Geographic Learning Objects in Smart Cities Context. Interaction Design and Architecture(s) Journal – IxD&A, N. 17, 2013, pp. 53-66

Diaz, P., Divitini, M., & Ramos, F., (Eds.) (2015). Smart City Learning: Opportunities and Challenges. N. 27, Special Issue. Includes a focus section on “Innovation in Human Computer Interaction: What can we learn from Design Thinking?”

Gianni, F., & Divitini, M. (2015). Technology-enhanced Smart City Learning: a Systematic Mapping of the Literature. In Smart City Learning: Opportunities and Challenges (Special Issue).

Ito, M. Gutierrez, Livingstone, K. S., Penuel, B., Rhodes, J., Salen, K., Schor, J., Sefton-Green, J., & Watkins, S. C. (2012). Connected Learning: An Agenda for Research and Design.

Mikulecký, P. (2012), Smart Environments for Smart Learning. DIVAI 2012 – 9th International Scientific Conference on Distance Learning in Applied Informatics.

Pérez-Sanagustín, M.; Buchem, I.; Delgado Kloos, C. (2013). Multi-channel, multi-objective, multi-context services: The glue of the smart cities learning ecosystem. Interaction Design and Architecture(s) Journal – IxD&A, 17, pp. 43-52. Discusses needed services to connect and orchestrate the technology-enhanced learning ecosystems ecosystem, to help mediate the information flow. They highlight multi-channel, multi-objective, and multi-context as key attributes to support active and participatory processes.

President's Council of Advisors on Science and Technology (2016). PCAST Report to the President on Technology and the Future of Cities, February 2016.

Sharples, M., Adams, A., Alozie, N., Ferguson, R., Fitzgerald, E., Gaved, M., McAndrew, P, Means, B., Remold, J., Rienties, B., Roschelle, J., Vogt, K., Whitelock, D., & Yarnall, L. (2015). Innovating Pedagogy 2015: Open University Innovation Report 4. Milton Keynes: The Open University.

Yang, S. J. H., Okamoto, T., & Tseng, S..S. (2008). Context-Aware and Ubiquitous Learning (Guest Editorial), Educational Technology & Society, 11 (2), pp. 1-2.

Zhang, B., David, B., Yin, C., & Chalon, R., (2013). Contextual Mobile Learning for professionals working in the "Smart City". Interaction Design and Architecture(s) Journal – IxD&A, N. 17, 2013, pp. 67-76.