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Coalescing Knowledge Within Networks of Research Practice Partnerships: The Case of a School-Based Citizen Science Network

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Abstract: Synthesizing valuable insights developed within diverse partnerships that are part of a network is challenging. This study explores implementation stories of school participation in Citizen Science and insights shared by participants as part of two workshops, intended to increase cross-fertilization among participants. Six new abstract design principles were identified as corresponding with learning through Citizen Science. This study illustrates how these principles' identification can support cross-fertilization between partnerships and amalgamation of the dispersed knowledge.

Introduction and theoretical background

The Taking Citizen Science to School (TCSS) center is a network of Design-Centric Research-Practice Partnerships (DC-RPPs, Kali, et al., 2018), that includes members from different organizational, scientific, theoretical, and practical backgrounds. Each partnership within the network, implements a different Citizen Science (CS) project offered by the center in one or more schools, and co-designs or adapts curriculum materials to local contexts. This requires members to cross cultural boundaries of the various expertise. In doing so, members collaboratively advance educational practice, educational-research and the CS-related scientific research. As a result, unique knowledge and insights develop within each partnership, which have the potential to be valuable to other members in the TCSS network (Sagy, et al., 2019). The challenge of TCSS is to amalgamate this dispersed knowledge and make it accessible to all members of the network. This goal is in-line with the educational research challenge to increase and scale the educational innovations' applicability (Law, et al., 2021). The approach we chose is based on identification and abstraction of design principles (DPs, Linn, et al., 2006), within implementation stories of school participation in CS, which were perceived as effective for this challenge (e.g., Kidron & Kali, 2015). DPs connect theories of learning and instruction (know-why) with features of implementation (know-how, portrayed here by the stories) and provide a way to encompass, synthesize and present the knowledge gained in the diverse DC-RPPs, communicating the conceptual design ideas behind the implementations. Members of RPPs can then further adapt these emerging DPs to their RPPs' needs (Kali, et al., 2018). This poster describes how this approach was examined in two workshops, as a first step towards synthesizing the insights developed within the various DC-RPPs.

Method

To provide opportunities to identify, share and discuss cross-project DPs while enriching existing design knowledge and amalgamating the TCSS network's dispersed knowledge, we designed two workshops. In each workshop, participants (N=38, 30) worked in groups (five in the first and four in the second) where they: a) shared implementation stories of CS activities within their schools; b) identified or formulated DPs for school-based CS that may be integrated in these implementations; and c) shared and discussed those DPs in a plenary session. A description of 25 DPs for implementing CS in schools, which stemmed from the Design Principles Database (Kali, 2006) for science education was used as a resource. By integrating practical (know-how) and theoretical (know-why) knowledge, participants developed what Bereiter (2014) calls principled practical knowledge, intended for further use by the TCSS network. Data from both workshops was recorded, transcribed and analyzed deductively and inductively with the aim of identifying references to DPs as well as overarching insights beyond existing principles. The process of developing new DPs based on these insights was validated by the six authors of this research and triangulated with current learning science and educational research literature.

Initial findings

Altogether, 128 statements that related to DPs were identified. These statements were chosen as they included insights that made an abstraction of the practice. 23 of the 25 DPs were referenced in one way or another. Three DPs were not referred to at all (e.g., "Cultivate productive discourse norms"). Overarching insights provided bases

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for six DPs that were later on validated and articulated, capitalizing on learning sciences and educational research literature: "Encourage active citizenship", "Freedom of choice", "Multidisciplinary and interdisciplinary learning", "Flexibility and adaptability", "Promote educational leadership" (e.g., Ballard et al., 2017, Iyengar & Lepper 1999, Kidron & Kali, 2015, Bransford et al., 2000, Ado, 2016 and Bandura, 1997, respectively).

To illustrate the process that enabled the articulation of new DPs we focus on the emergent "Encouraging active citizenship" DD. Twelve statements (of 128, three in the first workshop and nine in the second) mentioned the idea of active citizenship, by six groups. One group, for instance, found that what connected between their implementation stories was that CS partnerships can foster empowerment of students, caring, and agency to contribute to their local environment. To add this emergent DP to the pool of DPs available to the network, we used language participants brought to the table and integrated it with learning theory. Within the description of each DP, we included also practical examples and citations of workshop participants, acknowledging their contribution as part of the DP's authorship. For example, the 'Encourage active citizenship' DP's description resulting from this process, which became a resource for use and refinement to networks' members follows:

> Participation in CS involves students in active citizenship and provides them with opportunities to contribute to their communities and wider society. Importantly, encouraging active citizenship tends to provide students with meaning to their activities outside the school's boundaries, connecting them with current issues such as climate change and biodiversity, while fostering students' sense of agency and self-perception as contributing citizens.

Discussion

The initial findings portray the potential of sharing implementation stories and relating them to DPs as a mechanism to support amalgamating of the dispersed DC-RPPs' knowledge. The workshops led to refinements of existing DPs and articulation of six new DPs. It also informed the design of a pilot version of a Web-based platform for supporting networks of DC-RPPs in coalescing principled-practical knowledge.

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