



Newsletter

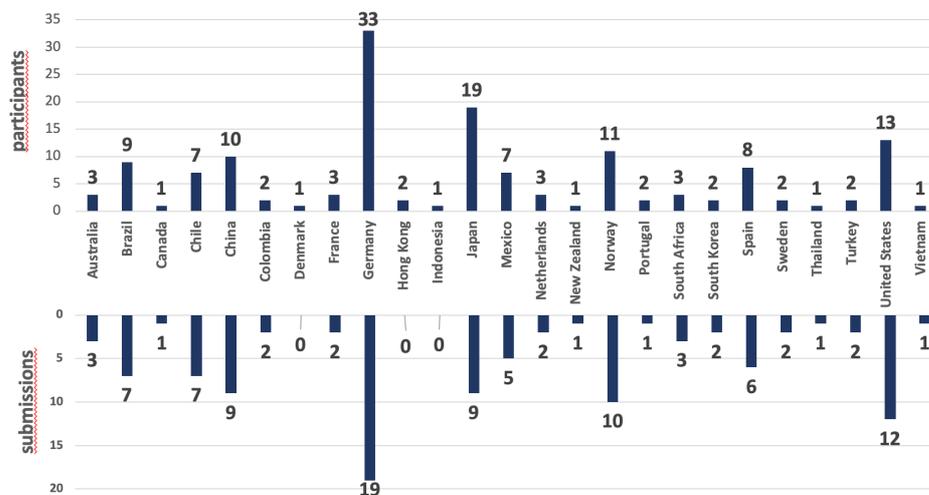
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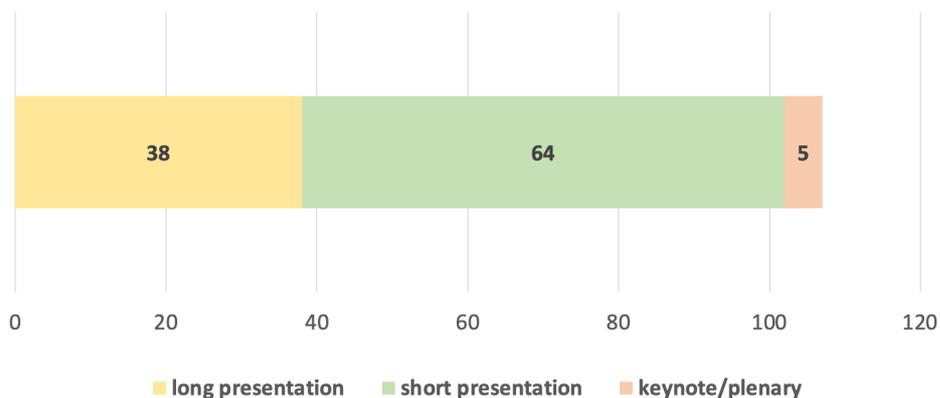
Report from Latest Conference ICTMA20 in Würzburg, Germany

ICTMA20 was successfully organised by the team of the Chair of Mathematics V - Didactics of Mathematics, **Chair Prof. Hans-Stefan Siller**, in the period 24-27 September 2023. Due to the necessary early decision, the conference was held online and virtually; thus, many participants could take part who would not have been able to attend due to country-specific travel restrictions and/or budgetary constraints. Based on the feedback from the participants, the organisers can assume that the conference was a resounding success. The scientific programme consisted of a keynote speech by Prof. Dr. Vince Geiger and four plenary lectures by Prof. Dr. Pauline Vos, Dr. Katrin Vorhölter, Dr. Xiaoli Lu and Prof. Dr. Milton Rosa as well as 102 long and short lectures. For the conference itself - without the team from Würzburg - 147 participants had registered.

