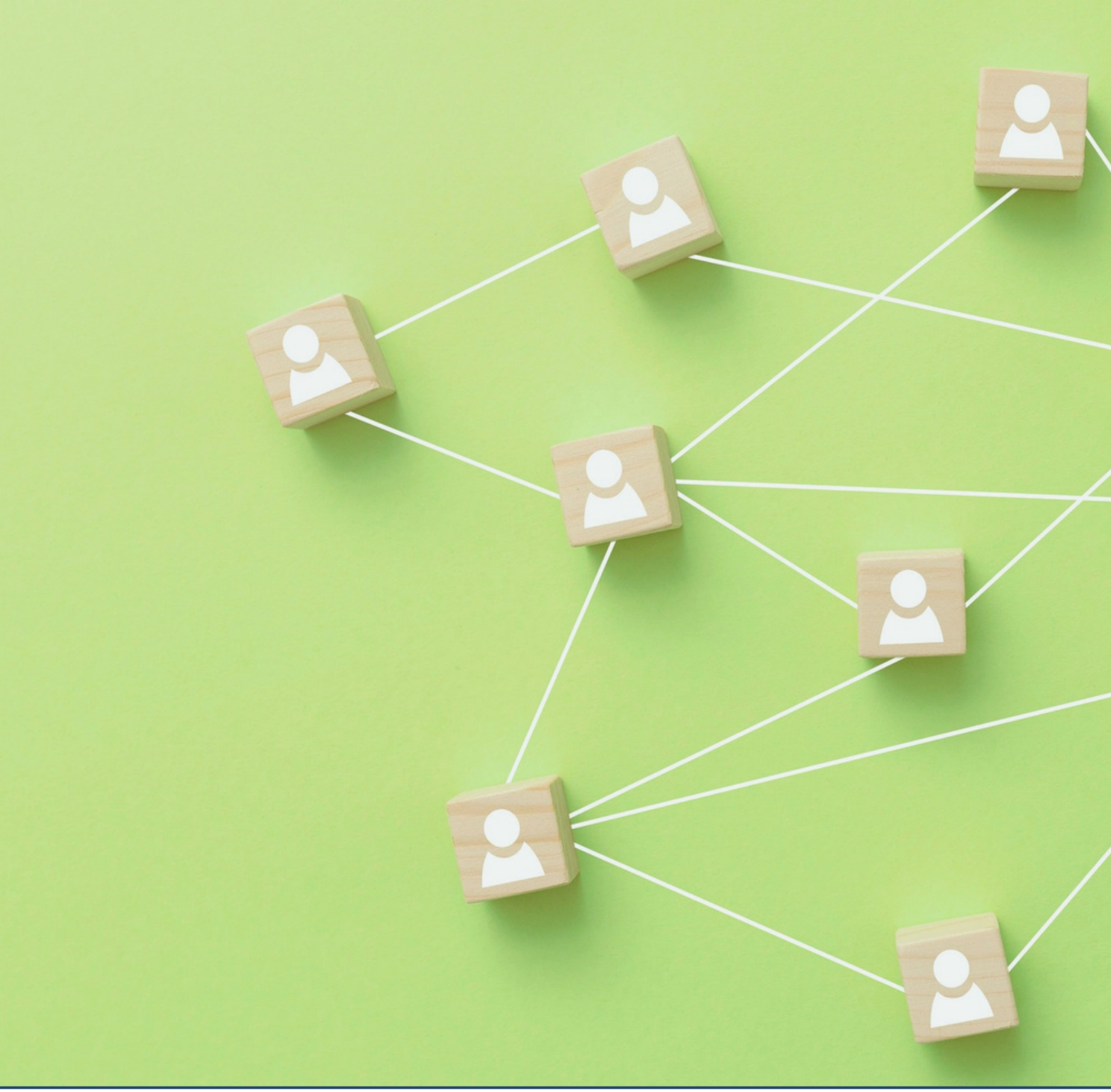

NNERPP
EXTRA
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Delivering Fresh Ideas From the Intersection of Education Research, Policy & Practice

IN THIS ISSUE

By Paula Arce-Trigatti | NNERPP

WELCOME TO OUR FALL EDITION

Welcome to the third edition of Volume 5 of NNERPP Extra! We are excited to share our fall edition with you, which includes three new articles: First up, an account by inquiryHub, one of our NNERPP members, describing their partnership work on co-designing and field testing curriculum materials; next, we share a reflection by another NNERPP member, Digital Promise, on the role of civic imagination and storytelling in RPPs; and finally, we spotlight two recent resources for those engaging in collaborative education research and RPP brokering. A special thank you goes to our wonderful guest authors who contributed to this issue.

Happy reading!

NNERPP | Extra Online
Be sure to check out the NNERPP | Extra website if you'd like to explore this issue's articles (and more!) online.

About NNERPP
NNERPP aims to develop, support, and connect research-practice partnerships in education to improve their productivity. Please visit our website at **nnerpp.rice.edu** and find us on Twitter: **@RPP_Network.**

LEARNING TO CO-DESIGN INSTRUCTIONAL MATERIALS FOR SCALE AND SPREAD

Douglas Watkins | Denver Public Schools | PRACTICE-SIDE
Bill Penuel | University of Colorado Boulder | RESEARCH-SIDE

OVERVIEW

THE RESEARCH ARTIFACT

OpenSciEd HS Instructional Materials

OpenSciEd is a **field-level initiative in science education to develop freely available, Next Generation Science Standards (NGSS)-aligned, K-12 science curricula and professional learning**. The inquiryHub research-practice partnership is a lead organization in a consortium developing and testing high school courses in biology, chemistry, and physics that address all of the NGSS, including Earth and space science standards. The units we are developing follow a unique "storyline approach" (Reiser et al., 2021) designed to be relevant to students and coherent from their point of view, where units are designed to anticipate and guide students to answering their own questions about a given phenomenon or design problem. The inquiryHub partnership's work is supported with funding from the Carnegie Corporation of New York, the Walton Family Foundation, the Bill and Melinda Gates Foundation, and the William and Flora Hewlett Foundation.

This research "artifact" is an example of an **artifact where ideas from research are embedded**

in tools designed to directly impact teaching and learning outcomes (see Ikemoto & Honig, 2018). In particular, OpenSciEd uses a "phenomenon-based" approach to problem-based learning in science, for which there is a strong evidence base for promoting deeper learning. Recent experimental studies have found this approach to be effective in promoting the kinds of three-dimensional learning outcomes of the NGSS that require students to apply core ideas, practices, and crosscutting concepts to explaining phenomena and solving problems (Krajcik et al, 2022; Schneider et al., 2022).

