STEMester in Review

Kaput Center Newsletter

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Kaput Center
UMass Dartmouth

Holistic Individualized Coaching: Advancing the Professional Wellbeing of Elementary Mathematics Teachers

By Zarina Gearty, Ph.D., 2023 Graduate of STEM Education

On February 24th, the Kaput Center virtually hosted Dr. Dionne Cross Francis, a Joseph R. Neikirk Professor in the Culture, Curriculum and Teacher Education Program at the University of North Carolina at Chapel Hill. Dr. Cross Francis studies teacher motivation, specifically focusing on understanding the contextual, culture, and teacher-specific factors that allow teachers to thrive. Her work has influenced both national and international professional development initiatives and we were very honored to have her share a bit about her research with us at the Kaput Center.

Dr. Cross Francis's presentation was focused teaching coaching. She started by situating herself, sharing and talking about the biases she has in her research, as well as her assumptions about classrooms and the school as a learning ecology. She explained how she sees teachers as part of a bigger system, drawing on Bronfenbrenner's

ecological systems theory. She often repeated that she views teachers as learners, just as teachers view their students as learners.

Dr. Cross Francis shared several key take-aways from different phases of her research. In one phase where her goal was to understand what constructs inform teachers' decision-making and practice, she talked about how she came to view teachers as individuals with individual differences and variability. Another key take-away was that teaching has psychological, cognitive, affective, social and behavior dimensions that need to be acknowledged. In the second phases of studies, she discussed how her focus was on exploring design features of PD that would support ambitious teaching. Her key finding from this phrase was that shifts in teacher knowledge and skill often did not lead to similar shifts in student learning.

All of her research led her to design the Holistic Individualized Coaching (HIC) model. She walked the audience through the six components of the model and pointed out how it differed from other models. She then shared her findings from implementing this model in Georgia, USA and in Ghana, Africa, which were positive in supporting cognitive, behavior, psychological and socio-emotional changes related to math teaching.

To see this talk, visit: https://www.youtube.com/watch?v=6hY70viC0pk&t=2s

Big Ideas: Yasmin Kafai Introduces Computational Thinking 3.0

By Ali Daniyal Asif, Kaput Center Graduate Research Assistant

The Kaput Center for Research and Innovation in STEM Education organized its first step towards a series of colloquiums of big ideas. The goal of the big idea was to have the leaders in STEM education research come and talk about an issue in education research. Dr. Yasmin Kafai, Lori and Michael Milken President's Distinguished Professor at the graduate school of Education at the University of Pennsylvania, was the first speaker of this series. In this insightful talk, Dr. Kafai unfolded the emerging trends in computational thinking (CT), such as CT 2.0 and CT 3.0. As an introduction, she characterized the theory space of CT research on three framings of learning in education research. Among these three framings most prevalent is cognitive. Cognitive framing mainly targets computational concepts and practices investigating the development of mental models of an individual with little space for personal relevance or

social concerns. Situated framing focuses on personally meaningful contexts within and across communities with less focus on the issues of inclusion and cultural relevance. Critical framing highlights the issues of equity, diversity, and social justice inherent to the power dynamics of every society but foreshadows the computational concepts and practices.

CT 2.0 shifts the tides of traditional rule-driven practices of CT to data-driven models providing new classes of real-world applications for classroom practices. The emerging trend in Artificial Intelligence, such as ChatGPt of OpenAI and Bard from Google, has changed the dynamics of computer science education. This raises substantial implications for including AI tools to harness their power in educational endeavors.

In the end, Dr. Kafai explained her term CT 3.0 as it emphasizes the need to include the public voice in the architecture and design of the digital world to make and keep the digital public space inclusive and livable.

From an audience perspective, I find myself in rhythm with Dr. Kafai's arguments. In many ways, my own research is inspired by Dr. Kafai's work, which challenges me to think about CT in new and innovative ways.

To see Dr. Kafai's presentation, visit this link: https://www.youtube.com/watch?v=DjBOpJt9bb4

Student to Scholar: Travis Weiland
By Chandra Orrill, Kaput Center Director

For several years we have been thinking about how to help connect our alumni to our current students. This year, we created the Student to Scholar Colloquium that is designed to do just that! Our first ever Student to Scholar speaker was Dr. Travis Weiland. Travis finished his degree in 2017. He moved from UMass Dartmouth to a tenure-track position at Appalachian State University. Shortly after, he relocated to the University of Houston.

