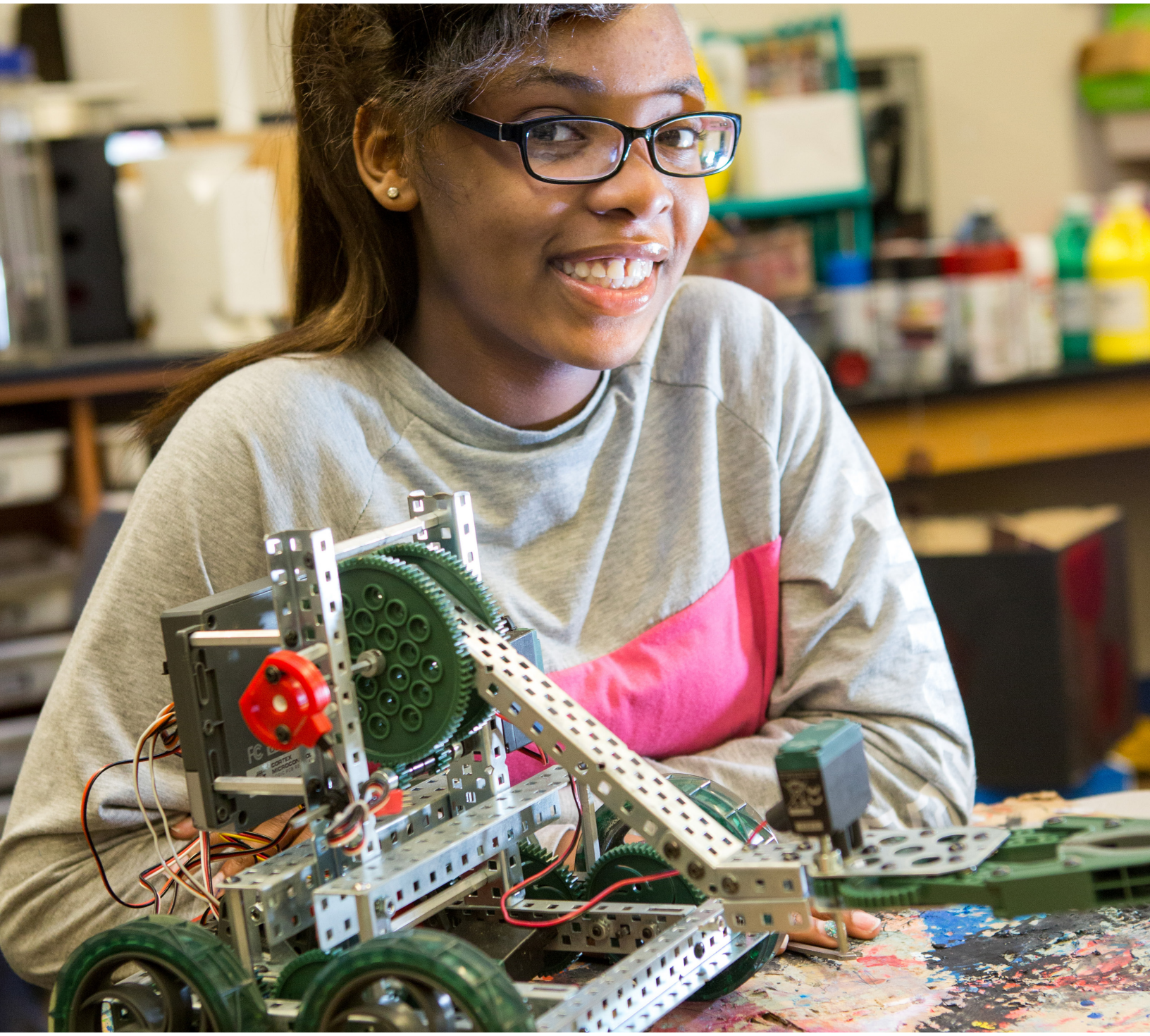
AFTERSCHOOL STEM QUARTERLY RESEARCH REVIEW



JUNE 2025

AFTERSCHOOL STEM HUB

Hello!

Welcome to the June 2025 issue of the Afterschool STEM Quarterly Research Review (ASQRR). This publication from the Afterschool STEM Hub aims to provide you with the latest and most relevant findings from the field of out-of-school time (OST) science, technology, engineering, and mathematics (STEM) education.