In addition, the curriculum materials have been informed by broad testing in a large sample of classrooms across the country, using methods adapted from improvement science (see Edelson et al., 2021 for a description of the approach used in supporting the development of middle school materials). As such, the materials reflect the experiences of students, the insights and feedback of teachers, and guidance provided by state level partners along the way, as elaborated below.

iHUB: OUR MISSION

The inquiryHub research-practice partnership was founded in 2007 **to support the ongoing work of curriculum and instructional leaders in Denver Public Schools (Colorado) in mathematics and science education**. The mission of the RPP is to **ensure that all students, but particularly those from systemically marginalized groups and communities, experience STEM learning that is coherent from the student point of view, personally relevant, and connected to important matters of concern to their communities**. In addition, we aim to support students in **becoming active contributors to collaborative knowledge-building efforts** that give them a feeling for what disciplinary practice could be.

The partnership works toward this mission by engaging in efforts to design and test new instructional materials (Penuel, A-R. Allen, et al., 2022), approaches to professional learning (Penuel, C. Allen, et al., 2022), and assessments (Penuel et al., 2019). We work to build more coherent and equitable instructional guidance infrastructures (Hopkins et al., 2013) at the district level. We call this work infrastructuring work (Penuel 2019a, 2019b), inspired by interdisciplinary scholars in the information sciences (Star & Ruhleder, 1996) and computing (Pipek & Wulf, 2009).

A Design-Based Implementation Research (DBIR) Approach

The inquiryHub is an example of a **design-based research-practice partnership, in which co-design and testing of innovations is a leading activity**. The RPP has been an incubator for the approach to research called Design-Based Implementation Research (DBIR; Fishman et al., 2013). **DBIR adheres to four principles that iHub projects follow:**

(1) Teams form around shared goals that address persistent problems of educational inequity identified through negotiation among multiple stakeholders' perspectives and values;
(2) To improve practice, teams commit to iterative, collaborative design;
(3) To promote quality in the research and development process, teams develop theory, knowledge, and practical tools related to both learning and implementation through systematic inquiry; and
(4) To promote lasting improvements, DBIR is concerned with developing capacity for sustaining change in systems.

DBIR is an approach that requires long-term research-practice partnerships. The work of infrastructuring, for example, requires partners with strong bonds of relational and politicized trust (see Vakil et al., 2016), because the work of producing more equitable systems frequently requires risk taking and taking difficult stands. Also, changing infrastructure requires persistent and ongoing efforts to align elements of infrastructure with one another and to a vision for equitable teaching and learning (Penuel, 2019b).

WHY THIS WORK

When OpenSciEd issued a request for proposals in 2020 for a high school developers consortium to develop materials for high school, inquiryHub was well positioned to bid on the request, because the RPP already had co-designed biology and chemistry courses aligned to Colorado Academic Standards in science, which are based on *A Framework for K-12 Science Education* (NASEM, 2012). We began developing these initial materials together ahead of standards adoption, beginning in summer 2014. Our intent was never to develop a full curriculum or to make the materials widely available beyond Denver. However, because Denver Public Schools leaders insisted on a full course in biology and teachers demanded one in chemistry, the team built both. Soon after, educators and leaders in other states found the iHub materials. The state of Louisiana's initiative to promote high quality instructional materials adoption was particularly influential in helping the inquiryHub partnership "up its game" to be able to provide professional learning opportunities for teachers at the scale of a state. Today, inquiryHub materials are in use in more than 45 states. We're in the process of now updating the materials, unit-by-unit, replacing them with new OpenSciEd units over the next year until three free courses in biology, chemistry, and physics become widely available and adoptable by districts by July 2024. A goal is to receive a "green" rating (the highest) for quality from EdReports, an independent review organization for instructional materials, to ensure broad adoption.

The OpenSciEd development project has been an extension of our work in Denver and builds on our approach to partnering strategically with other organizations to build the kinds of teams we need for specific lines of work. The core iHub partners who have been involved as part

of OpenSciEd have been Denver Public Schools and the University of Colorado Boulder, Northwestern University (Evanston, IL), BSCS Science Learning (Colorado Springs, CO), and the Charles A. Dana Center at the University of Texas. The new materials in development support iHub's core mission of promoting equitable and meaningful opportunities for science learning to students. In this project, iHub and its partners are working under contract for a nonprofit organization, OpenSciEd, which will be responsible for the continued curation and widespread distribution of materials. In addition, there is another, wider partnership of state education agencies that make up a key set of stakeholders in the effort.

Denver Public Schools plays a special role as a "pilot district" within the project. As a pilot district, we have continued our commitment to engaging Denver teachers as co-designers, as leaders of professional learning, and as people who test out the materials in their classrooms. One of us (Douglas), has been a lead writer for biology units.

The need for the OpenSciEd project derives from the fact that even 10 years after the NGSS were developed, there remain precious few instructional materials aligned to the standards, particularly for high school. And while iHub provided aligned materials in biology and chemistry, our materials did not integrate the Earth and space science standards, and we had no course in physics. OpenSciEd provided us with an opportunity as a partnership to continue progressing toward our aim of designing materials for the full complement of the NGSS by revising and extending our materials, to make them better and more comprehensive. In addition, the specifications provided to us by OpenSciEd would demand that we "up our game" with respect to supporting students' sensemaking and promoting equity in ways we were eager to pursue.

Unlike our typical process for designing projects, OpenSciEd's request for proposals specified a clear set of development tasks; at the same time, we were given some latitude about what kinds of questions we wanted to answer from the field test. Here, we decided together to build on instruments and approaches that we had been testing and refining for years in iHub. A major focus of our efforts over the years has been to gather data from students on their perceptions of their science learning, with an eye toward promoting epistemic justice, that is, ensuring that students from groups and communities owed an education debt by our society have opportunities to express their thinking and have their ideas respected and taken up in knowledge-building activities. Some of the approaches to data collection and instruments were also adapted from the OpenSciEd middle school field test, and iHub researchers had been involved in that effort, as well.

WHAT THE WORK EXAMINES

Here, we focus on our RPP's work of field testing the materials we developed. The basic research

questions we are asking in our field tests are: What are students' experiences of the curriculum, and how do they vary by race/ethnicity and by gender? How do teachers judge and experience the materials? What do they learn from professional development? Can students learn from the materials?

In the field test, the team developed a nimble approach grounded in the principles of improvement science (Bryk et al., 2015; Edelson et al., 2021). A challenge we had to address was the need to gather data and produce reports every three months for each unit development and testing cycle that could inform key stakeholders, including the writers of the units, which included university-based and district-based educators. Each cycle involved testing a single unit in biology, chemistry, and physics, along with associated professional learning materials for each. That required us to streamline data collection to focus on teacher surveys and interviews after professional learning workshops and after teaching units, student exit tickets, and a student survey. We added a pre-post data collection to study student learning for two of the units in each course, but this data collection was distinct and required us to spend more than a year co-designing the assessments with writers. We also received feedback from an external review process led by WestEd using a rubric to evaluate alignment of units to the NGSS.

