How do different RPPs define and design around different indicators of healthy RPPs and how do they evolve over time?

Characteristics of RPPs

Research Practice Partnerships (RPP) for computer science (CS) education efforts have gained momentum through NSF's investment in the CS For All program which funds groups of researchers and practitioners to work together on a common problem of practice related to broadening participation in computing (BPC). The National Network for Education RPPs (NNERPP) describe RPPs as "A long-term collaboration aimed at educational improvement and transformation through engagement with research, intentionally organized to connect diverse forms of expertise and to ensure that all partners have a say in the joint work." Farrell, Penuel, Coburn, Daniel, and Steup (forthcoming, 2020)

Doing this difficult work requires deliberate nurturing of the partnership in service of both implementation and research goals. There are three commonly accepted models for an RPP:

1. **Research Alliances** are typically locally based partnerships established between a district and a research organization to investigate problems of practice related to policy that are central to the district
2. **Design-Based Implementation Research** provides a structure in which to iteratively and rapidly develop, implement and research an innovation in a real world context. Often it is used when developing curricular materials or new pedagogical approaches or scaling to an entire district.
3. **Networked Improvement Communities** bring together like-groups of organizations or individuals to collectively explore a common problem of practice in pursuit of capacity building. This group will employ continuous improvement models in short-cycles.

Though these three common structures may provide an organizational taxonomy, the specific characteristics of a partnership will vary based on the shared goals and will affect things such as the membership, structure, frequency of engagement, shared agenda, resource sharing, and organizing documents such as a theory of change and a data-sharing agreement.

The Goals of RPPs in CS

NSF recognizes that "these studies have less prescriptive research designs and methods, with research occurring in rapid, iterative, and context-expanding cycles. They require deep engagement of researchers and practitioners during the collaborative research on problems of practice that are co-defined and of value to researchers and education agencies, for example, a school district or community of schools."

Specific initiatives, NSF invests in related to RPPs are projects that provide:

1. high school teachers with the preparation, professional development (PD) and ongoing support they need to teach rigorous computer science courses;
2. PreK-8 teachers with the instructional materials and preparation they need to integrate CS and CT into their teaching; and
3. schools and districts with the resources needed to define and evaluate multi-grade pathways in CS and CT.

Many of the CS for All RPPs formed in response to the NSF investment, often with the research partner leading the effort. This includes initially defining the problem of practice which is then presented to practice partners which is then refined as part of the proposal process. In many cases the members of the partnership had pre-existing relationships through other CS education efforts and the CS for All funding allows them to formalize the RPP structure. The goals of the projects are typically testing a program or intervention the partnership designed, rather than seeking to test an existing offering in a new environment or scale more broadly.

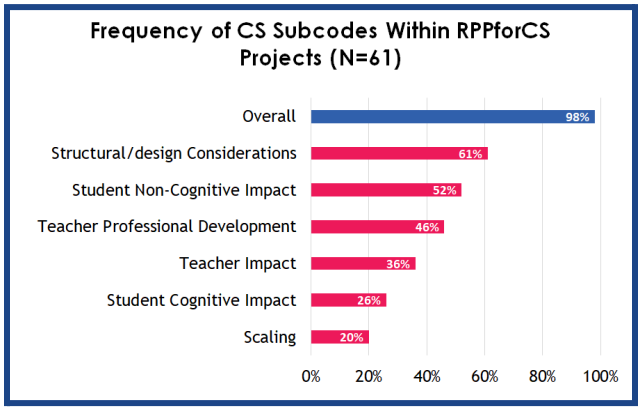
The projects typically have multi-layer goals for their CS for All work:

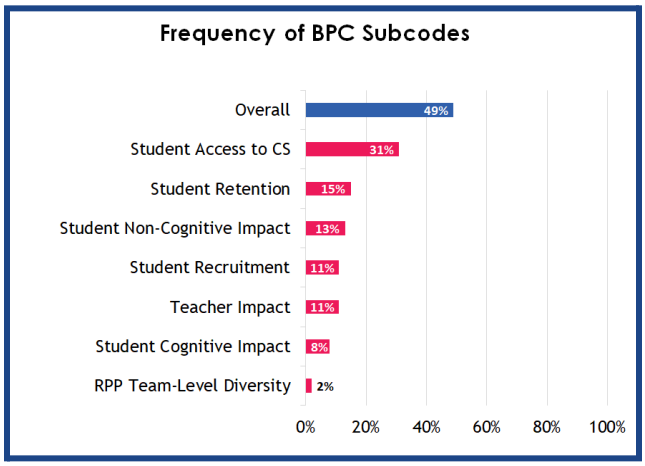
1. **Partnership goals**: These are goals related to the functioning of the partnership itself

2. **Implementation goals**: The implementation goals are often around preparing teachers to implement CS curriculum. In some cases the teachers are beneficiaries of PD for existing curricula and in other cases the teachers help co-create the materials.