As the importance of STEM in society and the workforce continues to grow, attention to STEM educator recruitment, preparation, and retention must be prioritized. That is why we are focusing this edition of the ASQRR on professional development for afterschool STEM educators

There is increasing awareness of the supports afterschool educators need to ensure their well-being, retention in the field, and ability to provide high-quality programming. The "Power of Us" report, released in April 2025, is based on a large national survey of afterschool leaders and practitioners and provides robust information about the afterschool workforce and their needs for support. Additionally, the National Institute on Out-of-School Time is researching effective strategies for sustaining the afterschool STEM workforce. The afterschool field has also been developing credentials and certifications for educators, such as the National Afterschool Association's National Youth Development Credential and STEM Facilitation Micro-Credentials. The Afterschool Alliance is also showcasing workforce solutions exemplars to highlight innovations in various contexts.

We recognize that there is an added level of support needed for programs that seek to provide high-quality STEM learning. We hope to find ways to strengthen and build capacity in the afterschool STEM educator workforce so that all youth can have access to high-quality afterschool STEM. With that in mind we are delighted to highlight two articles focused on the professional development needs of afterschool STEM educators:

- Cian, H. & Kastelein, K. (2025). How can educators exchange high-quality feedback with various forms of evidence of practice?: An analysis of afterschool educator professional growth through noticing. *Journal of Science Teacher Education*, 1-22.
- Wusylko, C., Dawson, K., Xu, Z., Antonenko, P., & Koh, D. (2025). Online professional development to prepare afterschool educators to teach an elementary STEM curriculum: Results of a design and evaluation study. *Journal of Science Education and Technology*, 1-16.

Each of these articles highlights the necessity of developing structures for peer support to sustain afterschool educator professional learning and help with troubleshooting the implementation of STEM pedagogy into afterschool activities.

We hope you will find the articles useful and informative for your own practice, research, or policy work in the field of afterschool STEM education. We also invite you to share your feedback, suggestions, and questions with us at stemhub@afterschoolalliance.org. We would love to hear from you and learn more about how the ASQRR can support your interests and needs.

Thank you for reading and subscribing to the ASQRR. We look forward to bringing you more high-quality and timely research in the next issue. Until then, happy reading, learning, applying, and advocating!

Sincerely,

The ASQRR Editorial Team - *Anita Krishnamurthi, PhD, Leslie Brooks, DVM, MPH and Amanda Sullivan, PhD (National Girls Collaborative Project)*

STUDY REVIEW

How can educators exchange high-quality feedback with various forms of evidence of practice?: An analysis of afterschool educator professional growth through noticing.

Cian, H. & Kastelein, K. (2025). *Journal of Science Teacher Education*, 1-22.
https://doi.org/10.1080/1046560X.2025.2466289

STUDY SUMMARY:

This study explores the efficacy of different types of teaching evidence (e.g., videos of educators teaching, their written lesson plans, etc.) that educators share in a virtual professional learning program called Afterschool Coaching for Reflective Educators in STEM (ACRES). The ACRES model consists of three two-hour virtual sessions. In the first session, a coach teaches educators a specific skill for leading STEM activities. In the next two sessions, educators bring evidence of themselves using that skill to share with other educators in their group. While coaches typically prefer videos of educators working with youth in their programs, sometimes educators must bring other types of teaching evidence (for example, if their program is not in session at the time of the training).

Using a concept called "educator noticing" (which involves how educators observe, think about, and apply their training), the researchers explored how different types of evidence stimulated reflection among participants in the ACRES program's foundational module, "Asking Purposeful Questions in STEM." Learning goals for this professional development are to encourage youth ownership of their STEM learning, attend to youth knowledge, and build learning environments focused on curiosity and questioning.

The researchers compared educator noticing in five common evidence types:

1. video of authentic practice with youth,
2. video with others (such as family members or neighborhood children),
3. audio of authentic practice with youth,
4. descriptions of future or past facilitation work, and
5. using a video provided by the coaches from a video database.

The researchers noted the strengths and limitations of each evidence type by assessing the extent to which the feedback educators exchanged aligned with the professional learning goals.

KEY TAKEAWAY:

Professional learning is more effective at building STEM facilitation skills when afterschool educators reflect on real examples of their own practice within small peer groups. To support this, professional learning should welcome diverse forms of evidence, such as videos with youth, videos with family, and lesson plans, each of which offers unique value to the learning community.