In this project, Denver educators and leaders were part of the writing and testing process, but there were other practitioners involved in all aspects of the work. A consortium of state science leaders from ten states were partners to the larger initiative, and they provided input on the materials themselves as well as the field testing research. With respect to the research, they had opportunities to make sense of data from each cycle of the field test, pose questions of researchers, and ask researchers to pursue additional questions to address puzzles in the data. Those opportunities for sensemaking took place at monthly Zoom meetings where Developers Consortium members were present, as were state leaders and staff from OpenSciEd. Also, interested educators who were part of the field test from those 10 states participated in co-

revision workshops for the units that they field tested. In co-revision meetings with writers, educators engaged with feedback from other teachers and reflected on their own experiences to make improvements to the units.

FINDINGS

Over 300 high school teachers (reaching over 15,000 students) field tested biology, chemistry, or physics units designed to support all students in meeting the vision for science learning described in A Framework for K-12 Science Education (NRC, 2012) and the Next Generation Science Standards (NGSS; NGSS Lead States, 2013). Each teacher received up to six different intensive professional learning workshops to prepare them to use the materials to support equitable learning in science.

There are many dimensions to the findings, but here we focus on those connected to teacher professional learning. It is important to note that those involved in writing materials were not responsible for collecting data related to teachers' experiences; instead, a different partner in the Consortium, the Charles A. Dana Center at the University of Texas Austin, has led the data collection and analysis for the field test.

From the standpoint of teachers, the professional learning (PL) prepared them well for several aspects of teaching OpenSciEd units. From self-report surveys, 81 percent of teachers said the PL had prepared them to **support students in using science and engineering practices to figure out pieces of disciplinary core ideas**. This is an important finding, since a major shift in the standards calls for students to develop proficiency in practices in ways that are integrated with understanding of disciplinary core ideas and crosscutting concepts. Seventy-nine percent said the PL prepared them to **have students pose questions to drive the learning of the unit**, while 77 percent said it prepared them to **push students deeper to revise explanations of phenomena**. Further, 74 percent said the PL prepared them to **motivate the next step in investigating the anchoring phenomenon in the unit**. Last, 72 percent said it prepared them to **help students put pieces together of knowledge learned across the unit**. These three sets of numbers tell us that teachers became more comfortable with key elements of the storyline instructional model, a finding that resonates with our findings from middle school (see Penuel et al., 2023).

Somewhat more challenging was convincing teachers that **the units met their standards better than other materials did**. Just 64 percent said this was true, in their estimation. State leaders helped us make sense of these findings, based on their own experience in working with teachers in their states. They said that teachers were likely reporting this to be true in part because teachers' understanding of the standards themselves remains limited. The research team members also suspect many hold a view of the standards as primarily focused on disciplinary core ideas, based on their comments and responses to follow up interview questions. When state leaders developed these conjectures, members of the field test research team followed up to ask

more about how materials fell short, and the data they gathered confirmed some of our own conjectures.

A second challenge and surprise that remained was helping teachers to know **how to link phenomena being studied to students' own interests and experiences**. Seventy-two percent of teachers said the PL helped them to do that. Many remained concerned about interest dropping off toward the end of units, something they call "phenomenon fatigue." As we revised materials for both units and PL, we have been highlighting strategies for helping build relevance in materials for students.

Findings are still being developed for the overall project, and we do not yet know what effects the materials have had on student learning.

WHAT THE PARTNERSHIP LEARNED

This is the first project of our partnership that is intentionally both inward and outward facing. That is, it is intended to continue a line of capacity-building and improvement work that directly supports Denver Public Schools, while also making materials that can be used everywhere. DPS teachers have grown and stretched their skills as writers and leaders of professional learning in ways that would not have been possible without this opportunity. And the instructional materials we have developed have greatly improved, in terms of their quality. We have learned that we can do this kind of work together, but it does require us to take extra care to make sure that DPS voice is a prominent one in a wider effort that has many different stakeholders. DPS district leaders have learned how valuable the co-design process is in scaling reform ideas (curriculum) in a large district. The co-designing teachers serve as highly respected voices, through PL facilitation, aiding in successfully growing the number of piloting teachers participating in the project each year. Initially there were 6 teachers involved in the co-design/piloting process and now there are 25 teachers piloting.

IMPACT AND USE OF THE WORK

This is a project where research findings are less likely to be taken up than are the instructional materials themselves. Of course, these materials are grounded in research on how people learn and reflect a principled approach to curriculum design grounded in what we know about how best to promote meaningful engagement in science and engineering practices to explain phenomena and solve problems.

So far, two units from each course have been publicly released and are available for use by any educator, free of cost. In addition, materials for professional development are freely available at the OpenSciEd web site. All of the units undergo external review by the NextGen Science group at WestEd. All six of the released units have earned high ratings for quality by this group.

It is too soon to know how findings from the field test have impacted policy and practice more broadly, but the field test data, input from

state leaders, and teacher feedback as part of co-revision meetings have all been used extensively to support improvements to the units themselves.

OPEN QUESTIONS AND NEXT STEPS

We have many open questions, particularly related to professional learning and student learning. The OpenSciEd materials demand major shifts to most teachers' instruction. To support these shifts, OpenSciEd provides extensive professional development – a multi-day "launch" followed by two-day workshops for every unit in every course. The conditions under which districts can adopt this approach are not yet known. We also need to design a study to test the impacts of the materials on student learning. Our assessments are a first step toward doing so, but we still need to analyze additional validity information about their instructional sensitivity.

As materials are released, we will be continuing to support DPS teachers in implementing them. In addition, we will be developing joint research projects to address questions of mutual interest regarding their use.

*This article was co-written by members of the **inquiryHub** (iHub) research-practice partnership: Douglas Watkins is Manager of K-12 Science Curriculum & Instruction at **Denver Public Schools** and Bill Penuel is Director of iHub University of Colorado Boulder, Professor of Educational Psychology and Learning Sciences in the **School of Education at the University of Colorado, Boulder**, PI at the **National Center for Research in Policy & Practice** (NCRPP), Co-PI of the **Research+Practice Collaboratory**, and a contributing author to the **LearnDBIR** website.*

REFERENCES

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). Learning to improve: How America's schools can get better at getting better. Harvard University Press.

