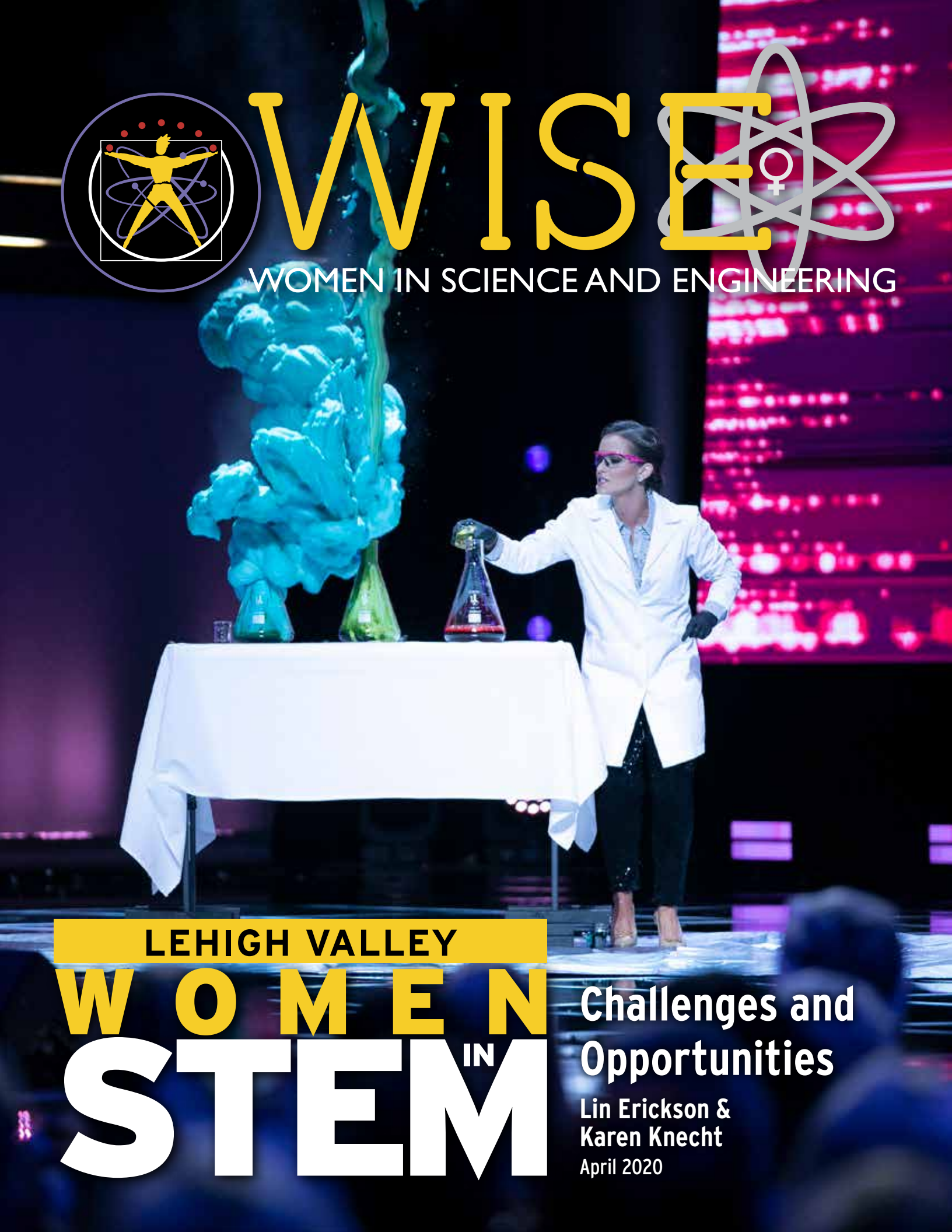

WISE

WOMEN IN SCIENCE AND ENGINEERING

LEHIGH VALLEY

WOMEN IN STEM

Challenges and Opportunities

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On December 19, 2019, Camille Schrier earned the title of Miss America 2020, after performing a science demonstration, the "catalytic decomposition of hydrogen peroxide," live on NBC for the world to view. Her story as a biochemist and repeat pageant winner has been viewed by millions. It will be shared again on PBS39 WLVR 91.3 on September 9, 2020 from 5:30 – 7pm. Ms. Schrier will join other distinguished female leaders in science, technology, engineering, and math (STEM) in a panel discussion hosted by the Da Vinci Science Center (DSC) as part of its annual Women in Science and Engineering (WISE) Forum. Ms. Schrier and her fellow panelists will inspire and motivate the young girls in the audience to pursue their dreams of a STEM career.

THE NEED

Inspiration is only part of the equation. The path to a STEM career, and success and fulfillment once employed, can be challenging for girls and women. Since 2014, the Da Vinci Science Center has been attempting to address these challenges through its WISE Initiative. In 2018, with support from the Institute for Museum and Library Services, the Da Vinci Science Center conducted two studies to better understand the support needed by girls and women in the Lehigh Valley to pursue and persist in STEM careers.

For the Lehigh Valley, it is essential that more women enter and persist in the STEM workforce. The Lehigh Valley is among the top five fastest growing regions in the Northeast and the fastest in Pennsylvania. STEM-heavy occupations make up 19% of all jobs, and the Lehigh Valley's targeted growth sectors for economic development are all STEM-intensive: Advanced Manufacturing and Food and Beverage Manufacturing; High Value Business Services; Transportation, Logistics, Warehousing, and Wholesale; Health Care Services; and Life Science Research and Manufacturing. Between 2018 and 2023, the industry sectors targeted for growth have an anticipated replacement demand of 96,826 workers[1]. Despite women holding 49% of all jobs in the region, they represent 29% of the STEM workforce[2]. Women have the lowest representation in engineering and computer and mathematical sciences, where much of the growth in STEM jobs is occurring. The growing demand for a STEM workforce can be met by hiring more women to work in these fields.

