nPower Girls: Empowering Female Students in STEM Through Teacher Professional Development and Community Connections

Supplementary materials

Between workshops, teachers had the opportunity to reflect on and apply their learning in the classroom, as well as complete their own action research projects. In our first year, all teachers investigated the recommendation to provide girls with spatial intelligence skills training. The American Association of University Women's (AAUW) *Why So Few?* report discusses the importance of spatial reasoning and training in visual-spatial skills in STEM (science, technology, engineering, and math) fields, particularly engineering (Hill, Corbett and St. Rose 2010, p. 20). We focused on this recommendation due to the implication that spatial intelligence can increase in a very short period of time with intervention involving relatively inexpensive resources (Hill, Corbett and St. Rose 2010, pp. 27–29). All teachers used the same baseline test—the Visual-Spatial Intelligence Test from *Queendom.com*—and, throughout the year, engaged all students in spatial intelligence skill-building tasks such as tangrams, origami, and designing nets for three-dimensional objects. Additionally, teachers collected anecdotal and observational data. Initial student scores ranged from 61–72% of students scoring below average on the initial assessment. Follow-up data were not available for all students who participated; after eight months of intervention, however, 61% of students' postscores in one set of classes ($n = 150$) showed increases. Some scores decreased (9%) and almost one third did not change (29%). One teacher in the program also surveyed her students on their perceived growth in skills, reporting that 82% of her female students felt they had improved their skills (where the actual number of females who improved their scores was 60%). In subsequent years, teachers had the option to depart from the visual spatial skills work and select their own topic for their action research, based on recommendations for working with girls in STEM. Although many teachers chose to continue focusing on spatial intelligence for the duration of the project, others investigated growth mindset, using female STEM mentors in the classroom, or emphasizing informational feedback.

Table S1

Full data on the 18 items measured by 12 teachers in table format

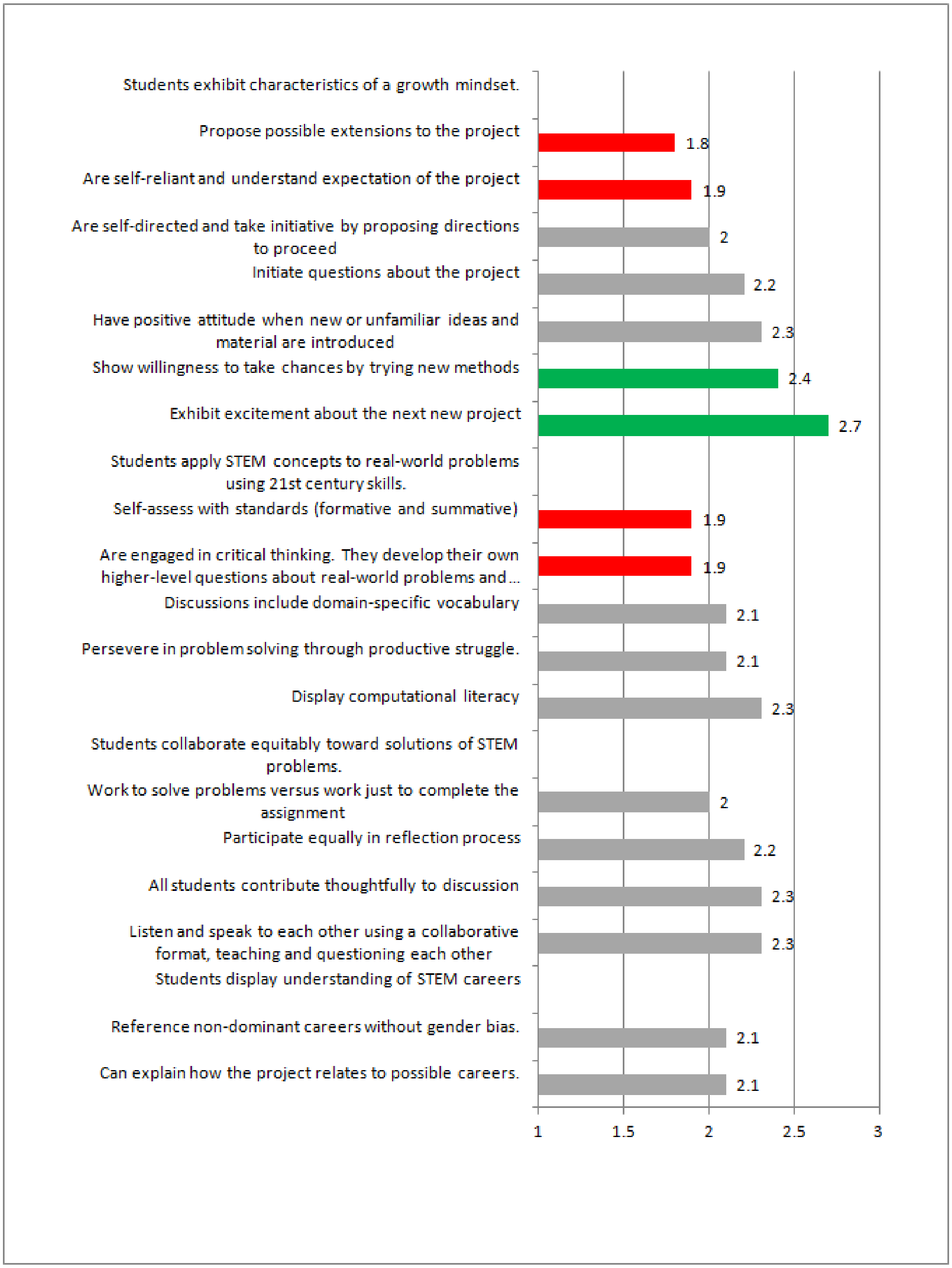
Figure S1 shows all items in graphical format. Teachers rated students as "always/often" exhibiting the characteristic (3 points), "sometimes" (2 points), or "rarely/never" (1 point). The "Sum" column contains the sum of the teachers' ratings, with 12 teachers rating each item from 1–3. Hence, the maximum sum would be 36 and the minimum would be 12.

