

Mathematics education's most prestigious awards

ICMI column in this issue presented by Alan H. Schoenfeld and Kaye Stacey

The ICMI awards for mathematics and mathematics education

Much as the International Mathematics Union (IMU) offers awards for distinguished contributions to various aspects of the mathematical enterprise,¹ the International Commission on Mathematical Instruction (ICMI) awards three prizes recognizing outstanding achievement in different aspects of mathematics education. And, just as the IMU awards are awarded every four years at the opening ceremony of the International Congress of Mathematicians (ICM), the ICMI awards are presented every four years at the opening ceremony of the International Congress on Mathematical Education (ICME).² The three awards are:

- The Felix Klein Award, which honors lifetime achievement in mathematics education. As explained below, awardees are typically senior scholars who have made multiple contributions, in breadth and depth, that forward the enterprise. In this, the Klein Award parallels the IMU's Chern Medal.
- The Hans Freudenthal Award, which honors a major cumulative program of research. Such work is frequently but not always done by a younger scholar. In this, the Freudenthal Award parallels IMU's Fields Medal.
- The Emma Castelnuovo Award, which recognizes outstanding achievements in the practice of mathematics education. Such work might involve a program of instructional design, textbook development, assessment, models of teacher preparation, or other work that advances the state of practice. In this, the Castelnuovo Award perhaps most parallels IMU's Gauss Prize. Awardees receive certificates that highlight their contributions to mathematics education and medals that commemorate them.

The three awards encapsulate varied aspects of mathematics education as they have evolved chronologically. Klein, of course, was the ultimate mathematician, who developed a strong interest in mathematics education and advocated modernization of the curriculum. His name alone highlights the importance of mathematics

at the center of mathematics education. Freudenthal was a mathematician who also studied student thinking and learning, and applications of these ideas as a foundation for theorizing instruction. This opened up possibilities of mathematics education as an empirical discipline. Castelnuovo opened the space of instruction to building on children's thoughts and ideas, helping students to mathematize real-world phenomena and to build on their ideas and intuitions. As such, these three awards symbolize the breadth and scope of the theory and practice of mathematics education.

In the following sections there is some detail about the people after whom the awards are named and the criteria for each of the awards. There is some information about the committee processes involved in the selection of the awardees, and information that may assist in developing a nomination for the 2028 awards. The ICMI website gives further information about all aspects of the awards and official instructions for making a nomination. Our aim for this article, as the chairs of the award committees, is to set the awards in context and encourage nominations for 2028.

The Felix Klein Award, for lifetime academic achievement in mathematics education

Felix Klein (1849–1925) needs no introduction to a mathematical audience. Klein had a broad theoretical sweep. He was celebrated for revolutionizing geometry via group theory in his 1872 'Erlangen Program,' in which geometries were classified by their symmetry groups. More broadly, he was known for a wide range of mathematical syntheses, e.g., advanced function theory, specifically the study of Riemann surfaces, elliptic modular functions, and automorphic functions, for which he created a unified view. Klein was collaborative. He established Göttingen as a premier mathematical research center, fostering collaborations between pure and applied mathematicians.

Klein was a strong supporter of Göttingen's admitting women to study. He supervised Grace Chisholm Young's PhD thesis in mathematics. Young was the first woman to receive a doctorate in any field in Germany. And, Klein had an abiding interest

¹ <https://www.mathunion.org/imu-awards/imu-awards-prizes-and-special-lecture>

² <https://www.mathunion.org/icmi/icme/icme-international-congress-mathematical-education>



Felix Klein.

in mathematics instruction. He pioneered the idea of examining ‘elementary mathematics through an advanced viewpoint,’ an enrichment of elementary mathematical ideas for teachers – a concept that is embodied today by ICMI’s Klein Project.³ Klein was an advocate for connecting mathematical research with industrial applications and for reforming school curricula to treat mathematics as a connected whole. Presumably in response to these achievements and efforts, in 1908 Klein was elected the first president of the International Commission on Mathematical Instruction (ICMI).

The Felix Klein Award is awarded for lifetime academic achievement in mathematics education. This award acknowledges distinguished scholars who have shaped the field of mathematics education over the course of their careers. It honors those candidates who have made substantial research contributions, typically along multiple lines of inquiry, and have also introduced new issues, ideas, perspectives, and critical reflections. Additional considerations include leadership roles, mentoring, and peer recognition, as well as the actual or potential relationship between the research conducted and the improvement of mathematics education at large, through connections between research and practice. As you can see from the list of awardees that follows, each of the awardees made many and varied contributions. It should also be apparent that there is no simple template for the award: different awardees made different kinds of contributions.