3. **Research goals**: An analysis of *research questions* presented in the abstracts and proposals from the first 3 cohorts of projects finds that many of the CS related questions are information-gathering, meaning they would provide answers to descriptive and/or predictive questions such as: How many …? or What is the relationship between …? These types of questions are common as seen in a study of RPPs funded through the Department of Education

4. **Broadening Participation Goals**: Half of the projects have BPC-specific research questions, with most related to student access to computing. Our observation of the community, however, is that this discounts much of the BPC related efforts embedded in the implementation designs of the projects which may be to serve a specific community or population that has historically been marginalized in CS education.





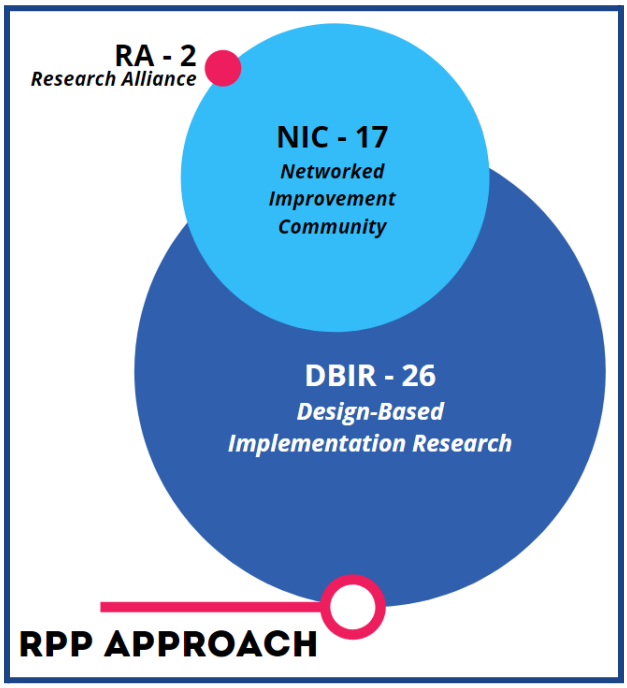
Characteristics of RPPs in CS

NSF funding provided an opportunity for many implementation efforts to formalize into an RPP. Overall, the funded projects seem to have some prior working relationships. When asked to describe their partnerships, most identify themselves as “early” or “middle” phase around various partnership dimensions. The categorization of projects did not vary based on the individual’s experience with RPP efforts.

Which statement best describes your partnership maturity?

Average (Scale of 1-3)	Early		Middle		Maturing		Average (n=103)
Impact Local Improvement Efforts	27	26%	43	42%	26	25%	2.0
Cultivate Partnership Relations	35	34%	27	26%	38	37%	2.0
Conduct and Use Rigorous and Relevant Research	25	24%	50	49%	20	19%	1.9
Develop Capacity to Engage in Partnership Work	53	51%	20	19%	19	18%	1.6
Inform the Work of Others	66	64%	29	28%	1	1%	1.3

Averages were calculated based on a three-point scale: Late phase = 3, Mid phase = 2, Early phase = 1. Participants also had the option to answer "I don't know", however these values were not used to calculate the average.



Within the RPP community, DBIRs are the most common type of RPP (56%), followed by NICs (38%). There were just two research alliances in the first three cohorts of awardees. Despite this helpful taxonomy, there is significant variation between projects.

Most of the projects have a smaller **leadership team** that coordinates the efforts of the partnership. The organizing team is often tasked with managing communications, developing meeting agendas, and ensuring the voices of all members are included. These leadership teams tend to have representation from the research and practice partners and can also include a project coordinator.

The **practice partners** are often described as participants in the research or co-creators of the curricular materials and approaches and also as the beneficiaries of the work. In some cases, "partners" refer to the many individuals that benefit from scaling an innovation, while in others the partners are closer to the decision-making efforts.