POPULATION:

Twenty-eight afterschool educators from six different cohorts across the U.S., led by two experienced coaches from the Afterschool Coaching for Reflective Educators in STEM (ACRES) program, participated in this study. Educator experience in afterschool or other out-of-school time programs ranged from zero to 24 years, and experience facilitating STEM activities for youth ranged from zero to 17 years.

METHODS:

Qualitative observations

RESULTS:

The researchers found that educators noticed unique aspects of STEM facilitation depending on the type of evidence that was shared. Key findings include:

- **Diverse evidence supports educators' professional growth.**

  The study found that afterschool educators' professional growth was supported through "noticing" (observing, analyzing, and applying training) when using various types of evidence of their STEM teaching practice, not just standard videos of their work with youth.

- **Each evidence type offers unique benefits.**

  Each of the five forms of teaching evidence (i.e., authentic practice videos, videos with family/others, audio recordings, written descriptions, or coach-provided videos) highlighted distinct aspects of STEM facilitation for peer feedback and reflection. For example, authentic practice videos with youth were particularly useful for educators to notice non-verbal cues and body language and for peers to build empathy and relate to the specific context of the educator's program. Meanwhile, the audio-only recordings helped educators and their peers to focus on the verbalizations, language, and specific phrasing used by both the educator and the youth, prompting reflection on questioning techniques.

  However, when authentic practice videos were used, peers appeared less likely to make recommendations that would suggest disconnect between educator actions and their understanding of what works best for program youth. In contrast, when coach-provided videos were used, educators were more likely to notice and name such mismatches, perhaps because offering critical feedback felt less socially risky when directed at someone outside their peer group.

- **"Imperfections" can be productive.**

  The study noted that perceived limitations or "imperfections" in some evidence types, such as poor audio quality in a video, could prompt educators to use their own experience and knowledge to fill in gaps, leading to deeper reflection.

- **Flexibility enhances participation.**

  Allowing educators to choose the form of evidence they shared (which could be different due to program schedules, newness to the field, restrictions on recording in their programs, etc.) helped remove barriers to participation in the professional learning program while still achieving learning objectives. This adaptability ensures that a wider range of afterschool educators, facing various real-world constraints, could still access and benefit from the professional growth opportunities offered by the ACRES program.

CONCLUSIONS:

Because afterschool educators vary widely in their schedules, experiences, age-group focus, and community contexts, national professional learning programs must remain flexible in how they engage with the materials educators bring to reflect on their STEM facilitation. These different types of teaching evidence—videos, photos, transcripts, or written reflections—each offer different entry points for developing skills.

When professional learning coaches recognize both the strengths and limitations of different types of teaching evidence, they can better support educator learning, foster a sense of ownership, and build belonging across the learning community. To help coaches make the most of these materials, the ACRES research team developed two support guides, available on their website. These resources describe common forms of educator reflection, outline what each can offer, and provide prompts to help coaches guide feedback, especially when educators are unsure how to respond. Strengthening how educators reflect on and learn from practice not only supports individual growth but also helps ensure afterschool programs continue to be responsive and inclusive spaces where all youth can thrive in STEM.

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

- **Offer flexible professional development.**

  Offer afterschool educators professional development opportunities that are flexible in how educators can demonstrate their practice. This includes allowing diverse evidence types, such as audio recordings, videos with family members, or written plans, to accommodate varying schedules, experience levels, and program limitations (e.g., video recording restrictions).

- **Empower educators through the practice of "noticing".**

  Encourage and train afterschool educators to "notice" specific elements of their own and their peers' teaching, using various forms of evidence. This structured reflection process helps educators become more aware of their facilitation skills and how they impact youth learning.

IMPLICATIONS FOR POLICY:

- **Fund flexible professional learning models.**

  Support and fund professional learning programs for afterschool educators that are flexible in their design and allow for diverse forms of teaching evidence. This adaptability addresses the unique constraints of afterschool settings (e.g., varied schedules, staff turnover, video restrictions) and can increase educator participation and growth.

- **Expand coach training and certification.**

  Fund developing and scaling coach credentialing programs that include strategies for emphasizing strength-based coaching practices and support for various documentation formats (audio, narrative, etc.).