	Item ID	**Sum**	**Median**	**Mean**
Students exhibit characteristics of a growth mindset.				
Students have a positive attitude when new or unfamiliar ideas and materials are introduced.	S1a	27	2	2.3

Students are self-directed and take initiative by proposing directions to proceed.	S1b	24	2	2.0
Students show a willingness to take chances by trying new methods.	S1c	29	2	2.4
Students initiate questions about the project.	S1d	26	2	2.2
Students propose possible extensions to the project.	S1e	21	2	1.8
Students are self-reliant and understand the expectations of the project.	S1f	23	2	1.9
Students exhibit excitement about new projects.	S1g	32	3	2.7
Students apply STEM concepts to real-world problems using 21st-century skills.				
Students are engaged in critical thinking. They develop their own higher-level questions about real-world problems and discuss relevance.	S2a	23	2	1.9
Students persevere in problem-solving through productive struggle.	S2b	25	2	2.1
Student discussions include domain-specific vocabulary.	S2c	25	2	2.1
Students display computational literacy.	S2d	27	2	2.3
Students self-assess with standards (formative and summative).	S2e	23	2	1.9
Students collaborate equitably toward solutions to STEM problems.				
Students listen and speak to each other using a collaborative format, teaching and questioning each other.	S3a	27	2	2.3
All students contribute thoughtfully to discussion.	S3b	27	2	2.3
Students participate equally in the reflection process.	S3c	26	2	2.2
Students work to solve problems versus work just to complete the assignment.	S3d	16	2	2.0
Students display an understanding of STEM careers.				
Students can explain how the project relates to possible careers.	S4a	23	2	2.1
Students reference nondominant careers without gender bias.	S4b	23	2	2.1

Figure S1

A graphic representation of the data from Table S1



During the second and third years of our program, we broadened our business and industry connections to include STEM careers (often nontraditional) that are part of the rural, isolated communities in which our teachers and their students reside. We continued to develop the pedagogical skills to include the recommendations from AAUW and the Institute of Education Sciences, and developed templates for our STEM business visits and teacher reflections on their application of ideas in their classrooms. We also added seven more teachers representing additional districts and broadened our participant grade levels to K–12. Our content focus for professional development integrated more computer science and computational thinking, and this research helped directly support working with girls in this field. Perhaps most exciting, after year 2, teachers planned the summer's Camp nPower and guided the development of the entire program: from selecting the driving question, to determining content goals, to identifying and recruiting community STEM partners, to sharing in the facilitation of the camp. This shift in planning is an important part of the sustainability of the program and its goals in the communities we serve.

The full report, as well as an online Canvas course developed around it to support teacher professional learning communities and other STEM Network directors across our state and others, are available as supplementary materials to this article through Educational Service District 112.

Reference

Hill, C., C. Corbett, and A. St. Rose. 2010. *Why so few? Women in science, technology, engineering, and mathematics*. Washington, DC: American Association of University Women.