All of the RPPforCS member partnerships invested in **developing their community**. Though some have prior working and partnership relationships, few were formal RPPs. Efforts to develop the sense of community may be dependent on the nature of the partnership, for example, in some cases, the effort is seeking to work across a large **geographical area** (state or nationally) while in others the partnership may be with one district in which case the partners are coming from a set of shared experiences or norms. Many of the partnerships had prior working relationships among subsets of the members, and the RPP has deepened and changed those relationships.

Among RPPforCS survey takers, **most are higher education researchers** (62%) or non-profit researchers (22%) or evaluators (9%). Within their role as researchers, just over half (53%) have engaged in CS education-specific

research efforts. Almost a quarter(35%) have been involved in CS-education PD efforts. Few have been involved in CS education curriculum design (10%) or teaching (7%).

Less is empirically known about the practice partners though it appears that practice partners are either district representatives with lead research or administrative responsibilities related to CS education *or* they are directly involved with delivering CS content as teachers.

Many of the partnerships also have **external partnerships** with nationally based CS education programs such as CSTA, NCWIT or Code.org suggesting they are part of a broader CS education ecosystem.

RPPs take significant time, often more than projects anticipated when they wrote their proposals. Despite this, most participants in RPPforCS felt that the amount of time with the various groups was "just right" though many would like more time with students and with teachers. It is important to note that for over 60% of these individuals, their work in the RPP either strongly or mostly **aligned to their general professional responsibilities** meaning they had the resources to support their time investment.

> **RPPforCS was designed to support the partnerships by engaging the research partners. Future study is needed to capture the practice partner experience and perspective.**

Partnership Operations

There are several common tasks that the CS for All partnerships undertake in pursuit of their goals.

Defining and understanding the problem of practice. As discussed, the problem of practice is typically suggested by researchers and refined with the practice partners as part of the proposal process. Once funded, the problem of practice is further refined over the course of the grant. One element that has been important to many projects is generating a shared language to understand the problem and interventions consistently across RPP members.

Recruitment Partnerships have to recruit into the partnership, and in many cases recruit teachers as part of the implementation and scaling efforts (which may or may not be the same individuals). An open question is *what were the expectations of participants, particularly practice partners or teacher-recipients for the RPP?*

Professional Development Almost all (85%) of the NSF CS for All: RPP projects include teacher professional development as part of their strategy, and of these, most PD is for in-service teachers. In some cases the practice partners are involved in co-creating the PD content and/or the PD delivery approach. In others, the content of the PD is independently created (either through the project or third-party). Over half (61%) of the projects are preparing teachers to offer Exploring Computer Science or the Computer Science Principles course. Those focused on grades K-8 are more likely to prepare teachers to integrate computational thinking into their regular classes.