LEHIGH VALLEY WOMEN IN **STEM**

Workforce: 49% female*
STEM Workforce: 29% female

*Source: WIB, Workforce Snapshot, Feb 4, 2020

At the Da Vinci Science Center, girls are underrepresented in STEM out-of-school-time programs. Approximately 37% of the total enrollment in DSC elementary and middle school programs is female, with the percentage declining as students get older, particularly in technology programs (e.g. coding, robotics and video game development). This decline mirrors local STEM achievement test data (Pennsylvania State School Assessment), with female scores on standardized math and science tests dropping dramatically between grades 4 and 8.

[1] The Lehigh Valley Talent Supply and Industry Sector Analysis and Strategic Action Plan, June 2018
[2] WIB, Workforce Snapshot, Feb 4, 2020

THE RESEARCH

The purpose of the research was to assess the needs of K-12 girls, undergraduate women, and women in STEM employment and identify opportunities to enhance the STEM learning and support ecosystem for women and girls in the Lehigh Valley.

NEEDS ASSESSMENT SURVEY

The first study was conducted in 2018-19 by Professor Kerrie Baker, PhD, and Associate Professor Scott Hoke, PhD, at Cedar Crest College. A questionnaire was distributed online to school-age students, college students, and women in STEM careers to assess their interest, perception, participation, and need for continued support in STEM learning and employment. 567 surveys were completed.

FOCUS GROUPS

The second study was conducted by The Melior Group, a marketing research firm in Philadelphia, to 1) identify strategies for engaging more girls in STEM experiences, particularly in middle and high school; 2) explore what kind of assistance women in STEM careers need to support their success and advancement; and 3) identify the marketing and messaging strategies that would be most effective in attracting girls' interest in Da Vinci STEM programs. The Melior Group conducted five focus groups with students in grades 4-12, college students, and working women in STEM. The focus groups took place at the Da Vinci Science Center.