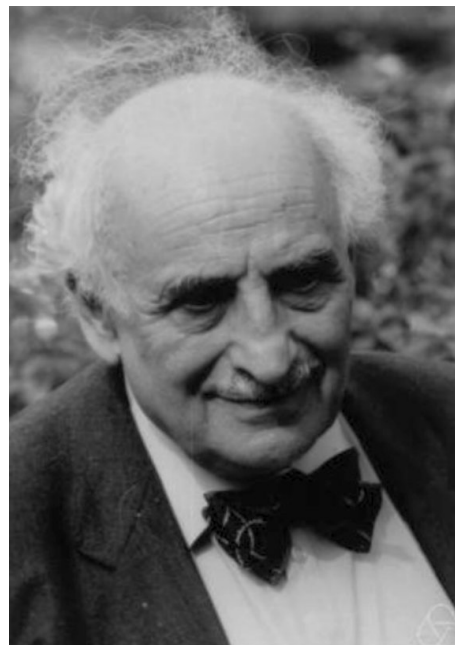
The Felix Klein Award, first granted in 2003, was at first biennial, and later quadrennial. The complete list of awardees to date is: Guy Brousseau (2003), Ubiratan D’Ambrosio (2005), Jeremy Kilpatrick (2007), Gilah Leder (2009), Alan Schoenfeld (2011), Michèle Artigue (2013), Alan Bishop (2015), Deborah Ball (2017), Tommy Dreyfus (2019), and Ferdinando Arzarello (2024).

The Hans Freudenthal Award, for a major program of research on mathematics education

Hans Freudenthal (1905–1990) was a renowned German-Dutch mathematician, educator, and philosopher. Freudenthal made significant contributions to Lie group theory, geometry, and the foundations of mathematics. His major contributions to mathematics education center on his reconceptualization of mathematics as a human activity and his development of Realistic Mathematics Education (RME), a theory that has shaped curricula, research, and international assessment beginning in the Netherlands but now influential in many countries.

Freudenthal argued that mathematics should not be presented as a finished system of abstract structures but as something people do to organize and understand reality. He maintained that students ‘learn mathematics by mathematizing,’ that is, by structuring real or imagined situations with progressively more formal mathematical tools. Teaching should begin with students’ experiences and gradually work towards mathematical theory. This view opposed concept-attainment approaches in which learners are confronted mainly with ready-made definitions and formal exercises and engage in applications later.

Realistic Mathematics Education was developed from the 1970s onward in Utrecht. RME treats learning mathematics as guided reinvention: students are supported to reinvent central mathematical ideas for themselves along trajectories that echo historical and didactical development. Characteristic principles include



Hans Freudenthal. (© Konrad Jacobs, Erlangen; Archives of the Mathematisches Forschungsinstitut Oberwolfach)

³ <https://www.mathunion.org/icmi/projects/klein-project>

mathematizing meaningful situations, progressive formalization from informal strategies to symbols, and a continual back-and-forth between reality-based models and more formal structures. This approach directly informed the notion of ‘mathematical literacy’ that underpins the Program for International Student Assessment (PISA) assessments, a major international assessment program sponsored by OECD.

Freudenthal was widely influential. He founded the Institute for the Development of Mathematical Education (IOWO) at Utrecht University in 1971. IOWO, renamed the Freudenthal Institute after his death, has been a major R&D center for both curriculum and assessment, in mathematics and science. He was also the founding editor of the journal *Educational Studies in Mathematics*, still one of the top journals in mathematics education. He also served as president of the International Commission on Mathematical Instruction (ICMI) from 1967 to 1970 and organized the first International Congress on Mathematical Education (ICME), which was held in Lyon, France, in 1969. The first International Congress of Mathematicians was held more than seventy years earlier, in 1897.

Freudenthal’s work exemplifies a major, focused program of research and development – the pursuit of an important idea in multiple ways, with implications and applications across a range of areas. Accordingly, the Hans Freudenthal Award acknowledges the outstanding contributions of an individual’s theoretically robust and coherent research program, which has had a clear impact on our research community. It honors a scholar who has initiated a new research program and has brought it to maturation over the past decade or more. Freudenthal awardees should also be researchers whose work is ongoing and who can be expected to continue contributing to the field. In brief, the criteria for this award are depth, novelty, sustainability, and impact of the research program. As is the case for the Klein Award, there is no simple template for achieving this honor: different awardees have made different kinds of contributions.

