Martina Rau — *Curriculum Vitae*

Human-Computer Interaction Institute

School of Computer Science

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Research Interests

My research interests lie in learning science, specifically in educational psychology, cognitive science, and human-computer interaction. I study computer-supported learning with multiple graphical representations as they are commonly used in educational materials. How can we best capitalize on the unique capacity of educational technologies to incorporate interactive graphical representations in a multitude of ways? I have investigated this question based on a combination of experimental studies in real classrooms with over 3,000 students. As part of this work, I developed and iteratively improved an intelligent tutoring system for fractions. The design of the Fractions Tutor is based on user-centered approaches to address the goals and needs of students and teachers in real educational contexts. I use sophisticated statistical methods to model students' learning with multiple graphical representations. I integrate measures of learning outcomes with process-level measures based on problem-solving behaviors, eye-tracking data, and think-aloud protocols into statistical models of students' learning. I use statistical models both as a means of evaluating cognitive theories of students' learning, and as a basis for individualizing instruction by adapting it to students' personal needs.

Education

Ph.D. student in Human-Computer Interaction, 2008 - May 2013 (expected)
HCI Institute, Carnegie Mellon University, Pittsburgh, PA, USA
Committee: Vincent Aleven (co-chair), Nikol Rummel (co-chair), Ken Koedinger, Richard Scheines, Brian Junker
Dissertation Title: How can we promote understanding and fluency from multiple representations?

Associate in PIER (Program for Interdisciplinary Education Research), 2008 - May 2013 (expected)

Master of Science in Human-Computer Interaction
HCI Institute, Carnegie Mellon University, Pittsburgh, PA, USA

Diploma in Psychology, equivalent to M.S., 2006 - 2009
Albert-Ludwigs-University Freiburg, Germany

Vordiplom in Psychology, equivalent to B.S., 2004 - 2006
Albert-Ludwigs-University Freiburg, Germany

Awards

Siebel Scholar, Class of 2013: awarded annually for academic excellence and demonstrated leadership to 85 top students from the world's leading graduate schools.

Best Student Paper Award at the 14th International Conference on Artificial Intelligence in Education. Rau, M. A., Aleven, V., & Rummel, N. (2009). Intelligent Tutoring Systems with Multiple Representations and Self-Explanation Prompts Support Learning of Fractions. In V. Dimitrova, R. Mizoguchi, & B. du Boulay (Eds.), Proceedings of the 14th International Conference on Artificial Intelligence in Education (pp. 441-448). Amsterdam, the Netherlands: IOS Press. Best Student Paper Award.

Research Experience

Combining Advantages of Collaborative and Individual Learning with an Intelligent Tutoring System for Fractions, present
Funded by IES R305A120734
With Dr. Vincent Aleven and Dr. Nikol Rummel

Learning with multiple graphical representations in a complex, real-world domain: Intelligent Software Tutors for Fractions, 2009 - present
Funded by NSF REESE-21851-1-1121307
With Dr. Vincent Aleven and Dr. Nikol Rummel

Sequencing learning with multiple representations of rational numbers, 2008 - 2009
Funded by the Pittsburgh Science of Learning Center which is funded by NSF SBE-0354420
With Dr. Vincent Aleven and Dr. Nikol Rummel

Flexible knowledge of fractions with multiple graphical representations in intelligent tutoring systems, 2007 - 2008
With Dr. Vincent Aleven and Dr. Nikol Rummel

Supporting conceptual learning in chemistry through collaboration scripts, 2007 - 2008
With Dr. Nikol Rummel

Analyzing and promoting computer supported collaborative learning in mathematics
With Dipl.-Psych. Dejana Diziol

Teaching Experience

Teacher in Teaching and learning with multimedia, Fall 2012
Graduate level
Institute of Educational Research, Ruhr-Universität Bochum, Germany

Teacher in Computer-supported collaboration, Fall 2012
Graduate level
Institute of Educational Research, Ruhr-Universität Bochum, Germany

Teaching Assistant in Social web: content, communities, and context, Fall 2012
Undergraduate and graduate level
Human-Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, PA, USA

Teacher in Applications of the classical learning theories, Spring 2012
Undergraduate and graduate level
Institute of Educational Research, Ruhr-Universität Bochum, Germany

Teacher in How to create computer-based learning materials: principles and practices, Spring 2011
Graduate level
Institute of Educational Research, Ruhr-Universität Bochum, Germany