Edelson, D. C., Reiser, B. J., McNeill, K. L., Mohan, A., Novak, M., Mohan, L., Affolter, R., McGill, T. A. W., Bracey, Z. B., Noll, J. D., Kowalski, S. M., Novak, M., Lo, A. S., Landel, C., Krumm, A., Penuel, W. R., Van Horne, K., González-Howard, M., & Suárez, E. (2021). Developing research-based instructional materials to support large-scale transformation of science teaching and learning: The approach of the OpenSciEd middle school program. Journal of Science Teacher Education, 32(7), 780-804. https://doi.org/10.1080/1046560X.2021.1877457

Hopkins, M., Spillane, J. P., Jakopovic, P., & Heaton, R. M. (2013). Infrastructure redesign and instructional reform in mathematics. Elementary School Journal, 114(2), 200-224. https://doi.org/https://doi.org/10.1086/671935

Ikemoto, G. S., & Honig, M. I. (2010). Tools to deepen practitioners' engagement with research: The case of the Institute for Learning. In C. E. Coburn & M. I. Honig (Eds.), Research and practice in education: Building alliances, bridging the divide (pp. 93-108). Rowman & Littlefield.

REFERENCES, continued

Krajcik, J., Schneider, B., Miller, E. A., Chen, I.-C., Bradford, L., Baker, Q., Bartz, K., Miller, C., Li, T., Codere, S., & Peek-Brown, D. (2022). Assessing the effect of project-based learning on science learning in elementary schools. American Educational Research Journal, 60(1), 70-102. https://doi.org/10.3102/00028312221129247

National Research Council. (2012). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. National Research Council. https://doi.org/10.17226/13165

Penuel, W. R. (2019a). Co-Design as infrastructuring with attention to power: Building collective capacity for equitable teaching and learning through Design-Based Implementation Research. In J. M. Pieters, J. M. Voogt, & N. N. P. Roblin (Eds.), Collaborative curriculum design for sustainable innovation and teacher learning (pp. 387-401). Springer. https://doi.org/10.1007/978-3-030-20062-6_21

Penuel, W. R. (2019b). Infrastructuring as a practice of design-based research for supporting and studying equitable implementation and sustainability of innovations. Journal of the Learning Sciences, 28(4-5), 659-677. https://doi.org/10508406.2018.1552151

Penuel, W. R., Turner, M. L., Jacobs, J. K., Van Horne, K., & Sumner, T. (2019). Developing tasks to assess phenomenon-based science learning: Challenges and lessons learned from building proximal transfer tasks. Science Education, 103(6), 1367-1395. https://doi.org/10.1002/sce.21544

Penuel, W. R., Allen, A.-R., Henson, K., Campanella, M., Patton, R., Rademaker, K., Reed, W., Watkins, D. A., Wingert, K., Reiser, B. J., & Zivic, A. (2022). Learning practical design knowledge through co-designing storyline science curriculum units. Cognition and Instruction, 40(1), 148-170. https://doi.org/10.1080/07370008.2021.2010207

Penuel, W. R., Allen, C. D., Manz, E., & Heredia, S. C. (2022). Design-Based Implementation Research as an approach to studying teacher learning in research-practice partnerships focused on equity. In A. C. Superfine, S. Goldman, & M.-L. M. Ko (Eds.), Teacher learning in changing contexts: Perspectives from the learning sciences (pp. 217-237). Routledge. https://doi.org/10.4324/9781003097112-15

Penuel, W. R., Allen, A.-R., Deverel-Rico, C., Singleton, C., & Pazera, C. (2023). How teachers' knowledge of curriculum supports partnering with students in their science learning. Journal of Science Teacher Education. https://doi.org/10.1080/1046560X.2023.2167508

Pipek, V., & Wulf, V. (2009). Infrastructuring: Toward an integrated perspective on the design and use of information technology. Journal of the Association for Information Systems, 10(5), 447-473. https://doi.org/10.17705/1jais.00195

Reiser, B. J., Novak, M., McGill, T. A. W., & Penuel, W. R. (2021). Storyline units: An instructional model to support coherence from the students' perspective. Journal of Science Teacher Education, 32(7), 805-829. https://doi.org/10.1080/1046560X.2021.1884784

Schneider, B., Krajcik, J., Lavonen, J., Salmela-Aro, K., Klager, C., Bradford, L., Chen, I.-C., Baker, Q., Touitou, I., Peek-Brown, D., Dezendorf, R. M., Maestrales, S., & Bartz, K. (2022). Improving science achievement—Is it possible? Evaluating the efficacy of a high school chemistry and physics project-based learning intervention. Educational Researcher, 51(2), 109-121. https://doi.org/10.3102/0013189X211067742

Star, S. L., & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. Information Systems Research, 7(1), 111-134. https://doi.org/10.1287/isre.7.1.111

Vakil, S., de Royston, M. M., Nasir, N. i. S., & Kirshner, B. (2016). Rethinking race and power in design-based research: Reflections from the field. Cognition and Instruction, 34(3), 194-209. https://doi.org/10.1080/07370008.2016.1169817

CENTERING COMMUNITY VOICE IN RPP WORK THROUGH CIVIC IMAGINATION AND STORYTELLING

By Merijke Coenraad, Emi Iwatani, and Quinn Burke | Digital Promise

INTRODUCTION: "A People of Innovation"

"We come from a people of innovation," explained Mary Slone, a high school teacher from Floyd County, Kentucky. She shared this reflection after a Civic Imagination Workshop supported by the 3-year National Science Foundation CSforALL Project entitled Drawing on Kinship: Rurally Sustaining Computational Thinking Pathways. Further reflecting on the history of making, innovation, and Appalachian Ingenuity in the community, Mary continued, "we were reminded there were people before us who had all these wonderful skills…they inspire me."

Mary was one of 18 teachers from two Eastern Kentucky school districts who shared their experiences during the Civic Imagination Workshop as part of the Drawing on Kinship research-practice partnership (RPP). Hosted in February 2023, this workshop kicked-off our project that aims to expand rural students' understanding of computational thinking through lessons that are connected to local heritages of problem solving. In order to design such lessons, it was important for teachers – who will be designing these project-based lessons – to explore such heritages and imagine how these may relate to innovation and problem-solving using computing. Most of the teachers had taught computational thinking through our previous RPP, Tough as Nails, Nimble Fingers, but had not connected these competencies to their or their students' cultures.

Thus, the Civic Imagination Workshop featured teachers' storytelling about Appalachian Ingenuity, a concept introduced to us by our practice-side partners that is tied to the history of making and survival in the

Appalachian region of Eastern Kentucky. Stories of Appalachian Ingenuity we've heard so far are characterized by perseverance, selflessness, collaboration, resourcefulness, agency, and pragmatism. We imagined that these stories would specifically feature components of computational thinking, such as working with data and automation.

In this article, we dive into how civic imagination and storytelling showed up in our RPP and share what we learned about the important role both of these concepts might play in RPP work more generally, in particular as they relate to meaningfully bringing community voice into RPP work, beginning with the stories of practice-side partners who are part of the local community.

