

AFTERSCHOOL STEM QUARTERLY RESEARCH REVIEW



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AFTERSCHOOL
STEM HUB

Hello!

Welcome to the spring 2026 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.

In this edition, we are pleased to highlight two articles that examine the creative and meaningful ways afterschool STEM programs support the development of young people's math skills. Math achievement has received renewed national attention following the release of the 2024 [National Assessment of Educational Progress](#) (NAEP) scores. In response, [Education Week](#) reports that states are passing new laws to improve math instruction. In addition, the Chair of the Senate Health, Education, Labor, and Pensions (HELP) Committee recently [sent an inquiry](#) to 35 colleges and universities seeking strategies to better prepare students for college-level mathematics.

Afterschool programs are part of the solution. High-quality programs offer engaging, joyful learning experiences that draw youth into STEM concepts and skills—including math—often in ways that feel natural and integrated rather than formal or high-stakes. By creating low-risk environments for project-based learning and centering youth-led inquiry grounded in real-world relevance, afterschool programs foster students' sense of freedom, confidence, and agency in their learning. The two articles featured in this review offer insights into the role afterschool programs can play in developing math proficiency:

- Simpson, A., & Kastberg, S. (2022). Makers do math! Legitimizing informal mathematical practices within making contexts. *Journal of Humanistic Mathematics*, 12(1), 40–75.
- Schoenherr, J. (2024). Personalizing real-world problems: Posing own problems increases self-efficacy expectations, intrinsic value, attainment value, and utility value. *British Journal of Educational Psychology*, 94, 407–424.

These articles demonstrate that motivation to engage in math can be increased by providing opportunities for youth to develop their own problems in ways that feel relevant, personal, and connected to everyday life. For each article, we present a general summary followed by implications for practice, research, and policy.

We are also delighted to bring back the researcher spotlight section in this edition, as we feature Dr. Kathleen Lynch and her research on summer math learning.

We hope you find the issue helpful and informative for your practice, research, or policy work in 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
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STUDY REVIEW

Makers Do Math! Legitimizing informal mathematical practices within making contexts

Simpson, A., & Kastberg, S. (2022). Makers do math! Legitimizing informal mathematical practices within making contexts. *Journal of Humanistic Mathematics*, 12(1), 40–75. <https://scholarship.claremont.edu/jhm/vol12/iss1/5>

STUDY SUMMARY:

This research builds on a previous study in which the researchers collected and observed videos of students participating in making activities (i.e., exploring and tinkering with materials to design and refine prototypes for play or utility) in informal learning environments. The purpose was to document instances of mathematical practices defined by the Common Core State Standards, but in doing so, the researchers noticed that youth also engaged in mathematical practices not defined by the school standards, including informal measurement, spatial reasoning, and curiosity. The authors define these as mathematical practices for making, as opposed to mathematical practices for school. They characterize the practices as both foundational for understanding broader math concepts and beneficial for seeing the value of math skills in everyday life, not just in the classroom.

RESULTS:

The study documented instances of youth engaged in three mathematical practices for making—informal measurement, spatial reasoning, and curiosity. Examples of informal measurement included using non-standard units of measure (e.g., placing one's thumb and pointer finger on two points to measure the distance between them), object-to-object comparison (e.g., using a dry spaghetti noodle to measure the length of an object and breaking a second noodle to match the first one's length), and measurement estimation (e.g., folding a strip of paper into thirds). Youth used spatial reasoning when manipulating pattern blocks, building models with LEGO bricks, and using tools like screwdrivers or wire cutters to take apart electronics. Curiosity was observed throughout the data set as youth built and refined their creations, often posing "what if" questions as they tinkered and tested ideas.

CONCLUSIONS:

The authors argue that making and tinkering activities are opportunities for youth to develop important math skills and see their utility in everyday life. Many people still view informal learning environments as less legitimate than school. But classroom teaching can seem detached from the real world and cause students to question the value of learning math skills, whereas in the context of making, youth naturally experience the need to use math as a tool to achieve a goal. Legitimizing ways of doing math in informal learning environments can encourage youth to see mathematics as necessary and useful, thereby supporting their development of math identity and belonging.

