A Baseline Analysis of the Research Questions of NSF-Funded Research-Practice Partnerships and the Knowledge They Generate

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***Abstract*—This study will present a baseline analysis of the types of research questions generated by 61 Computer Science (CS) for All: research-practice partnership (RPP) projects in computing education, providing insights into the types of research questions being pursued by RPPs with the intent to assess the potential knowledge being generated through these projects. These RPPs are designed to both democratize research and produce generalizable knowledge related to broadening participation in computing education (BPC). Thus the questions being pursued should reflect pressing needs of CS education practice. Through a review of 208 research questions, this study examined the research questions for the types of knowledge generated and by the focus area of the question. The latter set of codes were then broken into further subcategories for analysis. Results demonstrate a relative lack of focus on broadening participation in computing (BPC) or RPP function, which may impede the completion of CS research and implementation goals. Results also appear to demonstrate very little focus on investigating the broader applicability of research findings. By encouraging greater inclusion of BPC and RPP research questions as well as greater focus on scalability of findings in future RPPs, CS-related goals can potentially be more efficiently achieved. Future work will include tracking changes in research questions and identifying research questions addressing problems of practice specific to the practitioner partners in RPPs.**

Keywords— Broadening Participation, Computer Science Education, Research Question Quality, Research-Practice Partnership

I. Introduction

The National Science Foundation's (NSF) investment in the CS for All: RPP (NSF 17-525, 18-537) program focuses on RPPs as a model to foster the research and development needed to bring CS and Computational Thinking to all schools. The CS for All: RPP projects share dual objectives of promoting BPC and conducting research in CS education. From there, they differ broadly in their approach. Some seek to scale teacher professional development widely, some are investing in culturally responsive curriculum and pedagogy, while others may be conducting research on a specific learning tool. The knowledge generated by this body of projects has the potential to rapidly expand the knowledge base and BPC in CS education. By building upon previous work [1] investigating the research questions used by RPPs funded by the Institute of Education Sciences, using this research as a baseline to examine how research questions evolve in the future, and continuing to encourage the inclusion of BPC and RPP research questions as well as a greater focus on scalability of findings in these and future RPPs, their research can have greater impact and reach.

II. Methods

Research questions were identified for each project based on data drawn from project proposals or by direct submission to the authors. Projects fell into one of three cohorts depending on the year they received their first NSF award. Research questions from the first two cohorts were coded for the type of knowledge generated (table 1) with the intent to replicate previous research on RPP research questions [1]. The remainder were not coded according to this framework, as the authors concluded that a true reproduction of prior work could not be performed due to differences in focus between projects funded by the NSF and the funding organization in the original work. A second coding system was agreed upon by three of the authors based on the content of the first two cohorts' research questions (table 2), with the intent to classify questions based on the focus area addressed by the question. These focus area codes were then broken down by more specific concerns being addressed.

TABLE I. KNOWLEDGE CODE DEFINITIONS

Code	Definition
Information-gathering	Information-gathering provides answers to descriptive and/or predictive questions such as: How many …? or What is the relationship between …?
Data Quality	Data quality questions provide information about the availability, validity, and reliability of data, answering questions such as: What data do we have or need?
Evaluation	Evaluation questions ask: What is the effect of this program or policy?
Design	Design questions ask: What new materials, activities, and/or systems would address this problem?

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TABLE II.FOCUS AREA CODE DEFINITIONS AND HIERARCHY

Code	Subcode	Definition
CS-Related	Teacher PD	Teacher professional development-related.
	Teacher Impact	Impact on teachers.
	Student Learning	Impact on student learning.
	Student Experience	Impact on students (not related to learning).
	Structural considerations	Design-focused questions such as studying the dynamics within a school district's administration
	Scaling	The application of research findings to other contexts, such as testing a curriculum in one district with the intent to apply this curriculum in others.
RPP-Related	RPP relationships/ communication	Relationships/trust/communication between researchers and practitioners in an RPP.
	Vertical alignment	Alignment of purpose between researchers and practitioners.
	Practitioner support	Proper support for practitioner activities such as intervention implementation.
BPC-Related	Teacher impact	Impact on teacher-level BPC.
	Student access	Barriers to student access to CS.
	Student recruitment	Impact/outcomes regarding the recruitment of students.
	Student retention/supports	Retention of students and support they may need in order to succeed in CS.
	Student experience	Impact on student experience as it relates to BPC, such as student identity.
	Student impact	Impact on students as a result of an intervention, such as how an intervention improves student participation in CS.
	RPP Team-Level BPC	BPC related specifically to the RPP team (such as team diversity).

III. RESULTS

There were 208 research questions included in our study representing 61 projects. These projects represent a diverse sample of the NSF CS for All: RPP community, consisting of a variety of grant sizes, target grade spans, and curricula, among other attributes. One research question did not receive a subcode during final analysis due to lack of clarity.

Assignments of codes to questions from the first two cohorts (175 questions from 50 projects total) revealed that most projects had questions explicitly related to information-gathering (64%), then to design (52%), evaluation (38%), and finally data quality (6%).

Assignment of CS subcodes demonstrates that most projects with CS-related subcodes explore teacher (60%) or student (62%) learning and experiences, however very few investigate the broader applicability of their findings to other schools or districts (20%). Just over half of all projects had any research questions relating to either RPPs (18%) or BPC (49%).

TABLE IV. CODE FREQUENCY AMONG PROJECTS

Code	Subcode	Frequency (N=61)
CS-Related	Structural considerations	61%
	Student Experience	52%
	Teacher PD	46%
	Teacher Experience	36%
	Student Learning	26%
	Scaling	20%
BPC-Related	Student access	31%
	Student retention/supports	15%
	Student Experience	13%
	Student recruitment	11%
	Teacher impact	11%
	Student impact	8%
	RPP-Team-Level BPC	2%
RPP-Related	Research-Practitioner relationships/ communication	15%
	Vertical alignment	5%
	Practitioner support	5%

IV. CONCLUSIONS

The analysis suggests that despite the large amount of grant-funded research being performed, many projects are still involved in information-gathering activities to try to understand the landscape of CS education offerings and practices. This could reflect the relative infancy of this field of study rather than any omissions in research focus, however. There also appears to be a limited emphasis on issues known to impact CS education such as BPC than on simply delivering and evaluating improved curricula, teacher professional development, or other interventions. Additionally, very few projects appear to focus on the scalability of the research being completed (20%). This could limit developed interventions by preventing them from being expanded upon by other projects or adopted by other school districts that may face similar issues. By continuing to strongly encourage efforts targeting issues such as BPC, developing the relatively new concept of RPPs, and encouraging a greater focus on scalability of CS education research findings, it could be possible to improve the reach and efficacy of CS education interventions being performed by NSF-funded RPPs. Future work will include continued tracking of if and how the research questions examined in this study evolve over time and comparison of the baseline questions established in this study to questions from the same projects at a later date.

REFERENCES

[1] K. Thompson, M. Martinez, C. Clinton, and G. Diaz, "Considering Interest and Action: Analyzing Types of Questions Explored by Researcher-Practitioner Partnerships," Educational Researcher, Vol. 46 No. 8, pp. 464-473, October 2017.