Teaching Assistant in Research Methods for Human-Computer Interaction, Fall 2010
Undergraduate and graduate level
Human-Computer Interaction Institute, Carnegie Mellon University, Pittsburgh, PA, USA

Mentor at the PSLC summer school in the In-vivo Experimentation track and in the CTAT and Example-tracing Tutors track, Summer 2011
Undergraduate and graduate level
Pittsburgh Science of Learning Center, Carnegie Mellon University, Pittsburgh, PA, USA

Academic Service

Member of the Editorial Board of the International Journal of Technology-Enhanced Learning (IJ-TEL) Young Researcher Special Issue, since 2011

Student Representative of the Pittsburgh Science of Learning Center to the inter-Science of Learning Center Conference, since 2011

Member of the inter-Science of Learning Center Conference workshop committee, since 2011

Student Representative of the Program of Interdisciplinary Education Research, since 2011

Student Representative of the Curriculum Committee at the of the Human-Computer Interaction Institute, Carnegie Mellon University, 2011 - 2012

Reviewer, 2008 - present
Journal of Learning and Instruction, Meeting of the Cognitive Science Society, International Conference on Artificial Intelligence in Education, International Conference on Intelligent Tutoring Systems, Special Interest Group on Human-Computer Interaction

Publications

Rau, M. A., Scheines, R., Aleven, V., & Rummel, N. (in press). Does Conceptual Understanding Enhance Acquisition of Fluency – Or Vice Versa? Searching for Models to Investigate Mediators. To appear in the Proceedings of the Learning Analytics and Knowledge 2013 Conference (LAK 2013).

Rau, M., Aleven, V., Rummel, N., & Rohrbach, S. (in press). Why interactive learning environments can have it all: Resolving design conflicts between conflicting goals. To appear in the Proceedings of the 2013 ACM Conference on Human Factors in Computing Systems (CHI 2013).

Rau, M. A., Aleven, V., & Rummel, N. (2013). Interleaved practice in multi-dimensional learning tasks: which dimension should we interleave? Learning and Instruction 23, 98-114.

Rau, M., Aleven, V., Rummel, N., & Rohrbach, S. (2012). Sense Making Alone Doesn't Do It: Fluency Matters Too! ITS Support for Robust Learning with Multiple Representations. In S. Cerri, W. Clancey, G. Papadourakis & K. Panourgia (Eds.), Intelligent Tutoring Systems (Vol. 7315, pp. 174-184). Berlin / Heidelberg: Springer.

Rau, M. A., & Pardos, Z. A. (2012). Investigating Practice Schedules of Multiple Fraction Representations Using Knowledge Tracing Based Learning Analysis Techniques. In Yacef, K., Zaïane, O., Hershkovitz, H., Yudelson, M., and Stamper, J. (Eds.), Proceedings of the 5th International Conference on Educational Data Mining. (pp. 168-171).

Rau, M. A., & Scheines, R. (2012). Searching for Variables and Models to Investigate Mediators of Learning from Multiple Representations. In Yacef, K., Zaïane, O., Hershkovitz, H., Yudelson, M., and Stamper, J. (Eds.), Proceedings of the 5th International Conference on Educational Data Mining. (pp. 110-117).

Rau, M., Rummel, N., Aleven, V., Pacilio, L., & Tunc-Pekkan, Z. (2012). How to schedule multiple graphical representations? A classroom experiment with an intelligent tutoring system for fractions. In J. van Aalst, K. Thompson, M. J. Jacobson & P. Reimann (Eds.), The future of learning: Proceedings of the 10th international conference of the learning sciences (ICLS 2012) – Volume 1, Full Papers (pp. 64-71). Sydney, Australia: ISLS.

Rau, M. A., Aleven, V., & Rummel, N. (2010). Blocked versus Interleaved Practice With Multiple Representations in an Intelligent Tutoring System for Fractions. In V. Aleven, J. Kay, & J. Mostow (Eds.), Proceedings of the 10th International Conference of Intelligent Tutoring Systems (pp. 413-422). Heidelberg / Berlin: Springer.

Rau, M. A., Aleven, V., & Rummel, N. (2009). Intelligent Tutoring Systems with Multiple Representations and Self-Explanation Prompts Support Learning of Fractions. In V. Dimitrova, R. Mizoguchi, & B. du Boulay (Eds.), Proceedings of the 14th International Conference on Artificial Intelligence in Education (pp. 441-448). Amsterdam, the Netherlands: IOS Press.