KEY TAKEAWAY:

Making activities in informal learning environments provide legitimate opportunities for youth to develop mathematical practices that are important for understanding larger math concepts. In seemingly non-mathematical contexts like making and tinkering, youth develop these practices organically through exploration and problem-solving rather than explicit instruction in school. This can help youth recognize math skills as useful everywhere, not just in the classroom.

POPULATION:

Third through fifth-grade students in the U.S. Midwest participating in an afterschool program that implemented two six-week making units, and students who chose to participate in three days of TinkerLab activities during a free period of the school day at an intermediate school in the U.S. Northeast.

METHODS:

Videos of students participating in making and tinkering activities collected in a previous study were analyzed. Students had volunteered to wear chest-mounted GoPro cameras while working individually or in groups to solve challenges. In the present study, the researchers revisited this previously collected video data to explore how youth engage in mathematical practices for making in informal learning environments. The resulting mathematical practices they defined were derived from their analysis of the literature and practices they identified youth using through making activities.

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

- **Validate Mathematical Practices for Making:** Ask reflection questions that encourage youth to connect tinkering with mathematical thinking and notice when they intuitively use math to solve design challenges.
- **Foster Positive Math Identity Outside the Traditional Classroom:** Call attention to and celebrate examples of youth engagement in mathematical practices within making contexts. Promote a broader view of how math is used and what it looks like to use math skills.

IMPLICATIONS FOR RESEARCH:

- **Conduct Observational Research and Analysis:** This study lays the groundwork for observing and documenting additional mathematical practices for making and exploring how those practices contribute to one's development of mathematical thinking and decision-making.
- **Expand Research to Additional Populations and Settings:** The study focused on two U.S.-based informal learning programs with youth in grades 3–5. Further research could examine learners of different ages, of different cultures, or in other geographies to test whether findings can be generalized across contexts.

IMPLICATIONS FOR POLICY:

- **Fund Making Programs:** Invest in making and tinkering programs to give more students opportunities to develop mathematical practices through experience and exploration, in addition to formal instruction. This would strengthen skills development, including the ability to think mathematically, and foster students' understanding of math's relevance to their everyday lives.
- **Expand Standards Frameworks to Include Informal Mathematical Practices:** Recognize practices like informal measurement, spatial reasoning, and curiosity as foundational to building mathematical understanding. Support professional development aligned with broader definitions of mathematical practices and shift the narrative of what counts as math.

STUDY REVIEW

Personalizing real-world problems: Posing own problems increases self-efficacy expectations, intrinsic value, attainment value, and utility value.

Schoenherr, J. (2024). Personalizing real-world problems: Posing own problems increases self-efficacy expectations, intrinsic value, attainment value, and utility value. *British Journal of Educational Psychology*, 94, 407–424. <https://doi.org/10.1111/bjep.12653>

STUDY SUMMARY:

The study examined whether personalizing real-world math problems increases students' motivation to solve them. The researchers focused on two types of personalization: active-personalization (students create their own math problems related to their hometown) and context-personalization (students solve problems created by peers about their shared hometown). These were compared to non-personalized problems (real-world problems created by an instructor, featuring unfamiliar places, objects, or references).

Students in a six-month afterschool program posed problems for a math walk in their neighborhood. At the end of the program, students rated their motivation for solving different types of problems using a series of indicators: self-efficacy (confidence), intrinsic value (interest), attainment value (importance), utility value (usefulness), and perceived cost (effort). The study found that students felt more confident and more interested in solving problems they created themselves. These active-personalized problems also felt more important and useful to them. Context personalization had smaller positive effects, mainly increasing interest and perceived importance. Neither type of personalization changed perceptions of how much effort was needed to solve the problems. Overall, the study shows that having students create their own real-world math problems can meaningfully boost motivation.