THE ROLE OF CIVIC IMAGINATION AND STORYTELLING IN OUR RPP

Defining Civic Imagination

The University of Southern California's Civic Imagination Project defines civic imagination as a way of shaping a vision for the future through the uniquely human capacity for storytelling. Sam Ford, Executive Director of AccelerateKY who led our civic imagination workshop, works with the Civic Imagination Project and summarizes civic imagination as:

- People can't work toward a future if they can't see it first
- People don't want to design a future that they aren't in
- People need to feel a sense of agency or permission to help shape that future

These tenets of civic imagination have grounded the design of our early RPP work and the Civic Imagination Workshop.

Civic Imagination in Action: Teachers Share Their Stories

As a Kentuckian with a journalism background, Sam Ford knows the roots and importance of storytelling in the community. At the workshop, Sam invited each teacher to bring a physical object that represents the history of Appalachian Ingenuity and share the story of their object (visit our project website to hear teacher stories and see some of their objects). This object sharing brought teachers into the project by providing space for them to share their own stories, often stories of innovators in their families, and to use their voice to share what is powerful and unique

about their community and Appalachian Ingenuity. Generally, the stories recollected positive memories that the teachers were willing to share with others. They shared unique and innovative ways that family members added height to a stool using scrap lumber, scared away hornets using a faux nest, and preserved food with mason jars. Teachers also shared skills they learned from their parents and grandparents, like quilting, and innovation around family activities like car racing. As the storytelling went on, teachers built upon what others had shared and found commonalities between their stories like mason jars and race days. As Mary Slone shared in her blog post based on the workshop, "each story was a reminder that I, along with my peers, have borne witness and been impacted by makers–people who live on the edge of disruption and choose to use it as an agent."

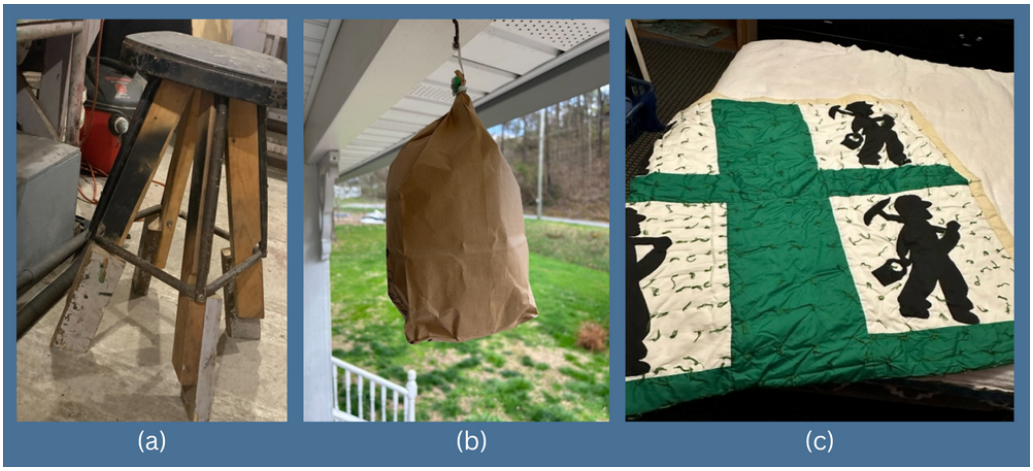

Figure 1. Examples of shared objects from the civic imagination workshop: (a) a stool with added height from scrap lumber, (b) a faux hornets nest hung on the porch, (c) a quilt with coal miners on the quilt blocks (photos courtesy of workshop participants)

Sharing stories provided a chance for the teachers to make a bridge between the past and the present. From there, the teachers looked to the future – a future that supports students to celebrate and develop the ingenuity of their Appalachian heritage. The teachers began to imagine the future of their community in Eastern Kentucky, where they hope it will be in 30 years, and what storytelling can do in their classroom. Civic imagination gave teachers the opportunity to voice stories from the past to imagine and design their future.

The Importance of Storytelling in our Research

How are storytelling and Appalachian Ingenuity stories related to computational thinking education research? Initially, we hypothesized that local and cultural innovation stories could provide clear, compelling, and relatable examples of computational thinking, thus facilitating understanding for teachers and students. We believed that showcasing Appalachian instances of

computational thinking skills and practices would help students learn in a way that aligns with their identity and values.

However, during our initial process of collecting and analyzing stories for computational thinking (Iwatani, Coenraad, Arnett & Tackett, 2023), and developing the summer curriculum design workshop for teachers, we encountered challenges. Many innovation and ingenuity stories did not naturally exhibit the computational thinking practices emphasized in the Kentucky Academic Standards. Furthermore, even if some computational thinking practices were present in certain innovations, they might not be the most captivating aspects of the storytelling. We also found it difficult to imagine a curriculum design teacher workshop that effectively integrates ingenuity storytelling with computational thinking. How can we convincingly explain to teachers that ancestral stories about food preservation for the winter can enhance students' understanding of computational thinking?

In the true spirit of RPP, our research-side and practice-side collaborative team engaged in a series of large and small-group meetings to address the conceptual issues we observed. A moment of clarity arose when we revisited the fundamental goals of our project. Eastern Kentucky educators and elders want students to be inspired to engage in general problem-solving, which strongly connects to local ingenuity and storytelling. On the other hand, computational thinking represents a specific set of technical skills that we believe will benefit students in solving various contemporary problems. These skills are a narrow subset of general "problem-solving" or "ingenuity," and therefore, it is neither necessary, expected, nor crucial for all instances of Appalachian ingenuity and innovation to involve computational thinking.

Building on this realization, our project now comprehends the significance of ingenuity and innovation stories for both research and practice. We have identified reasons to share with our storytellers, educators, students, and research colleagues, illustrating why these stories hold importance:

1. We want examples of local problem-solving and innovation that middle school students in Eastern Kentucky might find interesting. These examples can inspire students to solve problems in their own lives and their communities.
2. We're looking for real-world challenges that are close-to-home for middle school students in Eastern Kentucky. We believe that these students have creativity and resourcefulness to help find solutions to these challenges.
3. We are curious about whether anything similar to (what we today call) computational thinking skills have been used in the community and its history. Exploring this connection could provide helpful examples for students as they learn these skills themselves.
4. We aim to create a collection of resources that students and teachers can easily access and use during project-based learning. These resources will provide guidance and support throughout their projects.

5. We want to develop storytelling models and methods for educators and students, especially to support students to become better communicators. These models may encourage them to connect with their families and communities. They may also enhance student learning through community involvement, and inform community members about the interests and skills of today's students.

