What is the influence of RPPforCS on the grant-funded community and broader CS education community

How is RPPforCS designed to support the CS for All: RPP community?

RPPforCS fosters knowledge creation and exchange, cultivates leadership within the community and provides an organizational structure to steward a connected community of practice (CCOP) of awardees. RPPforCS shapes and amplifies the impact of the individual awardees by addressing key problems of practice in CS education. The learning within the CCOP is highly contextualized in that it is responsive to the member input. Creating horizontal accountability among members in which there is a sense of mutual relevance, peer recognition, and a commitment to collective learning is critical for generating the type of learning that is the value proposition RPPforCS offers. Although RPPforCS is open to everyone, our community is focused on the approximately 90% of active members who identify as PIs and/or researchers.

The success of RPPforCS as a research project depends on the voluntary participation of CS for All: RPP awardees to share their experiences and progress towards their individual goals. Researchers study individual project efforts to understand how the program can influence CS education. Developing the CCOP was complicated by the fact that the RPPforCS project has no authority to demand participation. Funded in 2017 as part of the first cohort of CS for All: RPPs, RPPforCS had to scale up quickly to support the contemporaneously awarded projects in their efforts to establish or formalize RPPs for CS education. Welcoming Cohorts 2, 3, and 4 in 2019, 2020, and 2021 further evolved the CCOP.

Given the open nature of the community and the annual influx of projects, the community is constantly evolving. Although the CSforALL: RPP projects are designed to meet multiple goals including implementation, developing the RPP partnership, BPC, conducting research and disseminating findings broadly, the cohorts are fundamentally different in important ways:

- Cohort 1: Projects were the first awarded in the new funding mechanism, with less time to carefully plan the RPP elements prior to funding. Several were legacy projects of prior funding that shifted to accommodate the RPP language in the proposal. This cohort also had a mix of curricular approaches including Computer Science Principles (CSP)(20%) and Exploring Computer Science (ECS) (32%).
- Cohort 2: Included a greater percentage of smaller grants with a duration of two years. Cohort 2 was most likely to use CSP as the curriculum choice (72%) with few ECS focused (10%). This cohort also had more time to consider RPPs in the CS context.
- Cohort 3: By Cohort 3, the shift in focus went from grades 6-8 to a heavier focus on grades pre-K to 5. This cohort was also more likely to work with multiple districts (70%) than the prior cohorts (48% each). ECS and CSP were not emphasized (13% and 17% respectively).
- Cohort 4: At this time, data for Cohort 4 is relatively limited. The emphasis on smaller projects was even stronger this year, however, with only 7% of projects in this cohort being awarded large grants (one million dollars or more).

Table 1: Award funding, duration, and curricular focus

	Award Year	Size of Award				Duration (Years)		
		# Projects	S	M	L	1-2	3-4	5+
Cohort 1	2017	25	12%	56%	32%	20%	72%	8%
Cohort 2	2018	29	31%	45%	21%	45%	55%	-
Cohort 3	2019	23	22%	48%	30%	35%	65%	-
Cohort 4	2020	43	44%	49%	7%	47%	53%	-

RPPforCS developed alongside the first cohort of awardees and was thus heavily influenced by their engagement in pursuit of supporting research across projects. As a social learning community the "curriculum" emerged as a result of participant experience. In the first year, there was a significant revision of the research questions to be descriptive rather than evaluative. In addition, technical assistance support was provided for projects launching RPPs for the first time, and there was a shift away from standardized measurement. Over the last three years, RPPforCS transitioned to providing a forum for sharing lessons learned about affecting CS education through an RPP and fostered sub-groups addressing similar problems of practice or using similar approaches. Thus the experiences of Cohort 1 heavily shaped the trajectory of the RPPforCS community. Cohorts 2 and 3 had increasing access to a well-established community and resources from the launch of their projects, with Cohort 3 having access to published materials during the proposal phase.

What support does RPPforCS provide the community?