Photo credit: National Museum of Mathematics momath.org

KEY TAKEAWAY:

Motivation to engage in math increases when the material feels relevant, personal, and connected to everyday life. In an afterschool setting, personalizing real-world math problems (e.g., by including references to familiar places, objects, or interests) is a valuable instructional strategy, but asking students to pose their own math problems boosts indicators for motivation even more.

POPULATION:

Twenty-eight students (19 fifth graders, 9 sixth graders) from the high achievement track of a secondary school in Germany. The students voluntarily joined a six-month math-focused afterschool program. Their average age was 10.73 years. Nine students identified as female and 19 as male. Their average mathematics grade in school was 1.79 (on a 1–6 scale, with 1 as best), indicating high levels of motivation and performance across the study sample.

RESULTS:

The study found that active participation (when students created their own math problems, such as estimating heights of and defining geometric shapes within local street signs) had the strongest positive effects on motivation. Compared to non-personalized problems, students reported significantly higher levels of self-efficacy, intrinsic value, attainment value, and utility value. In other words, students felt more confident and interested, and saw greater importance and usefulness in solving problems they had created themselves. Context-personalization (problems created by peers about objects or places in their hometown) had smaller effects. It significantly increased intrinsic value and attainment value, but not self-efficacy or utility value, compared to non-personalized problems. Neither type of personalization affected how much effort the students felt the problems would require (perceived cost).

CONCLUSIONS:

The study demonstrates that active personalization (where students pose their own real-world math problems) can boost students' motivation to solve those problems. Youth reported greater confidence and interest and perceived the problems they created themselves as more important and useful than those created by teachers, which included unfamiliar places or objects. To a lesser degree, context personalization (familiar, peer-created problems) also increased students' levels of interest and importance, but not their confidence or sense of usefulness. Neither approach changed how much effort the students felt the problems would require. Overall, having students pose their own problems appears to be an effective strategy for increasing math motivation.



Photo Credit: National Museum of Mathematics momath.org

METHODS:

Data were collected during the second-to-last session of a 10-session afterschool program. Students first completed a short demographic survey. Then they evaluated and rated 12 real-world math problems according to several criteria on a five-point Likert scale.

The afterschool program centered on designing an app-based “mathematical walk” in the students’ hometown to connect mathematical topics to their everyday lives. In groups of three or four, students walked around, generated place-based math problems, selected and refined their questions, solved them, added them to the app, tested peers’ problems, and revised their own. The program was led by preservice math teachers who followed structured lesson plans and met weekly with the research team.

STUDY IMPLICATIONS

IMPLICATIONS FOR PRACTICE:

- **Challenge Students to Pose Math Problems:** Educators can increase motivation for math tasks by giving youth structured opportunities to create their own real-world problems.
- **Use Familiar, Local Contexts in Instruction:** Even when students are not generating their own math problems, referencing familiar locations, objects, and concepts can increase youth interest and perceived importance.

IMPLICATIONS FOR RESEARCH:

- **Study Long-term Effects:** Continued research should examine whether the increased motivation generated by problem-posing leads to improved math proficiency, persistence, or identity over time.
- **Replicate the Study Across Disciplines and Demographics:** Researchers should investigate whether the motivational benefits of personalization extend to other subjects and other types of students, particularly those who are not already highly motivated.

IMPLICATIONS FOR POLICY:

- **Support Culturally Relevant Practices:** Recognizing that locally-grounded learning tasks boost motivation, policies and funding should promote culturally-relevant and community-centered instructional practices that connect learning to students' lived experiences.
- **Allocate Funding for Cross-Sector Collaborations:** Policies should incentivize schools and school-based afterschool programs to partner with libraries, museums, and community centers to bring learning out of the classroom and into the local neighborhood.

RESEARCHER SPOTLIGHT

Researchers are focusing on the intersection of research and STEM, and it is part of our mission to highlight and share their work with you. For our Researcher Spotlight, we interviewed Kathleen Lynch, Ed.D., an Assistant Professor in the Neag School of Education at the University of Connecticut. Some of her recent research focuses on the role of summer programming in helping students develop math proficiency.

