

## **Shu Ha Ri: Establish Break Create**

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Interviewee: Nakajima Sachiko

守破離. “Shu Ha Ri”. That’s how Sachiko Nakajima improvises on the piano. She begins with fundamentals [“Shu” 守]. Then breaks that frame [“Ha” 破]. Finally, she escapes to create her own world [“Ri” 離]. After interviewing Nakajima, I’ve seen how she integrates this principle in all walks of her life: whether it be math, music, or education.

Sachiko Nakajima’s interest in math blossomed in middle school. She had a teacher who would constantly tell the class that “math is beautiful” and would give questions that were unrelated to tests. Unlike the test questions, which required quick mathematics, these questions excited Nakajima because she couldn’t immediately solve them. About the same time, Nakajima also discovered monthly math questions released by Péter Frankl, a former International Math Olympiad gold medalist. She still remembers the immense satisfaction she felt after solving one particular question that had stumped her for a whole month.

Nakajima’s passion for mathematics continued in high school, as she became the first and still only Japanese woman to win gold in the International Math Olympiad. Besides being a mathematician, Nakajima is now also a jazz pianist and composer. And as the founder and CEO of steAm.Inc, she educates the public on the inherent connection that exists between math and music and the importance of including the Arts in STEM (science, technology, engineering, and math). “Sometimes in math,” she says, “we see equations that are really beautiful like music. Sometimes in music, we require the freedom of mathematics to try multiple different approaches and doubt things that are thought to be obvious”. After developing foundations in math and music [“Shu” 守], Nakajima broke the barrier between these two disciplines [“Ha” 破].

As a woman in mathematics, Nakajima has faced various struggles. She lives in Japan, which is ranked 120th among 156 countries by the 2021 global gender gap index. In order to enact change, Nakajima and other STEM women in Japan have begun attempting to quantify gender disparities by looking at participation rates at math conferences, or counting the number of female vs male speakers at a STEM event. Nakajima believes the biggest problem that currently exists in Japan is the lack of data around gender disparities. She hopes that by quantifying the problem, more people and institutions will be moved to change.

Furthermore, on a smaller scale, but equally significant, Nakajima emphasizes the importance of speaking out. Nakajima states that sometimes men can say things that are disrespectful to women without any bad intentions, but out of unconscious bias. However, Nakajima notes that especially in Japan, where talking back is particularly frowned upon and women are often told to conceal their hurt within, it is important that women speak up and let men know the unintended consequences of their actions in such situations. By speaking up about gender disparities, Nakajima is working to pave the way for other future women in STEAM in Japan.

Nakajima also fights against the gender gap by hosting various programs throughout Japan for girls and their mothers to explore mathematics. Nakajima uses topics such as cryptography as a way to engage students at all different math levels and to expose students to a type of mathematics that isn't taught at schools. Having participated myself in one of her programs 3 years ago, I saw how Nakajima's interactive workshops allowed both girls who already liked math and girls who didn't find interest in the subject to have fun throughout the session.

Besides just educating girls, Nakajima (who has a daughter herself) invites their mothers to come as well. However, rather than participating alongside their daughters, the mothers are sent to a different room and split into groups to try to tackle the same challenge that was also given to their daughters. By purposefully creating an environment with only mothers, Nakajima encourages the mothers to also have fun with mathematics. I remember how pleasantly shocked I was when I saw my own mother, who has constantly told me that she does not like math, come back excited and full of confidence as her team presented their mathematical solution to everyone at the event.

Recognized for her profound impact on STEAM education, Nakajima was selected as one of eight Thematic Project Producers for the 2025 World Exposition held in Osaka, Japan. In charge of the concept of "learn and play" as well as arts and sports, the theme of Nakajima's pavilion is "invigorating lives". By considering anyone 0-120 years old as a "child", the concept of her pavilion lies around "children" all around the world coming together and interacting with the exhibition. Everyone who comes is an innovator who will help "complete" the currently "incomplete" pavilion. 100 different schools will create their own vision of the future world which will be showcased in the pavilion, but she hopes that people who come can then further transform those ideas to create new prototypes. Along with a "LIVErary", "MUSEum", and "STEAM Atelier", she hopes to create an environment full of learning where participants can pose infinite questions and explore infinite answers, similar to her favorite subjects: math and music.

For girls interested in math, Nakajima gives advice that mathematics is a very broad field. Even if one type of mathematics doesn't interest you, what's important is to explore the various options and find the mathematics that best fits you.

To those who aren't currently interested in math, she says that you can love mathematics even if you aren't necessarily "good" at it. And even if you don't end up pursuing mathematics, she says that mathematics is everywhere. After all, Nakajima's favorite phrase is: "you are also a mathematician".

When asked what her next goal was, Nakajima replied that the Expo is an important event for her. However, beyond the 2025 World Expo, Nakajima wants to shake the world. For Sachiko Nakajima, the Expo is only a starting point through which she hopes to lead the creation of a new world ["Ri" 離].

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