KEY FINDINGS

The ***Needs Assessment Survey*** provided valuable insights about the interests, experiences, and perceptions of school-age students, college students, and working women in STEM careers.

SCHOOL-AGE STUDENTS

- Relatively low numbers of girls expressed interest in STEM fields, both as a future career and as a subject of extracurricular activities.
- Girls perceived careers in STEM to be high paying, but difficult, less exciting, and less flexible.
- Girls were interested in careers where they could help people, work for the good of humanity, have fun, feel respected, and be able to balance work and raising a family.
- Girls had limited encouragement from family, teachers, or the media to study science and math.
- Girls' free time was spent primarily with family and friends or engaging with social media or online videos.
- Girls had limited experience interacting with STEM

US WOMEN IN **STEM**

K-12 Education

Female students' achievement in mathematics and science is on par with their male peers, and female students participate in high level mathematics and science courses at similar rates as their male peers, with the exception of computer science and engineering (NSF, Science & Engineering Indicators, 2018).

*Source: National Girls Collaborative Project

professionals, but many were interested in participating in more of these interactions.

COLLEGE STUDENTS AND WORKING WOMEN

- Survey participants were attracted to STEM fields because of the perceived challenge and the ability to make the world a better place.
- Participants engaged in science and math activities early in their lives and intentionally selected events and programs that created the path to their desired career.
- Participants were encouraged to pursue science and math studies and careers by teachers, family members, mentors, and science and math activities outside school.
- College students were worried about the challenge of their coursework, being female, and gender stereotypes associated with STEM fields. Many of them sought support and guidance from peers, professors, and female role models.
- College students wanted more information about internships and volunteer opportunities, what to do now to prepare for jobs in the future, what jobs will be available in the future, and what jobs are like on a daily basis.
- College students were interested in opportunities for internships and mentoring.
- In the workplace, women were looking for better work/life balance policies, more money, and supportive co-workers/managers.
- Women reported that continuing education, flexibility, freedom to be creative, and good colleagues were important to their success. In contrast, male domination, lack of project management, and limited growth opportunities hindered their progress.

The ***Focus Groups*** provided firsthand feedback on the challenges and opportunities women and girls face in STEM careers and the support they need to persist.

OVERARCHING THEMES:

- All of the participants agreed that women in STEM face gender challenges. Examples included:
  - Being doubted, assumed to be less competent.
    - Nearly all of the high school girls had stories to tell about people who doubted them or were not supportive of their interests and aspirations.
    - Some of the elementary and middle school students were aware of being treated differently than boys in STEM subjects.
  - Being held to different standards, provided less rigorous programs, or singled out for being female.

DA VINCI SCIENCE CENTER

Higher Education*

The rates of science and engineering course taking for girls/women shift at the undergraduate level and gender disparities begin to emerge, especially for minority women (NSF, Science & Engineering Indicators, 2018).

- Since the late 1990s, women have earned about 57% of all bachelor's degrees and half of all S&E bachelor's degrees. However, women's participation in science and engineering at the undergraduate level significantly differs by specific field of study. In 2015, women received over half of bachelor's degrees awarded in the biological sciences; they received far fewer in the computer sciences (18%), engineering (20%), physical sciences (39%), and mathematics (43%).
- In 2016, women from underrepresented minority groups earned more than half of the science and engineering (S&E) degrees awarded to their respective racial and ethnic groups at all degree levels—bachelor's, master's, and doctorate (NSF, Women, Minorities, and People with Disabilities in Science and Engineering, 2019).

