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JIM KAPUT – 1942-2005: A MENTOR, A COLLEAGUE, A FRIEND

STEPHEN HEGEDUS

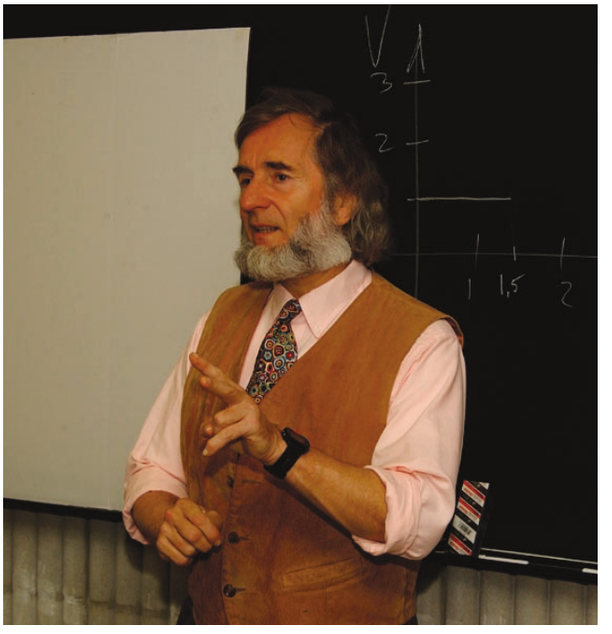
I met Jim Kaput in the early 90s. I was studying his works on technology (Kaput, 1991a, 1992) and particularly democratization of core, mathematical ideas to a broad population of learners (Kaput, 1994). Through the work I did with the UK government to arrange large mathematics festivals in shopping malls and schools in England, this theme continued to resonate deeply inside me to the time that I began to work with Jim closely. My whole reason for engaging in mathematics education research was a need to understand more about why students had difficulties with mathematics, specifically, at that time, in areas of algebra and calculus, and to create innovative teaching methods to address these needs.

I left family and friends in England and moved with my wife Nathalie to the US. Even prior to that move, Jim had immersed me in his on-going work and ideas, setting the scene for an incredible voyage. It was a broad awakening to me of how Kaput worked and operated when I finally started to work alongside him. There seemed to be an enormous amount of activities in progress; huge ideas flying around not just on technology *per se* but on the future of mathematics education. What seemed immediately apparent was his identity and visibility. He appeared to be always there, ready to interact, work, think and envision – slow to chide and quick to abide.

His energy was contagious, not only in his high work ethic, but in his joy for life. Long, deep discussions began.

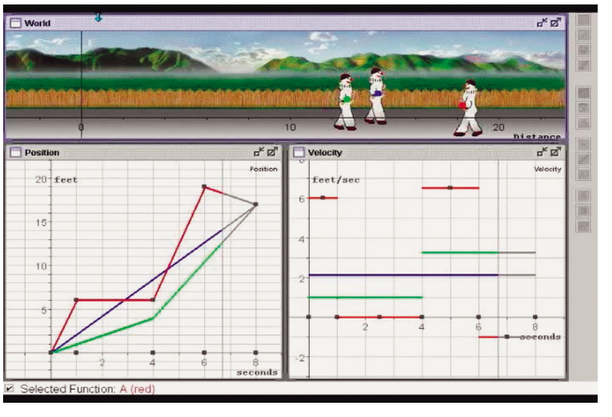
Jim's academic life was extraordinary. In my mind, he was one of the founders of modern day mathematics education research. His inquiry into new understandings of students' ways of mathematical thinking, teaching, and the impact of technology, which he began in the early 80's, was revolutionary. His ideas were visionary and his work continues to be a foundation stone for the field this century.

From the many emails and correspondence I have had with colleagues over the past few months [1], I believe that his legacy is not in the software he worked on but in the vision he offered to the greater mathematics education community of the theoretical perspective of what technology in mathematics education should look like in the 21st century, how teaching might be redefined, how "mathematics worth knowing" should be readdressed, and how policy might be re-written. It is encapsulated in a broad impact on people's lives that scoured the planet, and ranged from the elementary or middle school student who knew nothing of algebra, to the educator who was struggling with new ways of teaching, to the growth of doctoral students he had scattered around the world, and to the professor aiming for tenure or promotion.