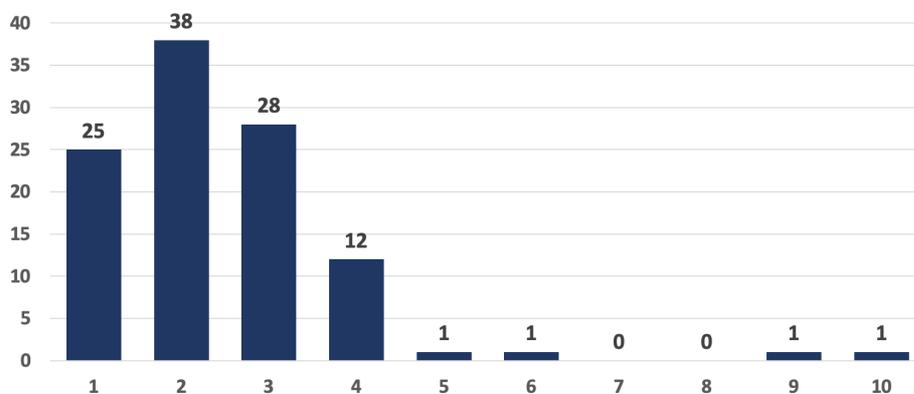
Participants and submissions per country of the submitting author



107 presentations, sorted by eleven topics



Number of submissions with ... authors



Furthermore, the Henry Pollak Award was presented for the first time in Würzburg. Within the framework of the virtual conference, this award ceremony was held in presence and the Henry Pollak Medal was presented on the spot. Viktoria Pohl on the piano and Prof. Kolla on

the saxophone gave the award ceremony an extraordinarily festive character with the selected jazz pieces. Also worth mentioning was the supporting programme of the conference, which included a virtual city tour and a virtual wine tasting for the participants. (S. Gerber, W. Weigel, H.-S. Siller)

The Henry Pollak Award 2021 - An ICTMA Career Research Medal

The ICTMA Career Research medal named The Henry Pollak Award established at ICTMA18 in Stellenbosch has been awarded for the first time in 2021 and has been announced at the ICTMA20 virtual meeting at 21st September 2021. The ceremony took place in 2022 at the official ICTMA20 conference.



The Henry Pollak Award is awarded to three eminent scholars due to their impressive research - not only in mathematical modelling - over decades, progressing the empirical discourse on mathematical education, important theoretical work on mathematical modelling, amongst others the understanding of mathematical modelling, modelling competencies, modelling cycles and their strong commitment to the progress of ICTMA as community.

Prof. Dr. **Werner Blum**, University of Kassel (Germany)

Prof. Dr. **Peter Galbraith**, The University of Queensland (Australia)

Prof. Dr. **Mogens Niss**, Roskilde University (Denmark)



The award winners with laudator G. Kaiser and organizer H.-S. Siller. (H.-S. Siller (left), W. Blum (middle left), P. Galbraith (screen), M. Niss (middle right), G. Kaiser (right))

Laudatory Speech by President of ICTMA - Prof. Gabriele Kaiser

Dear friends and members of ICTMA,

It is my great honour and pleasure to chair the ceremony for the ICTMA Career Research medal, named Henry Pollak award, which is taking place for the first time.

This award was proposed at ICME-13, the 13th International Congress on Mathematical Education, which took place in 2016 in Hamburg. It was then formally established by the Executive Committee at ICTMA18, which took place in 2017 in Cape Town. I proud that we managed to implement this award by an award committee, however, the names of the committee members are not allowed to be named as it is usual practice.

The criteria for the recipient of the Henry Pollak award are a career that exhibits the following:

- 1. sustained and distinguished achievement in mathematical modelling education research projects;*
- 2. research that has made a broad impact;*
- 3. an outstanding record of quality of scholarship; and*
- 4. research-related contributions and service to ICTMA over a period of time.*

Why did we name this award Henry Pollak award?

Henry Pollak is an Austrian-American mathematician known for his contributions to information theory, and graph theory. He worked at the Bell Labs as director of the Mathematics and Statistics Research Center applying mathematics to solve problems in communication theory, discrete systems, statistics and data analysis. Later, he joined the mathematics department at the renowned Columbia University.

With this rich background as an applied mathematician he became interested in mathematics education and he was responsible for the Section “The Interaction between Mathematics and Other School Subjects” at the 3rd International Congress on Mathematical Education (ICME-3), which took place in 1976 in Karlsruhe. Werner Blum was appointed as responsible German coordinator. Henry Pollak developed already at this time the distinction of mathematics and the rest of the world with an accompanying modelling cycle, which has been quoted very often in the past. He gave plenary lectures at several ICTMAs, ICTMA1 in 1983 in Exeter, ICTMA3 in 1987 in Kassel and ICTMA16 in 2013 in Blumenau. Since then, he has accompanied the discourse on mathematical modelling education with strong interest. We were therefore very happy, when Henry accepted our invitation to name this newly created award after him.