The principles of civic imagination played a vital role in our RPP as we sought clarity in the relationship between computational thinking and Appalachian Ingenuity. To work towards a shared vision of the future, we engaged in extensive discussions and reflection to define this connection, acknowledging the importance of having a clear direction. We ensured that the relevance of computational thinking and Appalachian Ingenuity was recognized by both research-side and practice-side partners (including district leaders and teachers), valuing their perspectives and motivations. By actively seeking input from practice-side participants, incorporating their ideas, and fostering a sense of agency, we established a collaborative and inclusive approach, guided by the principles of civic imagination.

THE POTENTIAL OF CIVIC IMAGINATION AND STORYTELLING FOR CENTERING COMMUNITY VOICE IN RPP WORK

As we reflected on the role of civic imagination and storytelling in our own RPP, we saw how the principles of civic imagination and storytelling may help center the voices of practice-side participants in RPPs. Here we explore how a civic imagination approach to partnership work might help bring community and practice-side members into partnership work as equal participants. We contend that for practice-side members of an RPP to be fully brought into a project, they need to be able to see the possible future for the project, be part of designing it, and have a sense of agency and permission to shape the project. This is deep work that RPP leadership can support through listening to practice-side partners' stories and purposefully decentering research-side voice, which may involve having activities that aren't traditional to research methods.

Practice-side partners can't work toward a future if they can't see it first. In our project, we were supported by practice-side leaders who were already envisioning the future and wanted the project to make that future a reality. The shared vision towards Eastern Kentucky's future has allowed the RPP to prioritize project activities and sustain momentum under time and resource constraints, and to organically welcome additional practice-side collaborators to the project. It has helped us understand that communities have dreams for where they are going, and that these dreams can serve as a valuable north star for joint project work. RPP work can be strengthened by providing practice-side partners the opportunity to explore, express, and collectively envision these dreams that may pertain to joint project work. To this end, we recommend that RPP leadership ensures that practice-side partners are part of imagining the future in the following ways:

- They are invited to imagine what the project looks like and the positive change that it can bring about in their community.
- They share stories of the past and present to imagine what the future might look like and how the future can build on community strengths surfaced by the stories.
- They are part of the project from its conceptualization, not just from when the work is submitted or funded, and all partners in the RPP work together to identify shared problems of practice.
- They help create a common vision for governance and administration of the RPP and project structures (Wentworth et al., 2022).

Practice-side partners don't want to design a future that they aren't in. Importantly, the future of RPP work will reside not only in the academic community, but also in the practice-side partners' communities. The stories of Appalachian Ingenuity shared at the civic imagination workshop will move our research forward, but, most importantly, they have helped teachers to see themselves and their families as part of this work and relevant. Along these lines, it seems important for RPP leadership to ensure that practice-side partners can see themselves in the future through the following ways:

- They see connections from where they are in the present to where the project is going in a way that includes them and their voices.
- They are part of the process of negotiating roles and are invited to lead portions of the project (Wentworth et al., 2022).
- They see the future of the work in their community, even once the project funding ends.
- They tell the story of the work they are doing and the impact that they are having.
- They have personal goals and aspirations to contribute to research-intensive activities (e.g., joint academic presentations, integration of research knowledge into practice), before being asked to do so.

Practice-side partners need to feel a sense of agency or permission to help shape that future. Over the four years of our partnership, the practice-side partners have taken an increasingly large role in both practice and research decisions. Including community voice within a project goes beyond listening, and means taking action based on what community members shared. Ensuring that practice-side partners feel a sense of agency and help shape the future means that they are fully engaged in the work in the following ways:

- They are repeatedly encouraged by the RPP leads, through both words and actions, to help shape the project's future, and have substantial opportunities to do so.
- They help determine who needs and wants to be involved in the partnership work and have support for the new or expanded roles that they take on (Wentworth et al., 2022).
- They are central to organizational structures that support the partnership and spread power through shared decision-making and conversations about equity within the partnership (Wentworth et al., 2022).
- They are part of processes of ongoing assessment and improvement that include bi-directional communication and continuous opportunities for reflection and adjustment (Wentworth et al., 2022).

IN CLOSING

In any project you are working on, practice-side partners need an opportunity to see, be part of, and take agency over the work that is being done. If we want to generate new knowledge from our RPPs, these three conditions have to be met in a way that is appropriate to the community culture in which we are working. For us, this meant creating opportunities for storytelling, particularly because storytelling is an integral feature and source of pride within the cultural context of Eastern Kentucky. When we center community voices, we are making space for listening to them, amplifying the voices of people who have been marginalized within research and, often, by society more broadly. RPPs are a direct extension of striking a better power balance between research-side and practice-side partners on shared projects, though recent studies suggest this power balance is always in flux and authority often defers to centering research-side voices and interests (Cooper et al., 2020; Tabak, 2022). In our project, finding opportunities to center practice-side community voices and encourage civic imagination has been a core value and has strengthened our work. Many of the most impactful research projects do not start with a collective review of empirical data, but rather over a simple shared story, a moment to pause and reflect on a past moment as well as the opportunity to consider a new and different future.

Merijke Coenraad is Program Director, Inclusive Computing Research, Emi Iwatani is Senior Learning Sciences Researcher, and Quinn Burke is Senior Director, Computational Thinking and Learning Pathways at Digital Promise.

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REFERENCES

Cooper, A., MacGregor, S., & Shewchuk, S. (2020). A research model to study research-practice partnerships in education. Journal of Professional Capital and Community, 6(1), 44–63. https://doi.org/10.1108/JPCC-11- 2019-0031.

Iwatani, E., Coenraad, M., Arnett, N. & Tackett, T. (2023, November 16-17). What does computational thinking have to do with Appalachian ingenuity? Paper presentation for the National Forum to Advance Rural Education (NFARE). Virtual.

Tabak, I. (2022) Productive tension in research practice partnerships: Where substance and politics intersect. Cognition and Instruction, 40(1), 171-177. DOI: 10.1080/07370008.2021.2010214.

Wentworth, L., Conaway, C., Shewchuk, S., & Arce-Trigatti, P. (2022). RPP Brokers Handbook, V. 2: A Guide to Brokering in Education Research-Practice Partnerships. Houston, TX: National Network of Education Research-Practice Partnerships (NNERPP).

COLLABORATIVE EDUCATION RESEARCH and RPP BROKERING: SPOTLIGHT ON TWO RECENT RESOURCES FOR THOSE ENGAGING IN CER and RPPs

By Nina Spitzley | NNERPP

We are excited to spread the word about two very recently published resources for those engaging in collaborative education research (CER) endeavors and/or those participating in research-practice partnership (RPP) brokering activities. Whether you have come across these already or are just hearing about them for the first time, we hope reading more about their history and purpose is useful as you decide how you might want to use them in your RPP learning. Let's jump in!