Core ideas and themes of Kaput's work

Kaput has been directing funded research in the area of Mathematics Education continuously since 1979, has published more than 150 papers and several edited books. Originally trained in mathematics (Category Theory), he became interested in teaching teachers in 1970. In the latter



A screenshot from SimCalc MathWorlds.

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70s, beginning with a calculus textbook (published in 1979 with Daniel Fleming) that introduced multiple representations of all key ideas, in the representational side of student learning – a key theme which overarches his work. His other continuing interest was in finding ways to bring educational and economic opportunity to those for whom it is too frequently denied.

From the early 80s onwards, he became interested in the empowering potential of newly available technologies, especially using new representations, to make subtle or complex ideas learnable. Classical themes in his work include problem-solving (Kaput, 1985); representation and symbol systems (Kaput, 1987a, 1987b); evolution of notation systems (Kaput, 1991a, 1991b, 2001); cybernetic manipulatives (Kaput, 1995); virtual culture (Shaffer and Kaput, 1999) and inscriptions (Kaput, 1999).

As an Associate Director of the National Center for Research in Mathematical Sciences Education (NCRMSE) at Wisconsin and chair in the late 1980s of the Algebra Working Group (AWG) funded by NCRMSE, he began efforts to understand how to develop the several forms of algebraic reasoning within the contexts of elementary grade mathematics. In the late-1990s, an iteration of AWG (reconvened as the Early Algebra Research Group, EARG), met regularly to continue to refine ideas and to share new research on early algebra. EARG has contributed to a growing research base in early algebra, documenting the capacity of students from a diversity of socioeconomic and educational backgrounds to engage in algebraic reasoning in ways that dispel developmental constraints previously imposed on young learners (Blanton and Kaput, 2005; Kaput, in press; Kaput and Blanton, 2005). With colleagues Maria Blanton (at UMass Dartmouth) and David Carraher (at TERC) he has edited a book on the early development of algebraic reasoning, currently in press with Erlbaum, which captures the state of the field, including characterizations of algebraic reasoning and the nature of algebraic reasoning as symbolization.

With Ed Dubinsky and Alan Schoenfeld, he was a founding co-editor of a series of volumes published by the American Mathematical Society on Research in Collegiate Math Education, 1994-99.

The SimCalc Project, started in 1992, involves building and testing software and curricular innovations to support the learning of the fundamental ideas underlying calculus for mainstream students beginning at the early middle-school level while simultaneously energizing and contextualizing the core ideas of algebra. The work has generated software that allows students to understand the mathematics of change and variation, by examining animations of actors whose motion can be driven by imported physical motion or by functions that students can edit algebraically or graphically (position or velocity graphs), as well as visualize new representations of rate and accumulation (Kaput, 1998, 2000).

Since 2000, with new partnerships with Texas Instruments, the project has widened to study the affordances and constraints of wireless classroom connectivity in algebra classrooms. Students can now construct functions, or motions, on a version of the SimCalc software for the TI-83+/84+ and send their functions to be aggregated (wirelessly) by the teacher in the PC version of the software in mathematically-meaningful ways, *e.g.*, each student constructs a function for the family of functions $y = mx$. We have studied the impact on participation and engagement, impacts on pedagogy and new forms of social cognition (Hegedus and Kaput, 2001, 2003). Working with this system has had a huge impact on students' participation in the classroom and their performance on Massachusetts State Examination items, especially with lower-achieving students. Jim thought this would be the educational landscape of the 21st century – I think he's right!

This line of work has moved from classroom studies of student learning towards studying issues of implementation. A new project, led by Jeremy Roschelle, using randomized assignment in a large-scale study, is investigating what it takes, in terms of teacher professional development and support, to implement such an ambitious curricular and technological innovation, and how these factors relate to teacher, school and district characteristics (Roschelle *et al.*, in press).