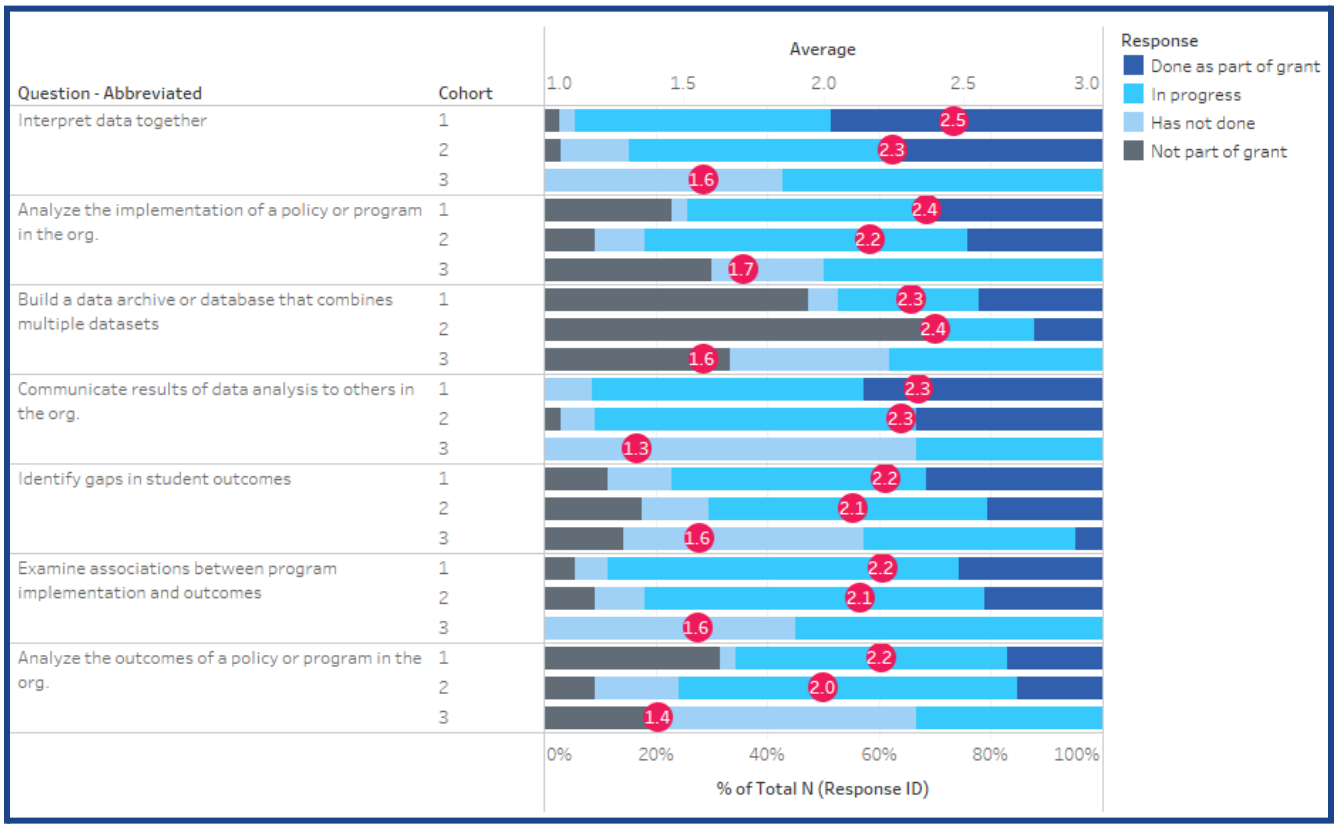
After PD prepares teachers to bring CS/CT into the classroom, the PD participants become research partners during the implementation of the material (Typical of DBIR projects). At this point practitioners

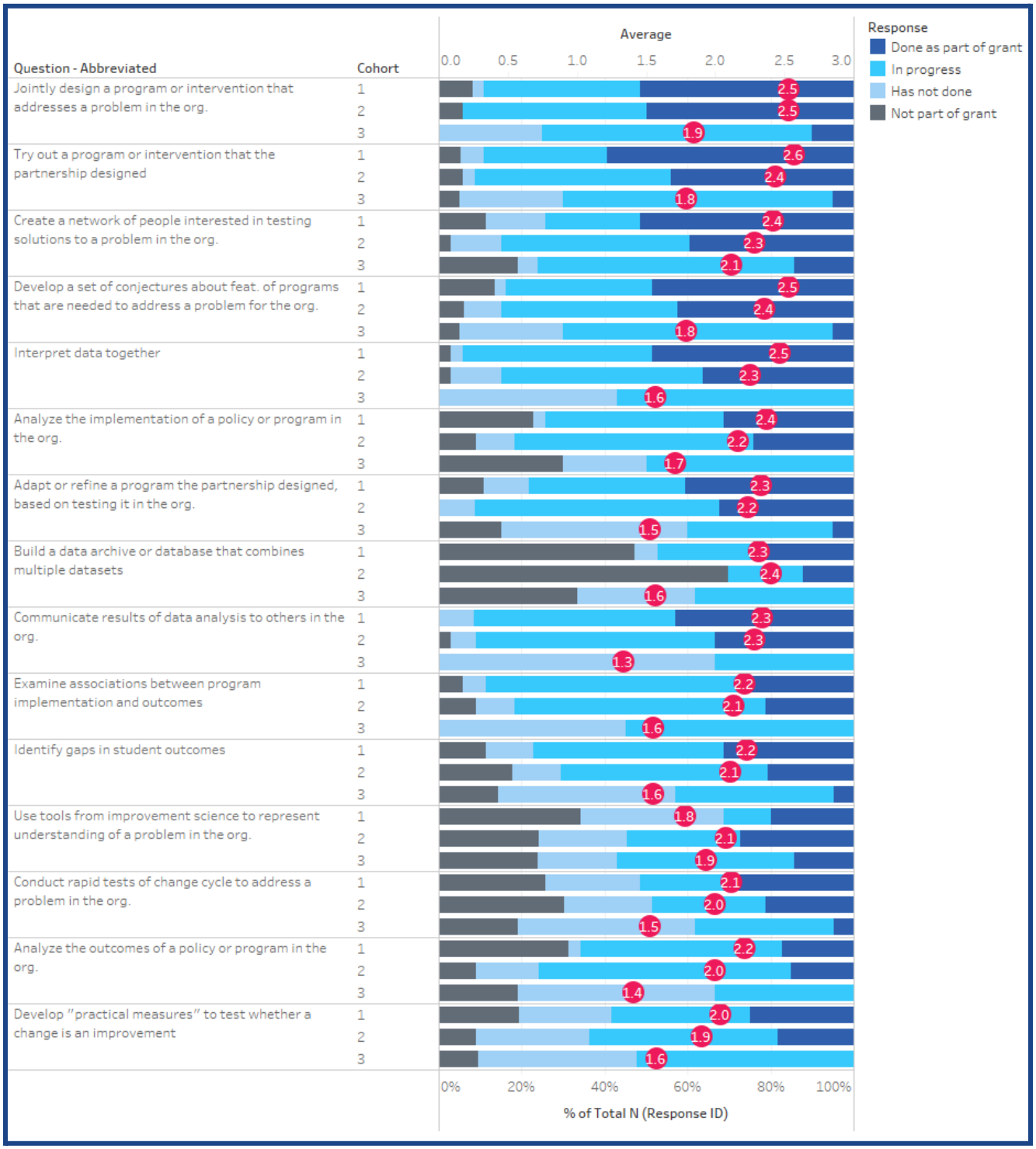
and researchers are engaged in an iterative process of testing and improving the effectiveness of the intervention.