Matlen, B., Atit, K., Goksun, T., Rau, M., & Ptouchkina, M. (2012). Representing Space: Exploring the Relationship between Gesturing and Geoscience Understanding in Children. In C. Stachniss, K. Schill & D. Uttal (Eds.), Spatial Cognition VIII (Vol. 7463, pp. 405-415): Springer Berlin Heidelberg.

Hayashi, E., Rau, M. A., Neo, Z. H., Tan, N., Ramasubramanian, S., & Paulos, E. (2012). Time Blocks: "Mom, Can I Have Another Block of Time?" Proceedings of the 2012 ACM Conference on Human Factors in Computing Systems (CHI 2012).

Feenstra, L., Aleven, V., Rummel, N., Rau, M. A., & Taatgen, N. (2011). Thinking with Your Hands: Interactive Graphical Representations in a Tutor for Fractions Learning. Lecture Notes in Computer Science, 6738, 453-455.

Presentations	Rau, M. A., Aleven, V., & Rummel, N. (2011). How to schedule multiple graphical representations? A classroom experiment with an intelligent tutoring system for fractions. Paper presented at the Society for Research on Educational Effectiveness Fall 2011 Conference, Washington, D.C.

Rau, M. A., Tunc-Pekkan, Z. Pacilio, L., Aleven, V., & Rummel, N. (2011). Facilitating the Representational Fluency and Flexibility through Sequencing Multiple Graphical Representations. Paper presented at the 14th biennial EARLI Conference, Exeter, U.K.

Rau, M. A., Aleven, V., & Rummel, N. (2011). How to schedule multiple graphical representations? A classroom experiment with an intelligent tutoring system for fractions. Paper presented at the Society for Research on Educational Effectiveness Fall 2011 Conference, Washington, D.C.

Rau, M. A., Tunc-Pekkan, Z. Pacilio, L., Aleven, V., & Rummel, N. (2011). Facilitating the Representational Fluency and Flexibility through Sequencing Multiple Graphical Representations. Paper presented at the 14th biennial EARLI Conference, Exeter, U.K.

Rau, M. A., Aleven, V., & Rummel, N. (2010). Blocked versus Interleaved Practice with Multiple Graphical Representations of Fractions. Paper presented at the International EARLI Special Interest Group on Text and Graphics Comprehension, Tübingen, Germany.

Rau, M. A., Aleven, V., & Rummel, N. (2010). Supporting Learning with Multiple Graphical Representations with Intelligent Tutoring Technology. Paper presented at the International EARLI Special Interest Group on Instructional Design and Learning with Computers, Ulm, Germany.

Rau, M. A., Aleven, V., & Rummel, N. (2009). Self-explanations prompts enable students to benefit from learning with multiple graphical re-presentations of fractions. Paper presented at the 13th biennial EARLI Conference, Amsterdam, Netherlands.

Rau, M. A., Rummel, N., & Aleven, N. (2009). Selbsterklärungs-Prompts helfen Schülern beim Lernen mit multiplen graphischen Repräsentationen von Brüchen. Paper presented at the 12. Fachtagung Pädagogische Psychologie der DGPs, Saarbrücken, Germany.

Posters	Rau, M. A., Aleven, V., & Rummel, N. (2010). Blocking versus Interleaving Learning with Multiple Representations in an Intelligent Tutoring System for Fractions. Poster presented at the SREE Fall Conference, Washington, DC.

Rau, M. A., Aleven, V., & Rummel, N. (2010). Blocked versus Interleaved Practice with Multiple Representations of Fractions in an Intelligent Tutoring System. Poster presented at the Annual IES Research Conference, Washington, DC.

Rau, M. A., Aleven, V., & Rummel, N. (2009). Understanding Fractions with Multiple Graphical Representations in Intelligent Tutoring Systems. Poster presented at the Annual IES Research Conference, Washington, DC.

Rau, M. A. (2007). Flexible Knowledge of Rational Numbers with Multiple Representations in Intelligent Tutoring Systems. Poster presented at the 1st Annual inter-Science of Learning Center (iSLC) Conference, Pittsburgh, PA.

Feenstra, L., Aleven, V., Rummel, N., Rau, M. A., & Taatgen, N. (2011). Thinking with Your Hands: Interactive Graphical Representations in a Tutor for Fractions Learning. Poster presented at the 15th International Conference International Conference on Artificial Intelligence in Education, Auckland, New Zealand.

References

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