Kaput was also interested in the problem of bringing the newer mathematics of change, dynamical systems and the modeling of nonlinear and complex systems, into the core curriculum for mainstream students of the new century, and, with the New England Complexity Institute, where he was Treasurer and a member of the Board of Directors, has helped lead a series of conferences and subsequent publications in this direction.

His legacy should be in the sentiment and guidance he offered, his passion and enthusiasm, and the specific implementations with concrete ideas for his local districts in South-East Massachusetts and to his broader virtual space across the planet. A visionary, a revolutionary, a mentor to the wider community of learning sciences, a teacher, an academic rooted in substantive matters of local and widespread concern, a friend, a husband and a father of minds.

Jim has an unprecedented history of bringing more money into mathematics education than most other academics I know. But he did not choose to move to Harvard or elsewhere, but stayed at University of Massachusetts Dartmouth. We worked on over $20m of research proposals together of which several got funded. When we finished these proposals, many minutes before the deadline (much to the anguish of our grants and contracts office), we were energized. I always remember the first time, after submission, he shook my hand really hard, and with a big pat on the back, he cracked open a beer for me (at that point I really hoped we'd get the grant); we did.

Jim mentored me in ways that accelerated my thinking and focused my thoughts. Being concrete, original and visionary in forging ideas, he was a brilliant mentor helping me to achieve these skills. Always firm and honest, sometimes infuriating, but always with a serious, guiding point.

Jim loved his Massachusetts town of Dartmouth. He wanted to be here not elsewhere. He loved his students, his colleagues, local teachers, and his research team. He valued them all primarily as human beings, continually supporting them and their personal growth.

He always wanted to offer opportunity, continually hiring undergraduate and graduate students, whatever discipline, to be intimately part of the research process, not just Xerox-

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ing or filing. We have a strong, loyal, bright and energetic team of 12 people including programmers, research associates as well as students.

Jim has touched people's lives all over the world. He has guided, mentored and helped so many junior and senior academics. Young people who have worked with him closely have rapidly become leaders in their field, for example, Jeremy Roschelle, now the Director of the Center for Technology in Learning, at SRI International, in California, a major research institution and think-tank in the US. There are so many more. Jim wrote at least one reference a week supporting and guiding such people.

You knew when Jim loved an idea. His eyes glowed radiantly. You also knew when it was not that great when his eyelids were shut.

We were constantly in and out of each other's offices, buzzing with new thoughts and the future. Not always engaged with the pre-occupations of university professorial life but talking about new ideas. It was a shock to me of how generous he was with his time, for me and for so many other academics.

It was not always work. Jim was a life person, had a passion for good food, fine wine, and beer from Brattleboro as well as an insatiable appetite for the weather and folk music. He was an athlete, running many miles a day for years; he was a gazelle, who ran with his mind. Whether in the classroom, on an advisory board or in front of an international audience, he was always in his brightly colored shirts and ties as well as his running shoes, ready to do a many-mile run in the mid-day sun or early morning dew as a way out to think. Whether in the streets of Mexico City, the fjords of Norway, or the landscape of New Zealand, this was a solemn way for him to find meaning and answers for the hard matters that he was working on. Recently, the reality hit me hard as I found myself walking on and off planes on my own, without Jim to talk to at 35,000+ft, and feeling a blackness as I walked into hotel rooms. No more T-Shirts almost setting on fire as he left them draped on lampshades to dry, no more stories of him falling asleep with a cone of Cold-Stones ice-cream on his chest.

To quote one of Jim's favorite poets, T. S. Eliot,

> What we call the beginning is often the end. And to make an end is to make a beginning. The end is where we start from. (*Four Quartets, Little Gidding*)

Jim's love, friendship, energy and ideas have deeply touched me and I shall never forget him. His spirit will continue to burn inside, and for me, he will always be a guiding light.

As he often said "onwards".

Notes

[1] Please visit http://www.simcalc.umassd.edu and add your memories.

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