The Freudenthal Award, first granted in 2003, was at first biennial, and later quadrennial. The complete list of awardees to date is: Celia Hoyles (2003), Paul Cobb (2005), Anna Sfard (2007), Yves Chevallard (2009), Luis Radford (2011), Frederick Leung (2013), Jill Adler (2015), Terezinha Nunes (2017), Gert Schubring (2019), and Ole Skovsmose (2024).

The Emma Castelnuovo Award, for outstanding achievements in the practice of mathematics education

This is the most recently established ICMI award. Whereas mathematics is a unique creation of human thought, a universal discipline reaching back to the beginning of civilization and central to modern life, mathematics education has a different character. At heart, it has a social purpose, so that more people learn more mathematics with



Emma Castelnuovo. (Photo by Raimondo Bolleta, courtesy International Mathematical Union / International Commission on Mathematical Instruction)

more success and more satisfaction. The Castelnuovo Award addresses this ambitious goal, which is fundamental to the existence of ICMI.

The award was established on the 100th birthday of Emma Castelnuovo (1913–2014). Castelnuovo was an Italian mathematician from a famous Italian mathematical family. Her father, Guido Castelnuovo, was a foundational figure in the early years of ICMI. Emma Castelnuovo’s career in academic mathematics was thwarted by antisemitic laws in Italy at the time of the Second World War. After the war, she became a very influential mathematics teacher. An example of the approaches she used is given by an article⁴ she contributed to the first volume of *Educational Studies in Mathematics*, on her teaching of affine functions in early secondary school. The article is richly illustrated with images of models of geometric figures used to show transformations (e.g., of a square to a parallelogram) and the associated algebra. Although this was the era of ‘new math,’ hers was not an abstract approach, but designed so that students would experience mathematics in action. Castelnuovo committed herself to research and development of learning materials in mathematics education, aiming for students to use observation and visualization, to puzzle over unexpected outcomes and eventually to arrive at previously unknown results,

⁴ E. Castelnuovo, [Les transformations affines dans le 1er cycle de l’école secondaire](#). *Educ. Stud. Math.* 1, 274–288 (1969)

without being told. She deeply influenced mathematics education in Italy and Spain.

The first Emma Castelnuovo medal was awarded to Hugh Burkhardt and Malcolm Swan in 2016. Their joint work at the Shell Centre for Mathematical Education at Nottingham University had resulted in educational principles and extremely well-designed and imaginative teaching and assessment materials used around the world. The second award went to the National Council of Teachers of Mathematics (NCTM), the mathematics teachers' association for the USA and Canada, for its influential curriculum leadership, its journals for teachers, its conferences, its promotion of research and its advocacy. Clearly the NCTM has long been the most influential body in the practice of mathematics education in the English-speaking world. But making the award to an organization raised an issue for the ICMI Executive Committee. Was the award intended for organizations or even governments, or like the other awards, for individuals or small groups of colleagues who have worked together over time? The criteria for the award were subsequently altered to clarify the rules. The 2024 medal was awarded to Kaye Stacey, a researcher and teacher educator who gave special attention to translating her research findings so that they had an impact on practice.

Given the huge range of individuals or small groups involved in the practice of mathematics education (e.g., teachers and teacher educators, curriculum designers, software developers, assessment leaders, charismatic speakers), the diversity of nominations for the Castelnuovo Award is even greater than for the other awards. The criteria⁵ are written to be as inclusive of all these roles as possible. For this award, the essential feature is to demonstrate a positive influence on mathematics learning for schools, districts, regions, or countries. A benefit of the award is that it showcases models and exemplars of inspirational practices.

Committee processes

As explained below – the processes are highly confidential – there is only so much we can say about the processes used by the committees. The goal is for each selection process to be as fair as we can make it, while at the same time insulating committee members from pressure as much as possible. Thus, with the exception of the committee chairs, the names of committee members are kept secret while they are serving their terms. The committee member selection process is intended to be as broadly representative as possible. The ICME President is copied on all correspondence of each committee, which is permanently archived – and embargoed for 50 years! That's prudent, given that the correspondence concerns detailed discussions of the merits of individual candidates. However, committee chairs write reports to the ICME Executive

Committee providing details regarding committee processes and describing issues that need resolution. Significant issues that arise during deliberations are brought to the ICMI Executive Committee. For example, we have already been asked during this award cycle whether it would be possible to nominate for the Freudenthal Award a pair of researchers who collaborated intensively on the work that comprised the substance of the nomination. The Executive Committee was sympathetic to the idea but determined that its implementation should not take place until the beginning of the next award cycle, rather than possibly placing some candidates at a disadvantage because the announcement was not made at the beginning of this cycle.