There are several primary RPPforCS activities that support the CCOP:

1. Community-wide face-to-face meetings co-located with the RESPECT and SIGCSE conferences (nearly all projects have attended these meetings).
2. Small cross-project working groups focusing on a shared research agenda:
    a. Finding the Right "Look": Charting the capacity of "look for documents" to decern CT integration in elementary and middle school classrooms led by Kelly Mills, Pati Ruiz and Quinn Burke
    b. Achieving CSforAll: Starting early by developing elementary teacher competencies in computing education led by Aman Yadav
    c. Problems of Practice: Keeping Equity at the Center Led by Jill Denner, Jean Ryoo, Florence Sullivan and Sneha Veeragoudar
    d. ECS community meet
3. Monthly community calls that focus on a topical area of interest to the community.
4. A monthly newsletter that includes updates from our project and the community, as well as resources that may be of value.
5. Research-practice briefs that highlight how a set of projects are addressing a common issue or engage with a particular process.
6. Spotlights that showcase how a project is connecting their research to practice
7. Maintenance of a website that archives resources and opportunities
8. A searchable project database on the website that allows project to connect by geography, BPC goal, curricular approach, grade band served and other characteristics.

Who participates in RPPforCS?

Over three years, there have been 120 unique projects awarded (see Table 1), and as of 2020 the RPPforCS mailing list (open to anyone interested in the project) has grown to over 550 individuals. Of the 456 individuals that we have been able to identify as belonging to a particular grant project, 7% are highly engaged in the RPPforCS activities, meaning participants regularly attend webinars and events and contribute to data collection efforts. Just under 7% of the list are not engaged in the CCOP, and the remainder (86%) are minimally to moderately engaged in our activities. This represents a significant shift in participation behavior over the last year, where approximately 30% of our then-400 members were non-participants. There are also at least 36 "friends of RPPforCS" – individuals that we have confirmed are not participating in a funded CS for All: RPP project but are otherwise interested in the work that our community does. Membership is incentivized through reimbursement of conference fees for RESPECT. To maintain participation, the RPPforCS project must offer enough value to the community to motivate participation.

The RPPforCS Newsletter has also seen gains in readership and continued good performance. While readership fluctuates in time with the academic year and grant cycle, our newsletters have consistently been opened by an average of about 40-45% of the now 400+ individuals on our mailing list. A further average of approximately 20% of readers also interact with the content of our newsletters.

The RPPforCS website has seen similarly consistent traffic as it has grown into an archive of valuable resources and a searchable database of member projects. The website overall averages approximately 10-15 unique users per day and up to 300 per month, with some months seeing 800+ pageviews. Additionally, our resource and database pages generally average just over one minute of interaction time, with some months averaging as many as 3-4 minutes. This is as many as sixteen times the average user engagement time benchmark of 15 seconds commonly used for websites with "good" engagement. Interaction seems to be spread among resources such as spotlights and a variety of reports, among others, indicating that many of our products are useful to our community.

Table 2: Participation level distribution of RPPforCS Members over time

Participation Level	Percentage of Participant			
	Through Fall 2018 (N = 135)	Through Fall 2019 (N = 250)	Through Fall 2020 (N = 347)	To Date (N = 456)
High (has attended at least 60% of all eligible events)	-	3%	1%	7%
Mid (has attended between 30% and 59% of eligible events)	7%	22%	16%	21%
Low (has attended between 1% and 29% of eligible events)	49%	56%	79%	66%
Non-Participant (has attended no eligible events)	44%	20%	5%	7%

Influence of RPPforCS on the grant-funded community

Value of RPPforCS goals

Understanding the value of the RPPforCS project draws primarily from a community-wide survey administered in spring of 2018, 2019 and 2020. The analysis also uses supplemental information from other sources, including data from the year(s) a participant's project(s) was funded (Cohort 1, Cohort 2, Cohort 3, or some combination),

project demographics like duration or funding amount, and data describing how and how often a given participant interacted with the RPPforCS team through select media such as webinars.