- **Support statewide or regional repositories of curated practice-based resources.**

  Invest in regional or statewide professional learning hubs (e.g., through libraries, public universities, or afterschool networks) that house vetted videos, guides, and tools for afterschool STEM facilitation. This way, when educators are not able to review examples from their own sites, high-quality, local, and programmatically-relevant resources can still support reflection and growth.

STUDY REVIEW

Online professional development to prepare afterschool educators to teach an elementary STEM curriculum: Results of a design and evaluation study.

Wusylko, C., Dawson, K., Xu, Z., Antonenko, P., & Koh, D. (2025). *Journal of Science Education and Technology*, 1-16. http://dx.doi.org/10.1007/s10956-025-10211-6

STUDY SUMMARY:

This study reports on the design, implementation, and evaluation of an Online Professional Development (OPD) created to prepare afterschool educators to teach a content-heavy STEM curriculum on cryptology and cybersecurity to 3rd-5th grade students. The goals of the OPD were to provide educators with an overview of the curriculum and teach them enough cryptology and cybersecurity background information so they understood the content to be taught. The researchers designed a synchronous, three-day OPD, guided by adult learning theory and Community of Inquiry (COI) learning theory, such as the integration of cognitive presence (interaction with content), social presence (interaction with other participants), and teaching presence (interaction with instructor) to foster meaningful online interaction. Findings showed positive educator reactions, high implementation rates, and significant student learning gains in cryptology and cybersecurity. However, some educators struggled with learning difficult concepts and transferring them to the students, suggesting a need for additional post-OPD support to fully prepare afterschool educators to teach complex STEM content.

RESULTS:

Afterschool educators who participated in the OPD reported feeling confident in the STEM content introduced and demonstrated strong retention of the material. Statistically significant student learning gains further suggest the success of the OPD. However, results also revealed educator confusion around complex topics, as reflected in their qualitative feedback on the OPD and in their efforts to teach the content to students afterward. Key findings include the following:

- **High completion rates.**
  All 18 educators who began the OPD completed it, and 17 went on to implement the curriculum in their afterschool programs.

KEY TAKEAWAY:

Online professional development (OPD) is a promising option for afterschool STEM programs, especially for those with monetary and time constraints. Quality design of OPDs is crucial for program and student success. STEM-focused OPDs should be guided by adult learning theory and Community of Inquiry (COI) approaches. After the OPD is complete, OPD designers should also consider providing additional opportunities for educator learning and support, particularly for more complicated STEM content.

POPULATION:

Eighteen educators from 14 afterschool programs located in the Southeastern United States participated. One afterschool program could not implement the curriculum, so 13 afterschool programs with 17 educators and 223 students implemented the curriculum.

METHODS:

Qualitative and quantitative methods were used to evaluate the efficacy of the OPD. Educators completed two types of qualitative surveys: one to gauge their initial comfort and general perceptions of the OPD and another, administered weekly, to track their perceptions and progress during curriculum implementation after the OPD. Additional qualitative data came from educator comments and artifacts. Student learning was measured quantitatively using pre- and post-surveys focused on the specific STEM content of the curriculum.

- **Comfort with STEM concepts post-OPD.**
  After the OPD, educators felt generally comfortable with the content covered. However, some educators expressed reservations about trickier concepts. One educator explained, "I feel like I do need more understanding and knowledge on using plaintext, cipher numbers, and letters," and another said, "I will need to go back and review more."

- **Retention of learning from OPD.**
  During curriculum implementation in their afterschool programs, educators reported that they generally retained the content they learned during the OPD. However, some educators reported that they needed to review the content that they felt less confident about.

- **Significant gains in student learning.**
  Students' scores on the cryptology and cybersecurity knowledge survey were significantly higher after curriculum implementation than before implementation.

CONCLUSIONS:

OPDs, when thoughtfully designed using principles like adult learning theory and the COI theory, can effectively prepare afterschool educators to teach complex STEM curricula. Well-designed OPD programs can lead to significant positive impacts on educators' comfort with teaching complex STEM concepts and students' STEM learning outcomes, demonstrating their value in informal educational settings.

However, STEM-focused OPD programs (and professional development programs in general) can be further enhanced by providing additional, flexible support for educators to revisit and master particularly challenging concepts after the initial training. This will help afterschool educators bridge knowledge gaps and bolster their STEM understanding, ensuring they are well-equipped to lead engaging, cutting-edge STEM programs.