The Henry Pollak Award is granted to three eminent scholars due to their impressive research over decades – not only in mathematical modelling –, progressing the empirical discourse on mathematical education, important theoretical work on mathematical modelling, amongst others the understanding of mathematical modelling, modelling competencies, modelling cycles and their strong commitment to the progress of ICTMA as community.

In the procedure for the award nothing is said, how many awardees shall receive the award in one cycle. However, due to the strong working connections of these three scholars the selection committee decided to give this award to those three awardees as they have

contributed equally strong to the discourse on mathematical modelling education and to the flourishing of ICTMA as community.

I now wish to acknowledge the achievements of each awardee in more detail in alphabetical order.

Werner Blum is a retired professor at the University of Kassel, where he worked since 1972. Werner Blum's strong commitment to modelling in the scientific community is evident in the many conference contributions to ICTMA as well as in the publication of the proceedings of ICTMA. The International Commission on Mathematical Instruction (ICMI), as the international umbrella organization for mathematics education, has decisively shaped Werner Blum's work on modelling and application in several ways: Werner Blum acted as part of the preparation for ICME-3 as the German coordinator for the subject area "The Interaction between Mathematics and Other School Subjects" as already mentioned. The definition of applications of mathematics developed there by Henry Pollak and their graphic representation can be found again and again in Werner Blum's approaches to modelling and applying mathematics later on.

At the Sixth International Congress on Mathematical Education (ICME-6) Werner Blum led the Topic study group "Mathematics and Other Subjects" and gave a joint overview lecture with Mogens Niss on "Problem Solving, Modeling and Applications". Werner Blum and Mogens Niss still maintain this fruitful partnership to this day visible in many joint publications. At the beginning of the new millennium, Werner Blum functioned as chair of the 14th International ICMI Study on Applications and Modelling in Mathematics Education, organized the study conference in 2004 and, with his long-time colleagues Mogens Niss, Peter Galbraith, and Hans-Wolfgang Henn, published the associated study volume. This study volume is still shaping the current discourse on mathematical modelling and application and is most quoted one amongst the ICMI studies. In 2012 Werner Blum gave a plenary lecture at the 12th International Congress on Mathematical Education (ICME-12) in Seoul, in which he comprehensively presented the state of the discussion on modelling and application. Furthermore, at ICME-13, which took place in Hamburg in 2016, Werner Blum played an important role in the representation of mathematical modelling as a European didactic tradition including applications and modeling. Werner Blum developed the acronym ICTMA while hosting the third conference of this kind in Kassel. He was the continuing editor of the ICTMA proceedings and co-editor of all volumes from 1993 up to 2015, with a very few exceptions. But he contributed to ICTMA as plenary speaker as well, namely ICTMA4 in Roskilde in 1989, ICTMA6 in Delaware in 1993 and ICTMA14 in Hamburg in 2009. To summarize Werner Blum has shaped the ICTMA community since its very beginning under a theoretical and empirical perspective.

Peter Galbraith is currently an honorary professor at the University of Queensland and a Fellow of the Institute of Mathematics and Applications. He is a member of International Mathematical Union Circle, in which IMU honors the efforts of mathematicians in the representation of IMU.

During much of his academic career Peter Galbraith pursued two research and development avenues in parallel. While involved in researching and promoting the teaching and learning of modelling within Mathematics Education, he was simultaneously engaged in addressing real-world problems suited to methods of System Dynamics modelling. This provided unique opportunities to work in educational task design and the classroom implementation was influenced by parallel work as a modeller.

The career of Peter Galbraith has involved research-related contributions and service to ICTMA over an extended period of time. He has attended ICTMA since 1993 being the Chair of ICTMA8 in Brisbane in 1997. He has worked strongly together with others towards the recognition of ICTMA as an Affiliated Study Group of ICMI. He presented ICTMA as an Affiliated Study Group of ICMI at ICME-10, which took place 2004 in Copenhagen, chaired by Mogens Niss. He served as president of ICTMA from 2003 to 2007 before he was a member of the executive committee of ICTMA from 2002-2007. In addition, he contributed strongly to ICTMA as plenary speaker, at ICTMA6 in 1993 in Delaware, ICTMA12 in 2005 in London, and ICTMA15 in 2011 in Melbourne and furthermore as Symposium Chair/Plenary Panelist at four ICTMAs.

