



Increasing Diversity and Inclusion for Women in STEM

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In Science, Technology, Engineering, and Mathematics (STEM), the representation of women and women of color (WOC) is low because institutions and industries throughout the nation are having difficulties attracting and retaining this specific audience. Contributing factors to the low representation include lack of positive and engaging STEM experiences, negative classroom experiences, lack of self-confidence in their mathematics skills, and “chilly” campus and office climates. For the University of Wisconsin Eau Claire (UWEC), a public undergraduate university, we are addressing these issues, and we are finding success in the recruitment of women and WOC through our Sonia Kovalevsky High School (HS) and Middle School (MS) Mathematics Days.

Sonia Kovalevsky (SK) days are designed primarily to encourage and motivate young girls to pursue higher education, careers, and opportunities in STEM. During this one-day event, we create a “safe-space” learning environment for HS and MS girls, their teachers, and their parents by engaging them in activities that demonstrate that mathematics is FIERCE: Fresh, Innovative, Exciting, Research, Creative, and Eccentric! The overarching goal is to provide our participants with great out-of-classroom mathematics experiences designed to pique their STEM interests and curiosities. This goal is achieved through HS and MS workshops, math geocaching, a “Math Challenges” competition, teacher workshops, a keynote speaker address,

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a panel of diverse phenomenal women who use mathematics in their careers, and a parent chat with UWEC’s STEM admissions counselor.

SK days historically have been funded by the Association for Women in Mathematics (AWM) [6], but due to financial exigencies the AWM [1] <https://sites.google.com/site/awmmath/programs/kovalevsky-days> has not received grant funding to support SK days since 2013. At UWEC, we are sustaining our SK days through secured funding from the Provost, the UWEC Foundation, the UWEC Office of Research and Sponsored Programs, the Equity, Diversity, and Inclusivity fellows, and the Mathematics Department, while simultaneously seeking external support. Having an enthusiastic local organizing committee makes our SK days widely applicable to most public institutions. Our SK days differ from other local SK days in that we also use this venue to promote diversity and to broaden the participation of underrepresented groups and WOC in STEM.

Keys to Success

What makes our SK day unique is the challenge to engage students in their own learning by getting them to think outside the box and use mathematics in fun activities where they are challenged but not judged. Past student participants exclaimed “The workshops were challenging and had me learning all the time.” “The workshops made math active and made me enjoy math more.” “They give you new skills to take with you by relating skills to things I already understand.” Many students particularly enjoyed being able to “listen to people from around the country.” They learned that “math and science can be used (in) your daily life” and they learned about “wavelengths” from the Rubens’s tube [3] demonstration. Parents responded that the teacher

workshops impacted their views of math and science “greatly because they now have more resources to help their kids.” Teachers said they liked “new information that they can use to find activities for their classroom.”

The keys to our success are:

- Involving both UWEC and Eau Claire Area School District (ECASD) communities to create a network for the young girls to help them through critical education transition points.
- Involving colleagues and UWEC administration to ensure that the goals of the event align with the mission and purpose of our university.
- Having a team of organizers, passionate about creating opportunities for women in STEM.
- Involving mathematics and mathematics education majors in designing fun-filled enriching HS and MS workshops and activities.
- Building partnerships with local educators and schools.
- Providing professional development opportunities for teachers and parents. Workshops developed by colleagues in mathematics education.
- Creating an environment where young girls can network with prominent women in the mathematical sciences; and
- Continually seeking ways to assess, improve, and expand recruitment by promoting diversity in mathematics and science.

Each year two mathematics/mathematics education undergraduate majors are selected to work with me on designing mathematics-themed workshops and activities suitable for HS and MS girls. The two students conduct background research on instructional design, research methods to learn the importance of getting participant feedback, and effective methods for underrepresented student recruitment and retention. The designed activities are planned by the students, tested by me, and then pilot-tested in a math methods course with fellow mathematics and mathematics education majors. The activities have been focused on topics in calculus, algebra, geometry, trigonometry, probability, statistics, and permutations/combinations.

Math Challenges Competition

Each SK day we created eight engaging and hands-on math challenges for the girls to complete in groups. The girls were grouped in such a way that there would be at least several girls from each parallel student workshop in the group and an undergraduate volunteer with each group. The undergraduate volunteers were given a bag with a math challenge packet, the solutions to the challenge packet, and the materials needed for the eight challenges. Having volunteers for this activity made it run efficiently, and this allowed us to make sure that each group was given the materials at the

same time. Because research shows that girls learn more from hands-on activities, we designed a math competition where the girls would have to use their skills and knowledge of permutations and combinations. After each challenge, the student organizer briefly reviewed the solution to the challenge. If each girl successfully solved their Thinkfun [4] brain teaser (www.thinkfun.com/rectangle) before the competition, they earned their team 2 bonus points! The brain teasers were given to each participant at the start of the day.

