

Programming as a mediator of mathematical thinking: Examples from upper secondary students exploring the definite integral

Timo Tossavainen¹, Claes Johansson², Alf Juhlin² and Anna Wedestig²

¹ Luleå University of Technology, Sweden

² Luleå Upper Secondary School, Sweden

We report on three episodes from a case study where upper secondary students numerically explore the definite integral in a Python environment. Our research questions concern how code can mediate and support students' mathematical thinking and what kind of sociomathematical norms emerge as students work together to reach a mutual understanding of a correct solution. The main findings of our investigation are as follows. 1) Students can actively use code as a mediator of their mathematical thinking, and code can even serve as a bridge that helps students to develop their mathematical thinking collaboratively. Further, code can help students to perceive mathematical notions as objects with various properties and to communicate about these properties, even in other semiotic systems than the mathematical language. 2) For the participating students, a common norm was that an acceptable solution is a sufficient condition for the correctness of the solution method although students were aware of a problem in their code, yet also other norms emerged. This demonstrates that learning mathematics with programming can have an effect on what kind of sociomathematical norms emerge in classroom.

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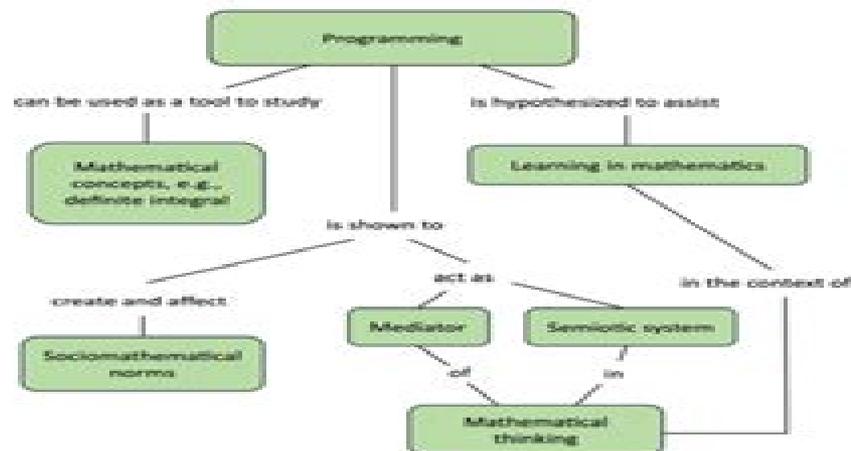
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Correspondence:
timo.tossavainen@ltu.se

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Programming And Mathematical Thinking

**Yong Chen,Xiaofeng Gao,Xiaoming
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Programming And Mathematical Thinking:

Programming and Mathematical Thinking Allan M. Staveland, 2013 **A Case Study** Hyunjung Woo, 2014

Mathematical Thinking Howard Karloff, 2023-08-09 This textbook invites readers to explore mathematical thinking by finding the beauty in the subject With an accessible tone and stimulating puzzles the author will convince curious non mathematicians to continue their studies in the area It has an expansive scope covering everything from probability and graph theory to infinities and Newton s method Many examples of proofs appear as well offering readers the opportunity to explore these topics with the amount of rigor that suits them Programming exercises in Python are also included to show how math behaves in action Mathematical Thinking is an ideal textbook for transition courses aimed at undergraduates moving from lower level to more advanced topics as well as for math recruitment and invitational courses at the freshman or sophomore level It may also be of interest in computer science departments and can be used as a supplemental text for courses in discrete mathematics and graph theory

Duality in 19th and 20th Century Mathematical Thinking Ralf Krömer, Emmylou Haffner, 2024-07-01 This volume brings together scholars across various domains of the history and philosophy of mathematics investigating duality as a multi faceted phenomenon Encompassing both systematic analysis and historical examination the book endeavors to elucidate the status roles and dynamics of duality within the realms of 19th and 20th century mathematics Eschewing a priori notions the contributors embrace the diverse interpretations and manifestations of duality thus presenting a nuanced and comprehensive perspective on this intricate subject Spanning a broad spectrum of mathematical topics and historical periods the book uses detailed case studies to investigate the different forms in which duality appeared and still appears in mathematics to study their respective histories and to analyze interactions between the different forms of duality The chapters inquire into questions such as the contextual occurrences of duality in mathematics the influence of chosen forms of representation the impact of investigations of duality on mathematical practices and the historical interconnections among various instances of duality Together they aim to answer a core question Is there such a thing as duality in mathematics or are there just several things called by the same name and similar in some respect What emerges is that duality can be considered as a basic structure of mathematical thinking thereby opening new horizons for the research on the history and the philosophy of mathematics and the reflection on mathematics in general The volume will appeal not only to experts in the discipline but also to advanced students of mathematics history and philosophy intrigued by the complexities of this captivating subject matter