He has worked for ICTMA as editor of several ICTMA proceedings and served as reviewer for all ICTMA proceedings. Furthermore, he served as member of the International Program Committee for ICMI Study 14: Modelling and Applications in Mathematics Education and edited the already mentioned book jointly with Werner Blum, Mogens Niss and Wolfgang Henn.

To summarize, Peter Galbraith has strongly contributed to the discourse of mathematical modelling education and the flourishing of ICTMA as community.

*Our third awardee, **Mogens Niss** is a retired professor from Roskilde University, where he worked since 1972. The teaching and learning of mathematical modelling and related aspects have been the core of his research from the start of his career until today. He has contributed significantly to the formation and development of this field of research. He has analyzed the development of the field several times and produced surveys and state of the art papers setting landmarks for the development of the research field. The impact of his research for the development of the field is evident in the long row of books based on the ICTMA conferences, for which Niss has contributed as editor and author. His theoretical work has led to significant advances of knowledge in research on mathematical modelling. The conceptualization of mathematical competence to include modelling competency in the frame of the KOM project and the unfolding of modelling competency at different levels and branches of mathematics teaching is one major contribution with international impact. More recent examples are the role of prescriptive modelling in modern societies and its inclusion in mathematics teaching.*

His achievements in and impact on mathematics education are also evidenced by leadership roles in important research organizations. He served eight years as the Secretary-General of the International Commission on Mathematics Instruction (ICMI) (1991-1998). He was the chair of the International Programme Committee of the 10th International Congress on Mathematics Education (ICME-10), which took place in Copenhagen 2004. He was a member of the International Program Committee for ICMI Study 14 on “The Teaching and Learning of Applications and Modeling” and joint editor of the consequent study volume together with Werner Blum, Peter Galbraith and Hans-Wolfgang Henn. He has also been until today a member of the editorial board of the Springer book series, International Perspectives on the Teaching and Learning of Mathematical Modelling, in which our proceedings and other modelling books have appeared.

He has contributed strongly to ICTMA, organizing ICTMA4 1989 in Roskilde, giving plenary lectures at ICTMA13 in Bloomington in 2007 and ICTMA16 in Blumenau in 2013.

To summarize, the outstanding theoretical contributions of Mogens Niss on research on mathematical modelling education have shaped together with its empirical implementations the current modelling discourse.

Overall, I hope that I could show how these three scholars have worked together as colleagues and friends and moved forward jointly the discussion on mathematical modelling education and its research. We all have to learn from you, from your intellectual brightness, your perseverance and your ability to cooperate and work together. We are all bowing to your achievements, which justify to grant you the Henry Pollak Award. Congratulations.

Greetings from Henry O. Pollak

It is a particular pleasure for me to introduce the awards for Werner Blum, Mogens Niss, and Peter Galbraith. I have learned so much from them and their students in recent years. Werner has introduced me to many aspects of the cycle from the original situation to the mathematical model and then back to the original situation and the verification of the model. One aspect of this which I have learned is that students do not do this in only one direction, but go back and forth many times. I had not realized this. When I learned this, I examined what I did myself, and discovered that I myself went back and forth many times. I just had not noticed it, and nobody until Werner had told me to look for it. A welcome step forward.

Mogens Niss told me that there were two different types of modeling, descriptive modeling and prescriptive modeling. Initially I found this distinction difficult. As you all know, descriptive modeling takes a situation outside of mathematics, idealizes it, mathematizes it and then you check whether you have succeeded. As I had learned from Blum, the “and then” is not true, it may go back and forth many times. But as Niss taught me, you may wish to design a structure to have certain properties you desire – can you or can’t you? Most educational are some of Niss’ favorite examples: How do you want to define body index, and how should income inequality be described? I also find it especially interesting, and perhaps a throwback to my earlier habits, to see if a particular property is or is not achievable. But earlier habits are hard to give up, and prescriptive modeling is an especially valuable point of view.