(I) FRAMEWORK FOR COLLABORATIVE EDUCATION RESEARCH

BACKGROUND

For those that are engaging in a wide variety of collaborative education research endeavors, we are thrilled to highlight a recently published framework that aims to identify foundational elements of collaborative education research: "Towards a Field for Collaborative Education

Research: Developing a Framework for the Complexity of Necessary Learning," authored by the Collaborative Education Research Collective, a naming convention that acknowledges and honors the many contributors involved in this effort, introduces a framework that outlines five core ideas to be used in guiding preparation for and participation in collaborative education research.

The white paper resulted from a collaborative, multi-organization effort to increase the number of individuals and organizations working to advance collaborative education research, whereby this term is intentionally broad and "meant to capture a broad family of approaches and traditions including, but not limited to, research-practice partnerships, participatory action research, youth participatory action research, community based partnerships, community engaged scholarship, social design experiments, school university partnerships, networked improvement communities, and design-based implementation research partnerships" (p. 4). This effort began as an initial set of conversations in 2019 led by the National Center on Research in Policy and Practice (NCRPP) and took further shape when additional organizations joined, forming a design team with members from California Education Partners, Rice University, Stanford University, and University of Colorado Boulder. The design team conducted three virtual open-access events in 2022 with the goal of further exploring what preparation is needed for engaging in collaborative education research. Throughout these events, 339 individuals representing 185 institutions registered, with iabout half of those (45%; 154 of 339) engaging in at least one online event via discussion, note taking, and survey input (p. 7). The three virtual events were followed by parallel in-person and virtual design events to further synthesize the insights raised. The resulting framework reflects an intentional weaving of participants' ideas and contributions, making it in and of itself a collaborative education effort.

WHY THE FRAMEWORK

Educational research conducted in collaboration with educators, families, communities, and other constituents has the potential to be more useful –and certainly more informed– than traditional ways of conducting education research. These efforts prioritize action and impact, typically with an explicit aim to support equitable outcomes for children; however, such collaborative work is not easy and we know less about the learning that researchers, practitioners, and community members need to engage in to support it. The Collaborative Education Research Collective's framework is a response to this, aiming to conceptualize and articulate the necessary learning for these partners to participate in collaborative education research. We invite you to explore the full paper to learn about the journey and shift in goals towards developing the framework that the design team and participants experienced.

The framework outlines critical questions to be considered for those engaging in collaborative education research – both individually and collectively. The following five core ideas make up the framework:

1. **Systems Landscape**: Educational research is embedded in social, cultural, historical, and political contexts.
2. **Interpersonal Relationships**: All collaborators can and should be positioned positively and powerfully through attention to roles and relationships.
3. **Intrapersonal Relationships**: Individuals can and should reflect on how they perpetuate power differences as they "show up" for the work.
4. **Resource Mobilization**: Human, financial, and material assets can and should be leveraged to create more equitable education systems.
5. **Educational Research**: Research evidence can and should be adaptive and responsive to local needs.

The critical questions for each core idea are grouped by those that relate to "Critical Reflection on Past Practices" and those that relate to "Equitable Development of Future Processes."

HOW TO USE THE FRAMEWORK

The framework can be used in a variety of ways, including but not limited to informing the creation of courses on different ways of conducting collaborative research, supporting the learning of individuals and groups that are currently or are planning to engage in such work, and informing additional articles and tools building on this work. We recommend using the framework (Figure 7 on pages 24-26 of the white paper) as a tool for these purposes. However, the white paper's description of the journey towards the framework also provides essential insights, and can be used as a learning opportunity as well. Lastly, plenty of future work remains to be done, as the field works towards developing routines / formal learning opportunities / curricula for conducting collaborative education research – and the framework and corresponding white paper hopefully function as a useful building block in these efforts. We invite you to explore it here!

(II) OPEN-ACCESS BOOK FOR BROKERS IN RPPs

BACKGROUND

We have previously introduced the NNERPP RPP Brokers Handbook in this NNERPP Extra article as a practical, research- and experience-informed resource that clarifies the various activities that collectively make up "RPP brokering." A broker is defined as "a person who helps members of research and practice organizations integrate into an RPP by cultivating and maintaining the relationships needed to effectively support research production and use" (RPP Brokers Handbook, p.5). As a follow-up to that effort, we are excited to announce that Routledge has now published an open-access version of the book: "Brokering in Education Research-Practice Partnerships: A Guide for Education Professionals and Researchers."

Authored by Laura Wentworth, Paula Arce-Trigatti, Carrie Conaway, and Samantha Shewchuk and including a number of use cases contributed by NNERPP members which highlight the actual work of brokering in existing RPPs, this book is the latest contribution in our quest to support RPP brokering. This work originated from NNERPP's earliest conversations about a brokering role in RPPs back in 2017 during the Annual Forum, our yearly gathering of members and friends where we talk all-things-RPP. These early conversations intensified into ideas for a handbook that would define this role and how it shows up in RPP work during the 2019 NNERPP Annual Forum, followed by two years of further development, led by Laura Wentworth and Carrie Conaway, with the additional authors joining along the way. At this point, three versions of the handbook have been published, with the Routledge version being the most recent. The latest edition has all updated chapters, including several new ones, featuring discussions on how brokering can differ by context, greater background on the theory and practice of brokering, and a new chapter offering a future look at brokering.

WHY THE BOOK

The book's primary contribution is in helping make clear the often invisible activities that constitute brokering in RPPs, through introducing a framework that helps us conceptually describe and understand the role. The framework divides the work of brokering into two main groups of activities: 1) brokering to strengthen **partners** and 2) brokering to strengthen **partnerships**. Brokering to strengthen partners involves supporting participants' research use and production, developing and nurturing relationships to weather partnering challenges, and building individual competencies for engaging in an RPP. Brokering to strengthen partnerships involves developing partnership governance and administrative structures, designing partnership processes and communications routines, and supporting the assessment and continuous improvement of the partnership. The use cases demonstrate what each of these activities can look like in action.

The authors describe the essential brokering activities as follows: "Brokering activities are to research-practice partnerships as gears are to

bicycles. Like gears, brokering is both very practical when it adjusts the speed of your bike and very challenging when they break down and stop your ride mid-journey. Consequently, the effectiveness of the brokering in an RPP can make or break the outputs and outcomes of an RPP" (p. 10). Given these important elements, the book aims to be a practical resource for current and future brokers in RPPs.

HOW TO USE THE BOOK

The book is packed with useful information about brokering work in RPPs, including lots of information and research on what brokering is and why it matters in RPPs, the evolution of the framework, and the above-mentioned case examples of brokering work in action. We recommend starting with the components of the framework first – and then diving into the examples for the framework's component(s) that are most relevant to your current work and needs or future ambitions. The open access version of the book is available here for free download or for those that prefer a hard copy, that version is available here (please note that all royalties associated with any purchases of the hard copy will be donated back to NNERPP!).