Computing and Combinatorics Yong Chen, Xiaofeng Gao, Xiaoming Sun, An Zhang, 2025-02-12 This three volume set LNCS 15161 15162 and 15163 constitutes the refereed proceedings of the 30th International Conference COCOON 2024 held in Shanghai China during August 23 25 2024 The 90 full papers and 6 short papers were carefully reviewed and selected from 277 submissions COCOON 2024 provided an excellent venue for researchers working in the area of algorithms theory of computation computational complexity and

combinatorics related to computing **Python for Mathematical Thinking** Pradeep Singh, Balasubramanian Raman, 2025-12-13 This book offers a rigorous yet approachable pathway to applying Python for mathematical problem solving spanning foundational concepts to advanced theoretical frameworks It bridges the gap between abstract mathematics and computational execution guiding readers through a logically structured step by step journey Emphasizing mathematical reasoning symbolic computation and real world problem modeling it equips readers to analyze simulate and visualize complex structures with clarity and efficiency Ideal for students researchers and professionals in Mathematics Data Science AI Physics and Computational Science it cultivates both programming skill and deep mathematical intuition **Artificial Intelligence for Supporting Human Cognition and Exploratory Learning in the Digital Age** Pedro Isaias, Demetrios G. Sampson, Dirk Ifenthaler, 2024-08-08 The Cognition and Exploratory Learning in the Digital Age CELDA conference focuses on discussing and addressing the challenges pertaining to the evolution of the learning process the role of pedagogical approaches and the progress of technological innovation in the context of the digital age In each edition CELDA gathers researchers and practitioners in an effort to cover both technological and pedagogical issues in ground breaking studies Some of CELDA s main topics include assessment of exploratory learning approaches and technologies educational psychology learning paradigms in academia and the corporate sector student centered learning and lifelong learning The CELDA 2023 conference selected and published a selection of papers that focus on the use of Artificial Intelligence and Learning Analytics in the educational context **Emerging Research in Intelligent Systems** Miguel Botto-Tobar, Henry Cruz, Angela Díaz Cadena, Benjamin Durakovic, 2022-02-02 This book constitutes the proceedings of the XVI Multidisciplinary International Congress on Science and Technology CIT 2021 held in Quito Ecuador on June 14 18 2021 proudly organized by Universidad de las Fuerzas Armadas ESPE in collaboration with GDEON CIT is an international event with a multidisciplinary approach that promotes the dissemination of advances in science and technology research through the presentation of keynote conferences In CIT theoretical technical or application works that are research products are presented to discuss and debate ideas experiences and challenges Presenting high quality peer reviewed papers the book discusses the following topics Artificial Intelligence Computational Modeling Data Communications Defense Engineering Innovation Technology and Society Managing Technology Sustained Innovation and Business Development Security and Cryptography Software Engineering **Orchestration of Learning Environments in the Digital World** Dirk Ifenthaler, Pedro Isaias, Demetrios G. Sampson, 2022-01-31 This volume focuses on the implications of digital technologies for educators and educational decision makers that are not widely represented in the literature The chapters contained in the volume are based on the presentations at the 2020 edition of the CELDA conference and cover multiple developments in the field such as deploying learning technologies proposing pedagogical approaches and practices to address digital transformation and presenting case studies of specific technologies and contexts The chapters form a lively debate and provide a comprehensive analysis of the

contribution of learning technologies designed to improve the learning process and the experience of the students as well as to develop key competences *Proceedings of CECNet 2021* Antonio J. Tallón-Ballesteros,2022-01-15 It is almost impossible to imagine life today without the electronics communications and networks we have all come to take for granted The 6G network is currently under development and some chips able to operate at the Terahertz THz scale have already been introduced so the next decade will probably see the consolidation of 6G based technology as well as many compliant devices This book presents the proceedings of the 11th International Conference on Electronics Communications and Networks CECNet 2021 initially planned to be held from 18 21 November 2021 in Beijing China but ultimately held as an online event due to ongoing COVID 19 restrictions The CECNet series is now an established annual event attracting participants in the interrelated fields of electronics computers communications and wireless communications engineering and technology from around the world Careful review by program committee members who took into consideration the breadth and depth of those research topics that fall within the scope of CECNet resulted in the selection of the 88 papers presented here from the 325 submissions received This represents an acceptance rate of around 27% Providing an overview of current research and developments in these rapidly evolving fields the book will be of interest to all those working with digital communications networks *Coding + Math* Nicol R. Howard,2020-04-14 This book offers a deep dive into computer science integration providing guidelines for designing elementary CS math curricula through case studies and practical examples How to books related to computer science CS and teaching CS in K 12 environments are often either step by step guides or reference books with little or no connection to pedagogy By contrast Coding Math offers the analytical foundation teachers need to inform their practice specifically in mathematics Grounded in research the book s mini lessons contrast visual based coding with text based programming and provide guidance in the selection and creation of lessons instructional materials and CS platforms to help educators prepare students for the careers of the future The book Includes case studies in each chapter with a research snapshot that contextualizes the key elements of the case study Offers strategies for getting out the blocks and introducing text based CS when students are ready Examines the rationale and effectiveness of scaffolded approaches to CS such as block coding scripted and storyboarding vs traditional syntax based and problem solving approaches Ties effective teaching strategies directly to the CSTA K 12 Computer Science Standards ISTE s Standards for Computer Science Educators and the ISTE Computational Thinking Competencies Coding Math will strengthen the ties between math and CS to support students achievement in math as well as their future CS course selections and pursuits of CS careers Audience K 5 educators **Mathematical Thinking Skills Needed by First-year Programming Students** Carla Coetzee,2016 **Great Currents of Mathematical Thought: Mathematics in the arts and sciences** François Le Lionnais,1971 *The Journal of Computer Game Design* ,1988 *Information Processing* ,1983 **Matematica: insegnamento e computer algebra** Michele Impedovo,2004-03-29 Esiste oggi un potente strumento didattico che pu essere utile per

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Information Processing International Federation for Information Processing, 1983 Mathematical Programming and the Analysis of Capital Budgeting Problems H. Martin Weingartner, 1967

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