In my life I went through many stages, from pure mathematics to mathematics in industry, to rethinking of school mathematics and then of tertiary mathematics, and finally to teacher education. Nothing was more inspiring and valuable than Peter Galbraith’s work on the conflicting purposes of traditional mathematics education and of mathematical modeling. What is each of them for? Are they conflicting or do they support each other? Read Peter’s examples, and think about them, and then read them again! They are enormously valuable. How can modeling and traditional education be tailored to support each other and not be in conflict? And what do employers want? Do they know? They are not only employers, but also parents. Read Peter Galbraith.

So, thank you Werner and Mogens and Peter for your wonderful work.

Forthcoming ICTMA21 Conference in Awaji Island, Japan

ICTMA21 (The 21st International Conference on Teaching of Mathematical Modelling and Applications) will be held in Awaji (Japan) 10-15 September 2023.

Please check our website(<https://ictma21.jp/>) for more details. Especially, registration, submission, and hotel booking (Grand Nikko Awaji) will start from **31 March** by means of online submission system (AMARYS) of ICTMA21 website. The schedule is as follows.

31st March 2023: Registration opens (Early birds)

31st May 2023: Early Bird closes

31st August 2023: Regular Registration closes

10th September 2023: Conference starts

31st March 2023: abstract submission opens

31st May 2023: abstract submission ends

1st July 2023: acceptance/rejection of abstract and review feedback to authors

2nd July 2023: Start of modification period for abstract

31st July 2023: abstract re-submission deadline

You can book Grand Nikko Awaji (<https://awaji.grandnikko.com/en/>) as special conference rate only by means of online submission system (AMARYS) of ICTMA21 website. This hotel is in front of conference center. As the number of available rooms is limited, please be careful about it. We sincerely look forward to your participation.

Toshikazu Ikeda, The chair of local organizing committee of ICTMA21

News

News from **South Africa**: Two South African universities (Stellenbosch University and University of Johannesburg) hosted Rita Borromeo Ferri and Andreas Meister for a series of seminars and workshops on mathematical modelling during March 2023. These scholars visited schools and interacted with teachers and teacher education students. (P. Biccard)

News from **Spain**: Regarding the IMMC modelling competition, in Spain we are organizing the selection phase of teams to represent our country (Spain participates from 2019-2020). Just this week we have finished the pre-selection phase, we already have three teams that will solve the problem of the international phase, the two best proposals will be sent to the contest. In the last years the results of the Spanish teams have been quite good, in the year 2021 a Spanish team reached the 5th place, with a meritorious mention. (I. Ferrando)

The **latest ICTMA-Book**: Leung, F. K. S., Stillman, G. A., Kaiser, G., & Wong, K. L. (Eds.). (2021). *Mathematical Modelling Education in East and West*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-66996-6>

A **new book** in the series "International Perspectives on the Teaching and Learning of Mathematical Modelling" will be published in May. This volume provides a snapshot of the current state-of-the-art in theory, research, and practice in the area of mathematical modelling in education. The various chapters reflect the work carried out at **ICME-14** held in Shanghai in July 2021, within the scope of Topic Study Group 22 and Survey Team 4:

Greefrath, G., Carreira, S. P., & Stillman, G. A. (Eds.). (in press). *Advancing and Consolidating Mathematical Modelling: Research from ICME-14*. Springer.

The “Proceedings of the Twelfth Congress of the European Society for Research in Mathematics Education collection (**CERME12**)” have been published. Contributions on modelling can be found at <https://hal.science/CERME12/search/index?q=modelling>

There is open special issue about research on Fermi problem in Education Sciences: https://www.mdpi.com/journal/education/special_issues/Fermi_Problems_Mathematics_Science_Edu

Recent Dissertations

- Gibbs, A. (2019). Socio-critical mathematics modeling and the role of mathematics in society (unpublished doctoral dissertation). Florida Institute of Technology.
- In March 2022 Carlos Segura's thesis was defended, his PhD dissertation presents a research related to the analysis of flexibility based on a sequence of Fermi problems. The thesis is published (in Spanish) on the Roderic platform: <https://roderic.uv.es/handle/10550/81850>
- In March 2023 Ioannis Liakos will be defending his doctoral dissertation "The development of students' mathematical competencies: The case of biology students". Supervisors: John David Monaghan, Yuriy Rogovchenko, Olov Viirman.