The five goals of the RPPforCS project were consistently rated as valuable, and the community sees progress being made towards those goals (Figure 1). There was no substantial difference between cohorts, time-point or RPP experience in perceived value or progress; however, nearly ⅔ of the community felt they were unable to comment on the progress made towards common data, and just under 50% didn't know how well RPPforCS was meeting goals of shared research questions or common measurements.
It is possible that people who were less interested in these offerings chose not to participate and were thus unable to comment.

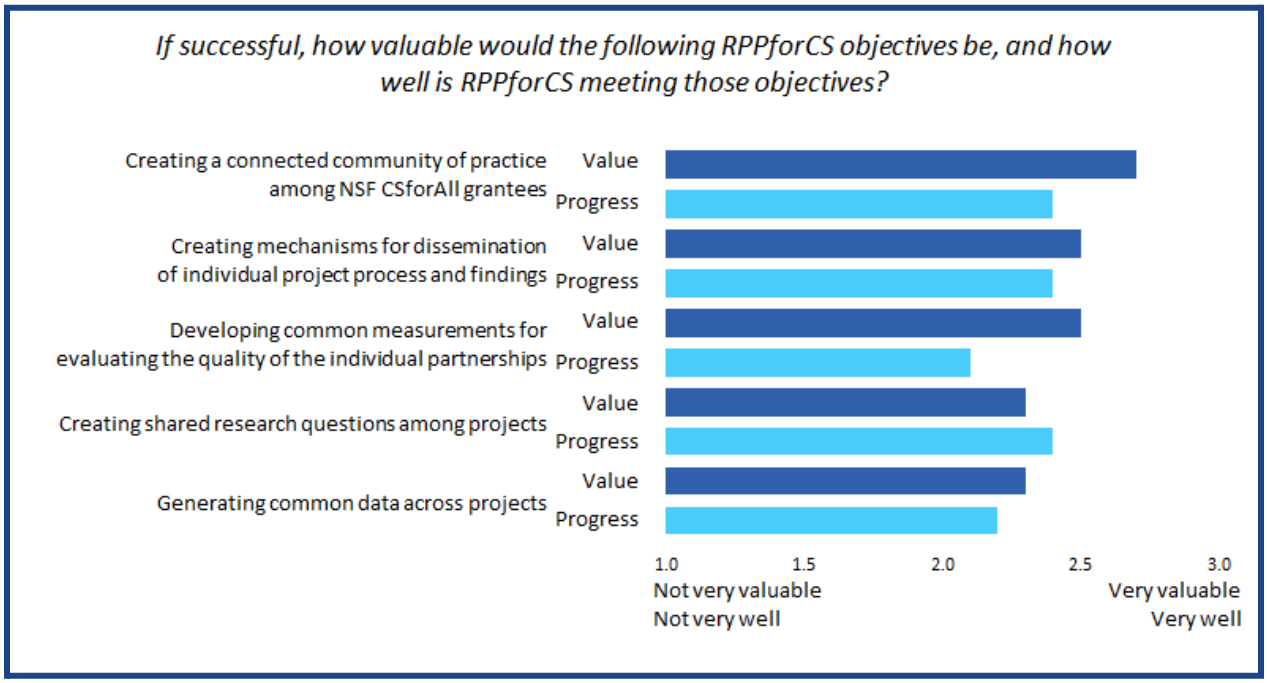

Figure 1: Value of RPPforCS goals and perceived progress in meeting the goal (n=94, scale of "A little"/"Some"/"A lot of value/progress")

Progress of CS for All: RPP projects' towards their project goals

CS for All: RPP projects have goals related to their partnership, implementation, BPC, dissemination and sustainability. Figure 2 presents the progress to date across Cohorts 1 and 2. Cohort 3 was excluded because data was collected before they had reached a year of funding. More progress has been made on implementation and research goals, with some progress being made towards dissemination and sustainability.