*Source: National Girls Collaborative Project

  - Being in situations that are less appealing for women, for example, courses that are lecture only.
  - Having few role models.
  - For working women, having to figure out work-life balance in a way that men simply do not.
- Women and girls want opportunities to be in community with one another, like those offered through the Da Vinci Science Center's WISE Initiative.
  - Women and girls want to be on both sides of mentoring relationships.
  - Girls want to hear stories about women who have "made it," despite naysayers and challenges.
  - Women and girls cited the positive impact of informal interactions and conversations with women in STEM fields, including one-time contacts with people they might never see again.
  - Women cited interest in programs that provide an opportunity for dialog with their colleagues around issues that are important to them.
- Women and girls do not want to be singled out and treated differently because they are female.
- Women and girls want to do things that matter, that affect society.
- Elementary students participate in things that make them feel happy and good about themselves.
- Middle school is a period when girls' interest in STEM is most vulnerable to unraveling. Girls' focus can move towards meeting societal ideals.
- Students are heavily influenced by the people around them, including adults, peers, and the media.
- Middle school girls need coaching to help build their confidence and interest in STEM and appealing role models, both those close to home and media personalities with STEM interests.

ANALYSIS AND RECOMMENDATIONS

Key findings from these local studies mirror the national research on women in STEM fields.

- The learning environment has an impact on girls' interest and achievement in science and STEM careers, both in direct and indirect ways. Cultural stereotypes, unconscious biases, and societal expectations shape the choices girls make, as well as the messages girls get from adult influencers, friends, and the media about what they should study or pursue.
- To prepare Lehigh Valley girls for the 21st century workforce, we need to develop girls' positive perception, interest, and confidence in STEM subjects before high school, when academic choices will open or close doors to postsecondary STEM studies and careers.

STEM Workforce*

Women remain underrepresented in the science and engineering workforce, although to a lesser degree than in the past, with the greatest disparities occurring in engineering, computer science, and the physical sciences (NSF, Science & Engineering Indicators, 2018).

Race and ethnicity are salient factors in rates of participation in the science and engineering workforce (NSF, Science & Engineering Indicators, 2018).

- Hispanics, blacks, and American Indians/Alaska Natives make up a smaller share of the science and engineering workforce (11%) than their proportion in the general population (27% of U.S. working age population).

*Source: National Girls Collaborative Project

- We must educate and share information about STEM fields with K-12 girls and their parents.
- We need to provide an ecosystem of supports and opportunities, beyond what a single program can do, for girls to engage in meaningful STEM activities with their peers, meet STEM professionals, learn about STEM jobs, and develop relationships with appealing role models and mentors.
- We need to expand programs and networks that support women in their STEM careers.

NEXT STEPS

To respond to the needs of women and girls in the Lehigh Valley, the Da Vinci Science Center is reaffirming is commitment to investing in programs for women and girls. Specific strategies include the following:

- Expand programs that build confidence and interest in STEM for girls at the elementary and middle school levels.
- Through marketing and media, demonstrate that all genders will be treated equally and that there will be appealing role models as program leaders.
- To attract more girls to programs with historically low female enrollment, design marketing materials to highlight what's important to them: having fun, being happy, making a difference, and connecting with peers.
- Expand opportunities for women and girls to network with one another, including near peer mentoring programs with middle and high school students.
- Train Science Center educators and mentors on effective strategies for engaging girls.
- Design programs for working women that include social opportunities and themed discussions about issues impacting their success in STEM careers.
- Expand partnerships with community organizations and colleges and universities to enhance the learning and support ecosystem for women and girls in the Lehigh Valley.
- Assess impact as measured by enrollment of girls and women in STEM programs.

CONCLUSION

Like Miss America 2020, Camille Schrier, everyone has a story about their career pathway, filled with challenges and victories along the way. At the WISE Forum, panelists like Ms. Schrier share their personal journeys to STEM careers inspiring young girls to pursue their goals with optimism and resilience. The Forum is one example of a program that our research suggests is so critical in connecting aspiring and practicing female STEM professionals. The studies further our understanding of the hopes, dreams, challenges, and needs of girls and women, allowing us to help them better navigate their journeys and persist in STEM careers. This knowledge will allow the Da Vinci Science Center and the Lehigh Valley community to expand resources to build a pipeline of female STEM workers that will help meet the growing demand for a skilled workforce.

The views, findings, and recommendations expressed in this report do not necessarily represent those of the Institute for Museum and Library Services.