What we can say is that the actual process is taken with great seriousness by the committees, with many rounds of discussions. The process begins with ICMI's attempt to publicize the awards widely – hence this article! – to insure, as best we can, that worthy candidates worldwide are encouraged. As you will see from the nomination requirements below, the nomination packages are quite substantial.

Even when considering a single award, there is a wide range of factors that one can consider. For the Klein Award, for example, how broad and deep are the candidate's contributions? How much does a candidate's theoretical impact matter? What about the candidate's methodological contributions? Impact on practice through editorship or through development of materials? Through leadership? Are these contributions truly international? Then, there is the question of how one weighs some of these contributions against others. If candidate A is stronger in some arenas and candidate B is stronger in others, how do you decide between them? Each field of candidates brings new challenges, because these are not abstract questions – their resolution depends very much on the particulars of the work. Similarly, definitions are not fixed: over the course of someone's career, a theoretical idea that was decidedly outside the mainstream may evolve to the point where it is considered central, or the very nature of what is considered 'theory' may evolve. (To give two examples deliberately chosen from outside our purview, we might think about how Piaget's ideas about constructivism have been regarded over the years, and the controversial decision by the Nobel Prize committee to award the 2016 prize in literature to Bob Dylan.) There are analogous issues in attempting to calibrate the importance of varied lines of work and their impact in both the Freudenthal and Castelnuovo awards.

Please nominate suitable candidates!

The awards process best serves the mathematics education community if it is broadly representative and international. We encourage you to nominate candidates who merit consideration. Creating the nomination package is a lot of work, but we promise that all

⁵ <https://www.mathunion.org/icmi/awards/emma-castelnuovo-award>

nominations will get very serious attention. Moreover, although only one nomination is chosen to win each award, the very fact of having been nominated is very heartening to the nominee. With only one award of each medal every four years, it is often the case that excellent candidates miss out. Repeat applications are encouraged.

Making a nomination

For official details about the nomination process, see the call for the ICMI awards.⁶ In addition, nominators might like to consider the following informal advice. First, it is probably easiest if a nomination is prepared by a very small group of reasonably senior mathematics educators. This shares the work, provides multiple perspectives on the nominee's achievements, and brings a good range of contacts who may give additional support. Typically, nominators tell the candidates that they plan to nominate them, especially because nominees usually need to share information with them. Second, the nominating group needs to identify a few strong themes around which coherent arguments for the award can be presented. It is likely that the nominee has made contributions to multiple aspects of mathematics education, but not everything they have done needs to be part of the application. Third, there is an opportunity to have letters of support from others – choose them well, so that they clearly support the main aspects of the candidate's suitability for the award.

Key dates

The 2028 awards will be conferred at the ICME-16 opening ceremonies in Prague, Czech Republic on July 9, 2028. Nominations for the awards are due by November 30, 2026. All nominations for the 2028 awards must be sent to the chair of the appropriate committee using the email addresses listed below.

- Felix Klein Award, Committee chair: Alan Schoenfeld, chair@klein28.mathunion.org
- Hans Freudenthal Award, Committee chair: Alan Schoenfeld, chair@freudenthal28.mathunion.org
- Emma Castelnuovo Award, Committee chair: Kaye Stacey, chair@castelnuovo28.mathunion.org

Alan H. Schoenfeld is a Distinguished Professor of Education and Mathematics at the University of California, Berkeley. His interests focus on mathematical thinking, teaching, and problem-solving, with the goal of helping all students become mathematically powerful thinkers. Schoenfeld, who was awarded the Felix Klein award in 2011, chairs the Felix Klein and Hans Freudenthal award committees.

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Emeritus Professor Kaye Stacey chairs the selection committee for the 2028 Emma Castelnuovo Award. She won the award in 2024. She was holding the Foundation Chair of Mathematics Education at the University of Melbourne. Her broad research interests include mathematical thinking and problem-solving, assessment, the school curriculum and new technologies. She is author of many articles and books in mathematics education reporting research and promoting the practical application of research findings.

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⁶ <https://www.mathunion.org/icmi/awards/call-2028-icmi-awards>