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

- **Adopt evidence-based OPD models.**
  Afterschool program leaders should prioritize adopting evidence-based online professional development programs grounded in established educational theories, as these have been shown to be effective.
- **Integrate ongoing support after OPDs.**

  Afterschool program leaders should build in mechanisms for continuous support for educators after completing an OPD, such as access to online resources, peer learning opportunities, or follow-up sessions, especially for challenging STEM content areas.
- **Foster online communities.**

  Encourage and facilitate the creation of online communities among afterschool educators who participate in OPDs to foster peer support, shared learning, and collaborative problem-solving.
- **Utilize data for program improvement.**

  Afterschool programs should routinely collect both educator feedback and student outcome data to evaluate the effectiveness of their professional development and make data-driven improvements.

IMPLICATIONS FOR POLICY:

- **Fund and prioritize OPD for afterschool.**

  Recognize and adequately fund online professional development as a viable and cost-effective strategy for upskilling afterschool educators, particularly given its accessibility and demonstrated impact on STEM learning.
- **Develop quality standards for OPD**.

  Despite the growing prominence of OPDs, the authors highlight a critical gap in research examining effective OPD design. Further studies are needed to investigate the unique pedagogical and technological considerations involved in developing OPDs, and compare the effectiveness of different OPD models (e.g., fully asynchronous vs. synchronous) on educator skill acquisition and student outcomes in STEM. There is also a need to establish guidelines or quality assurance standards for OPD programs aimed at afterschool educators, emphasizing evidence-based design principles to ensure program efficacy.
- **Support STEM curriculum development intentionally designed for afterschool programs.**

  Encourage and fund the development of high-quality, engaging STEM curricula specifically designed for afterschool environments, paired with effective professional development opportunities.
- **Recognize afterschool educator professionalism.**

  Explore pathways for recognizing or credentialing afterschool educators who complete rigorous, impactful OPDs, acknowledging their crucial role in informal education. Research is needed to understand the long-term impact of OPDs on educator retention, sustained teaching practices, and student engagement and achievement in STEM over multiple years.

RESEARCH ON THE HORIZON

The research team at the National Institute on Out-of-School Time (NIOST) is currently in the field examining effective strategies for recruiting, training, and retaining a high-quality afterschool STEM educator workforce. Through this work, NIOST expects to share information with program leaders on how to best support their staff to deliver high-quality STEM programming. You can learn more about their ongoing study here.

To further elucidate the needs of afterschool STEM educators, the Afterschool STEM Hub has also been gathering qualitative data through interviews and focus group discussions with afterschool STEM program leaders and practitioners. In the coming months, we will release a report outlining what is needed to support afterschool STEM educators and high-quality informal STEM education. In the meantime, you can check out the Afterschool Alliance's workforce innovations database to find ways that afterschool programs, including those centered on STEM, are already implementing creative ways to support their educators.

REPORT SPOTLIGHT

National Academies of Sciences, Engineering, and Medicine. (2025). The Future of Youth Development: Building Systems and Strengthening Programs. Washington, DC: The National Academies Press. https://doi.org/10.17226/27833.

In case you missed it, the National Academies of Sciences, Engineering, and Medicine released a consensus study report that examines the effectiveness of out-of-school time programs and opportunities to increase accessibility and quality. The report describes the wealth of out-of-school time activities and their impacts on learning, development, and well-being. It also outlines policy recommendations and a research agenda to support the field in improving accessibility for all youth and continued quality improvements. You can read the full report here.

We hope you enjoyed exploring this issue! Additional similar publications are listed below. Until our next issue, you can also read more about research highlighting the updated evidence of afterschool STEM in our research brief and explore evaluation summaries of afterschool programs in the Afterschool Alliance's Impacts Database. You can also follow us on LinkedIn to learn more and stay updated on our work.

You can register for our upcoming newsletters and receive a copy of any articles that are not open-access by completing this Google form.

ADDITIONAL PUBLICATIONS TO NOTE

Clark, J., Bloom, N., Rubino-Hare, L., et al. (2021). Designing professional development resources to meet the needs of OST STEM educators. *Afterschool Matters, 34*, 30-39. https://eric.ed.gov/?id=EJ1304837.

Swanson, K., Blanchard, M. R., & Gutierrez, K. S. (2023). "We're all like one big family": How teacher-coaches' after-school PLC's influence STEM Club success. *Learning, Culture, and Social Interaction, 42*. https://doi.org/10.1016/j.lcsi.2023.100739.