Measurement and use of data Nearly all of the partnerships engage in collective data interpretation efforts. Partnerships rely on data for defining the problem of practice. Sometimes this is a landscape study or gap analysis. Subsequently, data informs the initial design of an innovation and subsequent iterations, often referred to as *practical measures* and a common strategy among RPP projects in CS. Measurement and data is also used by the partnerships to answer the broader research, often related to ensuring that the equity goals are being met. Finally, many partnerships use data to improve the partnership itself by monitoring the health of the RPP. Survey data suggests that few projects are working to build a data archive or database that combines multiple datasets as part of their change effort or research strategy.

See here for a discussion on how RPPs develop healthy partnerships

Specific activities RPPs undertake as part of the grant are presented in the table below. Looking at progress by cohort helps estimate when in a project's maturity activities might be more prevalent. For example, adapting and refining a program obviously requires time to study and learn from a first implementation, so it cannot be done in the early part of a grant.





RPPforCS has provided support for projects as they engage in research efforts by facilitating cross-project collaboration. Projects operate at a local level, but many address similar themes. Cross-project collaborations that have emerged include:

- Evaluator working group and a subgroup focused on enhancing partnerships' capacity to consider equity beyond student access and participation measures
- Achieving CSforAll: Starting early by developing elementary teacher competencies in computing education
- Problems of Practice: Keeping Equity at the Center

- Finding the Right "Look": Charting the Capacity of "Look For" Documents to Discern CT Integration in Elementary and Middle School Classrooms
- Exploring Computer Science

Though there is great willingness and enthusiasm to engage in cross-project research efforts, doing so requires funding.

> The disruptions to education and research caused by the COVID-19 pandemic have had many consequences on partnerships internally and limit cross-partnership collaboration which often occurs most deeply and productively during face-to-face encounters.

Using RPPs to improve CS Education

The members of the RPPforCS community are in near universal agreement that RPPs are "a great way to address a challenge in CS education" (69% strongly agree and 30% agree). A closer look at the survey responses show that projects are progressing, with implementation goals and partnership goals having the most progress and dissemination and sustainability goals lagging. This is to be expected as dissemination and sustainability are generally late-stage grant activities. As discussed above many of the common activities in which partnerships have engaged (i.e. Jointly design a program or intervention that addresses a problem in the org.; Try out a program or intervention that the partnership designed; Create a network of people interested in testing solutions to a problem in the org.) are tied to these types of goals.