Recent Publications of Interest

- Albarracín, L., Segura, C., Ferrando, I., & Gorgorió, N. (2022). Supporting mathematical modelling by upscaling real context in a sequence of tasks. *Teaching Mathematics and its Applications: An International Journal of the IMA*, 41(3), 183-197. <https://doi.org/10.1093/teamat/hrab027>
- Berget, I. K. L. (2022). Identifying positioning and storylines about mathematical modelling in teacher–student dialogues in episodes from two upper secondary classrooms. *Teaching Mathematics and Its Applications*. <https://doi.org/10.1093/teamat/hrac020>
- Berget, I. K. L. (2022). Mathematical modelling in textbook tasks and national examination in Norwegian upper secondary school. *Nordic Studies in Mathematics Education*, 27(1), 51–70.
- Berget, I. K. L. (2023). Mathematical modelling in the discourses of the KOM and PISA frameworks and teacher interviews. *Research in Mathematics Education*. <https://doi.org/10.1080/14794802.2023.2165536>
- Böswald, V., & Schukajlow, S. (2023). I value the problem, but I don't think my students will: Preservice teachers' judgments of value and self-efficacy for modelling, word, and intramathematical problems. *ZDM - Mathematics Education*, 55, 331-344. <https://doi.org/10.1007/s11858-022-01412-z>
- Elicer, R. & Blomhøj, M. (2022). Mathematics in Action: On the Who, Where and How of the Constructions and Use of Mathematical Models in Society. In U. Jankvist & E. Geraniou (Eds.), *Mathematical Competencies in the Digital Era. Mathematics Education in the Digital Era* (Vol 20). Springer. https://doi.org/10.1007/978-3-031-10141-0_12

- Frejd, P., & Muhrman, K. (2022). Is the mathematics classroom a suitable learning space for making workplace mathematics visible?—An analysis of a subject integrated team-teaching approach applied in different learning spaces. *Journal of Vocational Education & Training*, 74(2), 333-351. <https://doi.org/10.1080/13636820.2020.1760337>
- Gibbs, A. & Park, J. (2022). Unboxing Mathematics: Creating a culture of modeling as critic. *Educational Studies in Mathematics*. <https://doi.org/10.1007/s10649-021-10119-z>
- Gibbs, A. & Park, J. (2022). Unboxing Mathematics: Creating a culture of modeling as critic. *Educational Studies in Mathematics*. <https://doi.org/10.1007/s10649-021-10119-z>
- Greefrath, G., & Wess, R. (2022). Mathematical Modeling in Teacher Education—Developing Professional Competence of Pre-Service Teachers in a Teaching–Learning Lab. *Proceedings of the Singapore National Academy of Science*, 16(1), 25–39. <https://doi.org/10.1142/S2591722622400038>
- Greefrath, G., Siller, H.-S., Klock, H., & Wess, R. (2022). Pre-service secondary teachers' pedagogical content knowledge for the teaching of mathematical modelling. *Educational Studies in Mathematics*, 109(2), 383–407. <https://doi.org/10.1007/s10649-021-10038-z>
- Greefrath, G., Siller, H.-S., Vorhölter, K., & Kaiser, G. (2022). Mathematical modelling and discrete mathematics: Opportunities for modern mathematics teaching. *ZDM – Mathematics Education*, 54(4), 865–879. <https://doi.org/10.1007/s11858-022-01339-5>
- Hernández, P. V., Huincahue, J., Cumsille, P., & Nechache, A. (2022). Articulating the Blomhøj Modelling Cycle and the Mathematical Working Spaces. Analysis of a Task in Higher Education. *Acta Scientiae*, 24(7), 146-175. <https://doi.org/10.17648/acta.scientiae.7135>
- Humenberger, H. (2022). Explorations and estimations using Google Maps images. *International Journal of Mathematical Education in Science and Technology*, 53(2), 503–515. <https://doi.org/10.1080/0020739X.2020.1863489>
- Humenberger, H. (2022). Modelling and optimising regarding swings and swinging monkeys. *Australian Mathematics Education Journal*, 4(3), 43–48.
- Jessen, B.E. & Kjeldsen, T.H. (2022). Mathematical Modelling and Digital Tools—And How a Merger Can Support Students' Learning. In U. Jankvist, E. Geraniou (Eds.), *Mathematical Competencies in the Digital Era. Mathematics Education in the Digital Era* (Vol. 20). Springer. https://doi.org/10.1007/978-3-031-10141-0_6
- Jung, H. & Brady, C. (2023). Modeling Actions Foregrounded in Whole-Class Modeling Discourse: A Case Study of a Model-Eliciting Activity and a Three-Act Task. *Mathematical Thinking and Learning*. <https://doi.org/10.1080/10986065.2023.2180849>
- Kacerja, S., & Julie, C. (2023). Values in preservice mathematics teachers' discussions of the Body Mass Index-A critical perspective. *The Journal of Mathematical Behavior*, 70, 101035. <https://doi.org/10.1016/j.jmathb.2023.101035>
- Lagrange, J. B., Huincahue, J., & Psycharis, G. (2022). Modeling in education: new perspectives opened by the theory of mathematical working spaces. In *Mathematical Work in Educational Context: The Perspective of the Theory of Mathematical Working Spaces* (pp. 247-266). Springer.
- Park, J. (2017). A Commognitive perspective on pre-service secondary teachers' content knowledge in mathematical modelling. In Stillman et al. (Eds.), *International Perspectives on the Teaching and Learning of Mathematical Modelling*, Springer, New York.