Please tell us about yourself.

I am an assistant professor in the Neag School of Education at the University of Connecticut. Before that, I completed my postdoctoral fellowship in education at the Annenberg Institute at Brown University and my doctorate in education from Harvard University. I served as a classroom teacher in my early career, which helped catalyze my interest in education.



What is the focus of your recent research?

My recent research has two primary foci: improving children’s STEM outcomes and understanding and strengthening children’s learning opportunities outside of school time, particularly during the summer.

One topic I’ve investigated is summer math learning, with the aim of understanding which factors may enhance children’s mathematical development during seasonal school closures. My team and I conducted a systematic meta-analysis of contemporary empirical studies of summer programs that focused on math. Notably, many of the evaluated programs were not exclusively math-focused, but also contained learning opportunities in other subjects and/or enrichment and recreational activities.

We found that kids who participated in summer programs that incorporated math activities showed significantly higher mathematics achievement than those in control groups. The average weighted effect size across studies was +0.10 standard deviations, equivalent to improving from approximately the 50th to the 54th percentile in math achievement. Children saw math benefits from attending summer programs in both high-poverty and relatively lower-poverty settings. These findings suggest that summer programs can be an effective strategy for enhancing children’s mathematics skills.

We also found that summer programs of the types evaluated in the literature tended to have positive impacts on social-emotional learning outcomes, alongside their positive impacts on math skills. So, encouragingly, there did not appear to be trade-offs evident between summer learning programs’ typical impacts on academic versus non-academic skills.

How did you become interested in afterschool, summer, and out-of-school time learning experiences?

Back when I was an undergraduate, I worked as a teacher in a summer program for refugee children, and I also volunteered as an afterschool tutor and in an out-of-school time mentoring program. I became really interested in the roles OST programs can play in supporting children and families, and strategies to bolster access to high-quality OST opportunities for children and families who may have unmet needs for them.

What has been most surprising to you in your research?

One facet that has surprised me is the relative paucity of empirical evidence to answer many important questions about seasonal school closures, such as children’s summertime use, how families make decisions about and allocate resources for their children’s summer activities, and what features make summer programs most effective. The field could benefit from more robust data collection and research in these areas.

In your opinion, what questions should the research community be asking about afterschool, summer, and out-of-school time learning for youth?

Rigorous program evaluations that provide empirical data on the impacts of summer programs on both critical academic and non-academic outcomes are really important. In addition to large-scale evaluations of major district programs, the field would also benefit from more demonstration studies of high-quality programs that may be smaller in scale and more resource-intensive to operate, but that showcase what is possible under ideal conditions.

What do you hope the field, funders, and policy-makers take away from your research?

The existing research evidence supports the conclusion that summer learning programs can improve children's math achievement. Summer programs are malleable factors under the influence of public policy, and policy investments in high-quality summer interventions warrant consideration.

What is something we didn't ask you that you wish we had?

In addition to structured summer programs, families and caregivers also have a range of assets that can support children's summer learning. Visiting libraries, reading books together, and finding the math in everyday activities are a few low-cost ways parents and caregivers can continue nurturing kids' love of learning when schools are closed.

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](#) as well as 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 up to date on what we are working on.

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

Nmah, J., Nmah, B., & Lamar, T. (2025). Examining the long-term effects of the Morehouse College Annual Math Competitions Bootcamp: A case study. *Journal of STEM Outreach*, 8(1). <https://doi.org/10.15695/jstem/v8i1.08>

Peppler, K., Keune, A., Bender, S. & Yankova, N. (2025). Materialized action: Reformulating the "doing of" math through fiber crafting. *Cognition and Instruction*, 1–26. <https://doi.org/10.1080/07370008.2025.2485070>

Zhou, L. (2025). Unveiling Lasting Impact: A cultural-historical activity theory perspective on original participants in an afterschool STEM club. *School Science and Mathematics*. <https://onlinelibrary.wiley.com/doi/full/10.1111/ssm.18372>