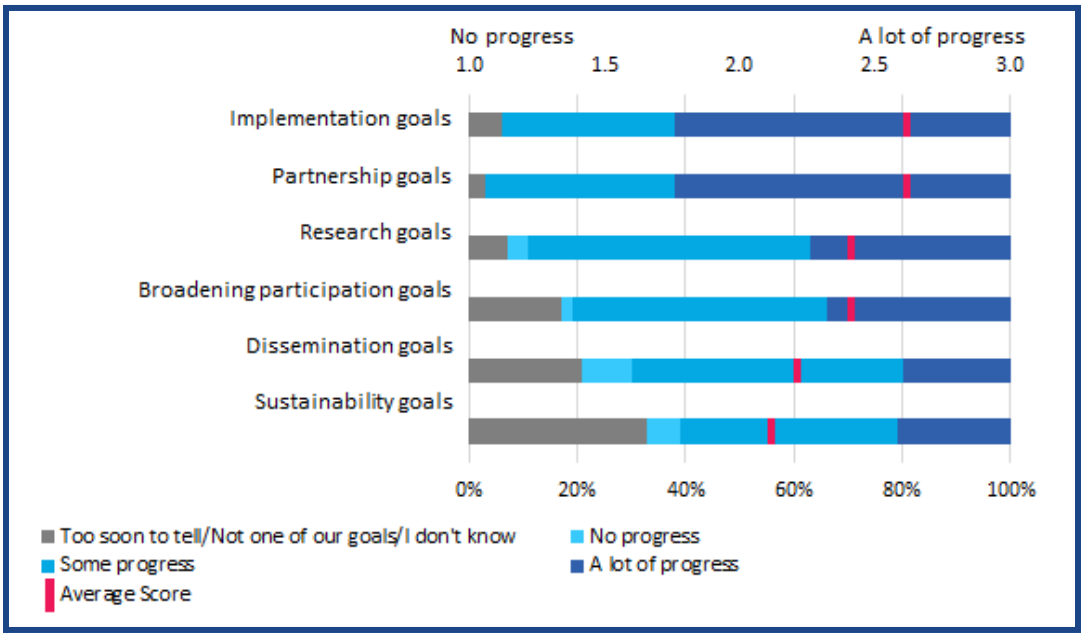


Figure # Perceived progress in meeting given goals (n=108, scale of "A little"/"Some"/"A lot of progress")

Implementation goals tend to be the "easiest" goals for projects, many of which are experienced with providing professional development, creating curricular materials and/or other interventions. Practice partners are, of course, intimately familiar with the education context.

Partnership goals are important to attend to over the life of the project. Early in the project they are about establishing norms for interaction, ensuring a balance of power and trust between partners. As

the partnership evolves so must the norms of interaction. Meeting the goals for the partnership is an on-going process.

Research goals tend to involve collecting and making sense of data which is more common for cohort 1 and 2 (i.e. Develop a set of conjectures about features of programs that are needed to address a problem for the org; Examine associations between program implementation and outcomes and; Analyze the outcomes of a policy or program in the org.). The difference is likely a function of time. Though teams are sharing results internally, the broader dissemination goals have yet to be met.

BPC goals in many of the RPPs have evolved, as the understanding of and approach to addressing the problem of practice is often fluid based on rapid feedback and practical measures as well as a changing context. We've observed in RPPs that projects that BPC is no longer a sufficient way of thinking about the goals of partnerships seeking justice, equity, diversity, inclusion (JEDI). The shift from participation to deeper focus on JEDI is observed to occur through various mechanisms:

- The RPP projects have a **deeper appreciation for JEDI-**related issues, as the partners and researchers engage in difficult and authentic conversations.
- There is **strong fidelity to the projects' proposed BPC goals,** though the understanding of the problem is often complicated (in a good way!) as the problem of practice is explored and better understood
- Projects did not embark upon their work with equal intent across the types of goals, and **over time the priority of various goals shift** as they gained importance. For example projects that had a heavy implementation focus may realize they need to invest more deeply in the partnership to be effective.

Dissemination goals that involve sharing beyond the partnership are sometimes challenged by the unique nature of RPPs and CS education research. This is particularly true for sharing experiences and submissions to conferences in which the intersection is not well appreciated. Within the RPPforCS community, RPPs have found a home at RESPECT which has a focus on diversity and CS education. RESPECT has accepted several RPP reports and the RPPforCS community gathers annually in coordination with the event.