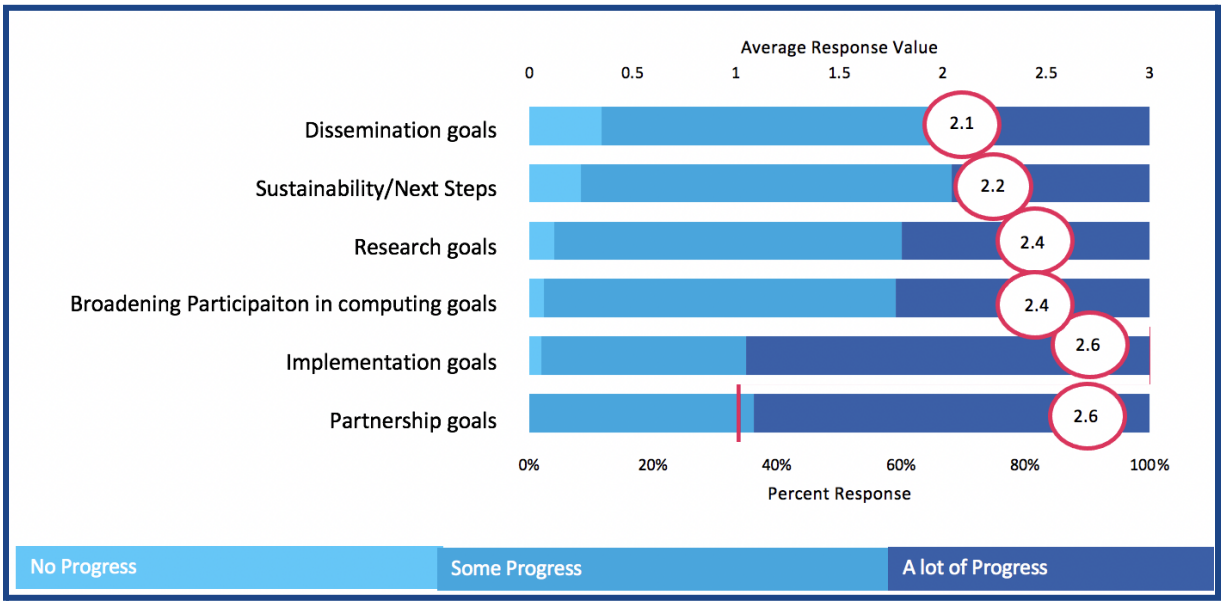

Figure 2: How much progress RPPs have made towards their goals to date (project Cohorts 1 & 2) and average item score (scale of 1: No progress to 3: A lot of progress)

Data across the three cohorts shows that progress towards specific goals is related to the length of the grant. Across cohorts, many have made significant progress to date developing their partnerships and implementing their project, with all cohorts having developed their partnerships and most of respondents from Cohorts 1 and 2 having made at least some progress on their implementation goals. The distribution of responses was similar between cohorts, though they do suggest that the goals related to BPC and research are realized later in a project, as Cohort 1 has made the most progress, followed by Cohort 2. Cohort 3 is just starting to address this goal. Finally, Cohort 1 is just beginning to make progress towards meeting dissemination goals (92%) and addressing their sustainability goals (83%). Cohort 3 has not made progress towards dissemination (26%) or sustainability (35%) goals.

RPPforCS helps projects meet their goals

Having established that the members of the RPPforCS community are making progress on their goals, the survey asks the extent to which RPPforCS as a community helped the projects meet their goals using a four-point scale (low to high). With a focus on the intersection between RPP and CS education centered on BPC, it is not surprising that RPPforCS has done well in helping teams form partnerships (67% agreement) and address BPC (56%). For Cohorts 1 and 2, which are further in their project lifecycles, there was also value in helping to meet BPC goals (66% and 45% respectively) and dissemination goals (77% and 60% respectively). Finally, the support of RPPforCS mirrors the progress by cohort, with those that have begun work on dissemination and sustainability efforts finding more value in RPPforCS than those that have yet to reach this phase.