Keynote, Diverse Panel, and STEM Colloquium

The keynote speaker for each of our SK days has been a WOC in mathematics. The strategy in choosing our keynote speaker is twofold: to expose student participants to people who they may not be exposed to otherwise because of the demographics in Eau Claire **and** to have WOC serve as conspicuous role models for a STEM population that is increasing. In 2014, Dr. Candice Price, an Assistant Professor at the United States Military Academy at West Point and co-founder of the Underrepresented Students in Topology and Algebra Research Symposium USTARS [5] (www.ustars.org), discussed her fascination with the way that numbers interacted, cool math tricks, and her journey to a doctorate in mathematics during her keynote address titled “My ‘Tricky’ Mathematical Journey.”

The diverse panel and STEM colloquium, organized by Dr. Carolyn Otto, is made up of five women, including two to three WOC; these women are mathematicians or use mathematics in their careers. The panel is an essential component of our event because our participants are given the opportunity to network with and ask questions of our panelists, who travel from all over the country to share their experiences during the panel discussion. Relevant discussion topics have been: *increasing diversity in STEM and ways in which HS and MS girls can make contributions and representation of women in STEM and STEM opportunities for HS and MS girls*. Since participating in our event, two keynote speakers and one panelist have started SK days at their own institutions.

A special STEM colloquium is held for the UWEC community on the evening before the SK day, and during this colloquium, each panelist gives a twenty-minute presentation on his/her research. All students and faculty are: invited to attend, given the opportunity to network with these women, and exposed to research topics being studied across the country. Names of panelists from each year are listed on my web-page [2] people.uwec.edu/lewisc/SK_Day_webpage/SK_Day_2015/skday_index.htm.

Data and Recruitment

Since starting in 2013, significant progress has been made in recruiting for our yearly SK day. This progress is attributed to assessing methods yearly and targeting schools to broaden participation. The most effective methods of recruiting have been through:

- advertisement in school newsletters via partnership coordinators in the ECASD;
- the STEM admissions office, who invited HSs and MSs within a fifty-mile radius of Eau Claire; and
- collaborations with UWEC offices such as the News Bureau, and local organizers appearing on local TV shows.

This year our organizing effort broadened to more effective recruiting of underrepresented groups. Through the UWEC Somali Immersion program, an ongoing partnership and Immersion Experience (IE) between UWEC and two predominately Somali schools in Minneapolis/St. Paul (MSP) Minnesota that has existed for five years, I met with teachers at a Somali community MS. The teachers of the Somali students brought a bus of twenty young girls to participate in our event. For many of the girls who attended from MSP, it was their first trip to a UW school and Eau Claire, Wisconsin. The teachers were excited about making this SK day a regular event for their students. The funding for this trip was supported by UWEC.

To reach underrepresented groups for participation, explore various avenues depending on the demographics in your community. For example, many universities have IEs to promote understanding of diversity, and contacts with other schools and communities are essential to successful IEs. I suggest contacting the facilitators of the IEs and asking them to connect you with their contacts; participating in IEs to broaden participation; recruiting in areas with large underrepresented groups; and working with advocates who desire to increase diversity in STEM. These suggestions made our recruiting efforts more effective.

The number of participants who registered and attended our event each year is given in Table 1. All participants in 2013 were Caucasian, and the ethnicities of the participants in 2014 were Asian, Caucasian, Hispanic, and Native American. In 2015, our recruiting was expanded to MSP, and the ethnicities of the participants were African-American, Asian, Caucasian, and Hispanic. Many students commented that they enjoyed “meeting new people and working in teams and groups with different kids.” These comments show that we are positively impacting these young girls by equipping them with collaboration, problem-solving, and networking skills that allow them to experience, first-hand, the power of mathematics and its limitless possibilities. Tables 2 and 3

demonstrate ethnicity participation for SK days 2014 and 2015.

Table 1. Sonia Kovalevsky Day Participation.

Year	Registered	Attended
2013	24	12
2014	89	64
2015	116	80

Table 2. Ethnicity for Sonia Kovalevsky Day 2014.

Ethnicity	Percentage
Asian	2 percent
Caucasian/White	93 percent
Hispanic	3 percent
Native American	2 percent

Table 3. Ethnicity for Sonia Kovalevsky Day 2015.

Ethnicity	Percentage
African American/Black	20 percent
Asian	4 percent
Caucasian/White	66 percent
Hispanic	4 percent
Other	2 percent
Prefer not to answer	4 percent

Conclusion

UWEC SK days are doing much more than teaching young girls that mathematics is fun and accessible. We are changing the cultures at our schools, and we are exposing young girls to people they would not have had a chance to interact with otherwise because of the demographics of Eau Claire. Participation of women and WOC in STEM is being broadened by teaching girls and young women that diversity in mathematics **does** exist and that gender, appearance, and ethnicity should play no part in dampening their educational or their career goals; they **can** be the next prominent female mathematicians, the next women in STEM.

References

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- [6] ROSA ORELLANA and DAN ROCKMORE, “Sonia Kovalevsky Days and Encouraging Young Women in Mathematics”, *Notices of the AMS*, September 2012.