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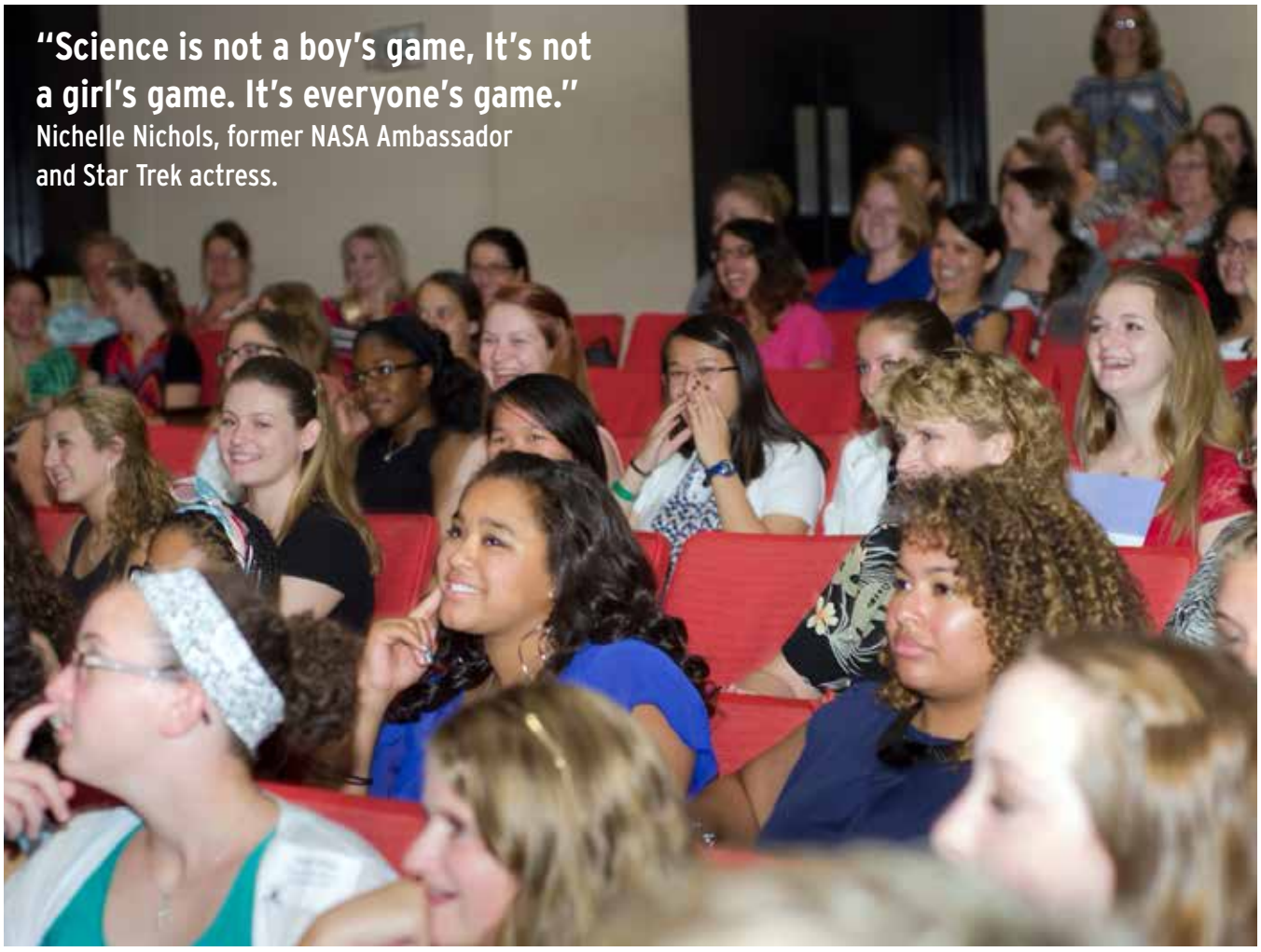

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