RPPforCS helps projects meet their goals through community and resources

To understand how RPPforCS supported the team's efforts, participants were asked to report how valuable specific RPPforCS supports have been. Using a three-point scale (low to high), participants placed the greatest value on the connection to other members via the networking opportunities and face-to-face gatherings through which there were guided discussions. The newsletter and website were also highly valued. This pattern holds true for members of the community who are experienced in RPPs, as well as those who are novices. The least valuable resources were mostly those that participants didn't know about or didn't use and either required the

participant to seek out (several reports posted on the website, 40-50% unused), or were abandoned by the leadership team due to low use (Slack, 60% unused).

When looking at the value of RPPforCS resources by cohort, there was increased value in the resources shared over time, for example, the newsletter, which provides rich content related to RPPs, CS Education, updates on webinars and events, and project-specific findings generated within the community. Cohort 3 found the newsletter more valuable than the prior two cohorts, perhaps because RPPforCS improved at creating meaningful content. Similarly, research practice briefs and theme studies were more highly valued by Cohort 3, which benefited from these resources at the start of their project. For Cohorts 1 and 2, the resources were developed in concert with the projects themselves. This is an indication that the community values the case examples of RPPs in CS in practice.

Face-to-face meetings, which had nearly 100% participation from projects, helped establish the trust and relationships that carried into virtual engagement through regular webinars and the 2020 community gathering which pivoted to a virtual meeting for safety reasons amid COVID-19. Virtual sessions provided opportunities for real-time interactions among participants, often informing subsequent resource development and technical assistance focus.

Access to a network of professionals working at the nexus of RPPs and CS education was the greatest asset of the project, with face-to-face and webinar interactions being most valued. Webinars that promoted RPPforCS-generated findings and resources were the most well attended.

It has become clear that supporting a program-wide set of projects that are similar in objective and function but highly distinct in implementation benefits from a social learning community. Specifically, in the early phase the CCOP can provide technical assistance support, a professional network facilitating the exchange of practical exemplars, and access to tools and resources. The content of the programming evolves in response to the needs that emerge from the CCOP. Mid-phase benefits include a deeper exploration for sub-groups around common themes, which are identified through CCOP engagement. Finally, as projects transition towards sharing knowledge broadly, an infrastructure for dissemination helps amplify the work. Ideally, the influx of new project cohorts at different time points allows for the more mature projects to serve as peer mentors and practical exemplars, and their dissemination efforts serve as valuable resources to newer members. This cycle provides value at all project stages.

As a result of community engagement, RPPforCS is accomplishing its research goals to document and describe how an RPP structure can be used to achieve CS education goals. Community members regularly contribute anecdotes, reflections, tools and instruments that allow us a window into more projects than we would be able to touch in a traditional research project, while simultaneously making these learnings available to their peers. Most importantly, this research is highly relevant and useful to the community, as it is shaped in response to participation.

Influence of RPPforCS on the grant-funded community and broader CS education community

The theory of RPPforCS posits that by supporting the CS for All: RPP projects, these projects will then be more efficient and have greater success in their contributions to the CS education community broadly. There is no feasible way to fully test this relationship other than the reflective responses captured above, nonetheless, the impact of the grantees on the larger CS education community has been significant. As part of the knowledge brokering, RPPforCS tries to keep tabs on the research generated by the community.

Guides to SIGCSE technical symposia

- 2018
- 2019
- 2020
- 2021

RESPECT conferences are where the RPPforCS community gathers. Members are actively presenting their RPP related CS education research

- RESPECT 2018
- RESPECT 2019
- RESPECT 2020

In addition to the community presentations, RPPforCS organized the keynote presentations in 2018 and 2019 featuring the work of RPPforCS members.
Many RPPforCS members had leadership roles at the first annual CS for All: RPP PI meeting in 2019.

RPPforCS supported publications include:

- A Longitudinal Analysis of K-12 Computing Education Research in the United States: Implications and Recommendations for Change
- A Gap Analysis of Statistical Data Reporting in K-12 Computing Education Research: Recommendations for Improvement
- NNERPP Extra: Spotlight: An RPP Approach To Computer Science Work
- NNERPP Extra: Spotlight: Dimensions Of Equity In Rpps – A Framework To Guide Partnership Discussions