- Park, J. (2023). A Case Study of Pre-service Teachers' Task Design and Implementation for a Mathematical Modelling Lesson Sequence in Project-based Instruction. In Greefrath et al. (Eds.), *Advancing and Consolidating Research on Applications and Modeling in Mathematics Education-Approaches from ICME 14, International Perspectives on the Teaching and Learning of Mathematical Modelling*, Springer, New York.
- Rellensmann, J., Schukajlow, S., Blomberg, J., & Leopold, C. (2022). Effects of drawing instructions and strategic knowledge on mathematical modeling performance: Mediated by the use of the drawing strategy. *Applied Cognitive Psychology*, 36(2), 402-417. <https://doi.org/10.1002/acp.3930>
- Rosa, M. Cordero, F., Orey, D. C., & Carranza, P. (Eds.) (2022). *Mathematical Modelling Programs in Latin America - A Collaborative Context for Social Construction of Knowledge for Educational Change*. Springer. <https://doi.org/10.1007/978-3-031-04271-3>
- Schukajlow, S., Rakoczy, K., & Pekrun, R. (2023). Emotions and motivation in mathematics education: Where we are today and where we need to go. *ZDM - Mathematics Education*, 55, 249-267. <https://doi.org/10.1007/s11858-022-01463-2>
- Segura, C., Ferrando, I., & Albarracín, L. (2023). Does collaborative and experiential work influence the solution of real-context estimation problems? A study with prospective teachers. *The Journal of Mathematical Behavior*, 70, <https://doi.org/10.1016/j.jmathb.2023.101040>
- Spooner, K., Nomani, J. & Cook, S. (accepted). Improving high school students' perceptions of mathematics through a mathematical modelling course. *Teaching Mathematics and Its Applications: International Journal of the IMA*
- Steffensen, L. & Kasari, G. (2023). "Forced to flee"—mathematical modelling and problem-posing in 7th grade. *Journal of Mathematics and Culture*.
- Vos, P. & Frejd, P. (2022). Grade 8 students' appropriation of Sankey diagrams – the first cycle in an educational design research. *Journal on Mathematics Education*, 13(2), 289-306. <https://doi.org/10.22342/jme.v13i2.pp289-306>

Thanks

We would like to thank all colleagues who have contributed to this newsletter with their comments and texts:

Gabriele Kaiser, Hans Humenberger, Hans-Stefan Siller, Henry Pollak, Irene Ferrando, Joo Young Park, Kerry Spooner, Pauline Vos, Piera Biccard, Sebastian Gerber, Stanislaw Schukajlow, Toshikazu Ikeda, Wolfgang Weigel

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Please send future contributions to the editor by email <greefrath@uni-muenster.de>. The next Newsletter will be published in November 2023. We are interested in your contributions to any of the current sections including project reports and problems.