Nina Spitzley is Marketing Specialist of the National Network of Education Research-Practice Partnerships (NNERPP).

RESEARCH HEADLINES FROM NNERPP MEMBERS

ATTENDANCE

METROPOLITAN EDUCATIONAL RESEARCH CONSORTIUM
examines strategies for addressing chronic absenteeism in the post-pandemic era

OFFICE FOR EDUCATION POLICY
examines Arkansas's course credit and unexcused absence policy

CTE

GEORGIA POLICY LABS
examines career and technical education alignment across five states

COURSE-TAKING

GEORGIA POLICY LABS
examines opportunities to improve the pipeline of students into and through advanced placement

COVID-19

DETROIT PARTNERSHIP FOR EDUCATION EQUITY & RESEARCH
examines student mobility in New York City and Detroit during the pandemic

EARLY CHILDHOOD EDUCATION

EDUCATION POLICY INNOVATION COLLABORATIVE
examines whether retention-eligible students are assigned to highly effective teachers under Michigan's Read by Grade Three law

GEORGIA POLICY LABS
examines expansions of Georgia's childcare and parent services program

NYC EARLY CHILDHOOD RESEARCH NETWORK
examines professional learning experiences of New York City early childhood educators during the COVID-19 pandemic

REL MID-ATLANTIC
examines changes in school climate during COVID-19 in Pennsylvania schools

ENGLISH LEARNERS

PHILADELPHIA EDUCATION RESEARCH CONSORTIUM
examines the diversity and supports for middle school English Learners

HOUSING

DETROIT PARTNERSHIP FOR EDUCATION EQUITY & RESEARCH
examines why Detroit housing policy is critical to the success of city schools

POSTSECONDARY

HOUSTON EDUCATION RESEARCH CONSORTIUM
examines the effect of a college advising program on student outcomes

LOS ANGELES EDUCATION RESEARCH INSTITUTE
examines twelfth grade math and college success

PRINCIPALS

UCHICAGO CONSORTIUM
examines efforts to improve principal effectiveness in Chicago Public Schools

RETENTION

UCHICAGO CONSORTIUM
examines structural factors that affect grade retention

SCHOOL BULLYING

UCHICAGO CONSORTIUM
examines school policies and practices that can help to address bullying in schools

SCHOOL CHOICE

HOUSTON EDUCATION RESEARCH CONSORTIUM
examines how a student's proximity to their zoned school and access to district-funded transportation impact school choice

SCHOOL QUALITY

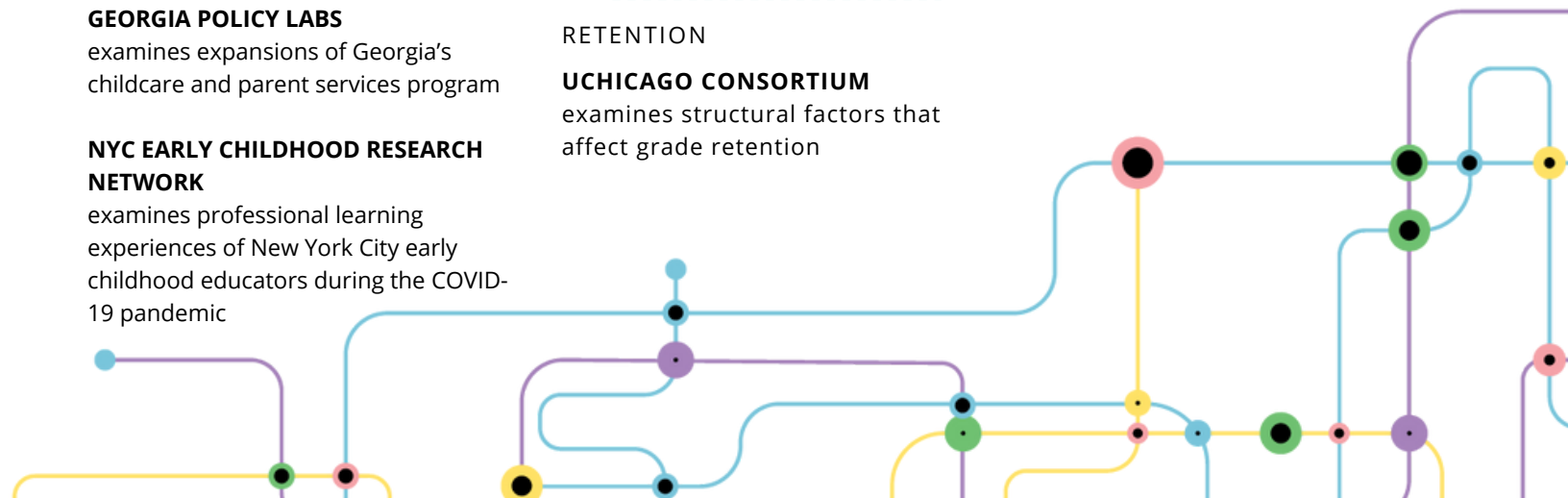
OFFICE FOR EDUCATION POLICY
examines the quality and accessibility of Northwest Arkansas schools

SCHOOL TURNAROUND

EDUCATION POLICY INNOVATION COLLABORATIVE
examines teacher mobility in Michigan turnaround schools

STUDENTS

UCHICAGO CONSORTIUM
examines differences in boys' and girls' grades in ninth-grade math in Chicago



RESEARCH HEADLINES FROM NNERPP MEMBERS, CONTINUED

TEACHERS

EDUCATION POLICY INNOVATION COLLABORATIVE
examines how the pool of prospective Michigan teachers changes as candidates progress through the pipeline and into the workforce

HOUSTON EDUCATION RESEARCH CONSORTIUM
examines
• equity in access to qualified teachers in HISD
• campus teacher characteristics and outcomes for Black and Hispanic students
• how the availability of black and Hispanic teachers in HISD schools shapes Black and Hispanic students' academic and behavioral outcomes

ILLINOIS WORKFORCE AND EDUCATION RESEARCH COLLABORATIVE
examines characteristics of Illinois districts with ongoing teacher shortages

UCHICAGO CONSORTIUM
examines variation of teacher effectiveness by student race

END NOTES

NNERPP | Extra is a quarterly magazine produced by the National Network of Education Research-Practice Partnerships (NNERPP), a professional learning community for education research-practice partnerships (RPPs) housed at the Kinder Institute for Urban Research at Rice University. NNERPP's mission is to develop, support and connect RPPs in order to improve the relationships between research, policy, and practice.

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