Travis was kind enough to talk to our students about the transition between being a student and a faculty member, opportunities to participate in while being a student, and different ways to think about a variety of experiences.

Because Travis has changed jobs as his family needs have changed, he also has considerable experience interviewing for positions and learning about new workplace cultures. He was very open and inviting in sharing this information with our current students and others in the audience.

Many students commented on how helpful it was to hear a recent graduate share his advice. And, this was the colloquium that attracted the most students this year! We thank Dr. Weiland for visiting and hope to be able to schedule more colloquia of this kind in the coming years.

To see this talk, visit https://youtu.be/MqwrjSql16k

Big Ideas: David Williamson Shaffer Explains Why We Need Quantitative Ethnography
By Chandra Orrill, Kaput Center Director

We closed out our colloquium series on April 5 with David Williamson Shaffer, the Sears Bascom Professor of Learning Analytics and Vilas Distinguished Achievement Professor of Learning Sciences at the University of Wisconsin-Madison. David introduced the audience to what quantitative ethnography is in a way that tightly connected it to both qualitative and quantitative research. His talk also emphasized the roles of theory in empirical research.

While the talk was intended to introduce quantitative ethnography (which it did), the clarity with which David's slides and his talk linked all of the critical aspects of research ranging from the phases of engaging with data to the required data loss to the use of theory, that it's worth a watch just to see that discussion. In fact, I was able to take the first several minutes of the video to my Ph.D. course the next day to unpack it with my students, who found it extremely useful.

David's talk is available at https://youtu.be/TX-NeXBE9MA

Quick Notes:

- Chandra Orrill departed the University on May 31, 2023. A new director should be appointed very soon.

The Kaput Center's Published Articles and Proceedings

2022

Cieto, M. M., & Witzig, S. B. (2022). It starts at home: Building upon students' extracurricular interests and STEM knowledge in the classrooms through socio- scientific issues-based approaches. Science and Children, 59(5), 38-42.

Epstein, M. L., Malik, H., Wang, K., & Orrill, C. H. (2022). Teacher-responses: Highlight characteristics of low response process validity for item(s) measure teachers' pedagogical content knowledge. In A. E. Lischka, E. B. Dyer, R. S. Jones, J. N. Lovett, J. Strayer, & S. Drown (Eds.), *Proceedings of the 44th annual meeting of the North American Chapter of the International Group for Psychology in Education* (pp. 671-675). Middle Tennessee State University.

Güçler, B. & Ji, C. (2022). What do the emerging themes in high school teachers' journals tell us about their thinking? In Lischka, A. E., Dyer, E. B., Jones, R. S., Lovett, J. N., Strayer, J., & Drown, S. (Eds), *Proceedings of the forty-third annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education,* pp. 1394-1402. Nashville, TN: Middle Tennessee State University.

Harper. A &, Kayumova. S. (2022). Invisible multilingual Black and Brown girls: Raciolinguistic narratives of identity in science education. *Journal of Research in Science Teaching. DOI:* https://doi: 10.1002/tea.21826.

Kayumova, S., Arrigo, A. F., Harper, A., Richard, E., & Welty, H. (2022). *Supporting STEM identity development through asset-based positioning*. Rapid Community Report Series. Digital Promise; International Society of the Learning Sciences. URI.

Kayumova, S. & Dou, R. (2022). Equity and justice in science education: Toward a pluriverse of multiple identities and onto-epistemologies. *Science Education, 106*(5), 1097-1117. https://doi.org/10.1002/sce.21750.

Kayumova, S., & Sengupta, P. (2022). Beyond representationalism: Heterogeneity as an ethical turn in STEM and computing education. In *The learning sciences in conversation* (pp. 218-234). Routledge.

Liu, Z., Gearty, Z., Richard, R., Orrill, H, C., Kayumova, S., Balasubramanian, R. (2022). Computational thinking into K-12 classrooms: Experiences and challenges from professional learning experiences. In C. Chinn, E. Tan, C. Chan & Y. Kali (Eds.), *Proceedings of the 16th International Conference of the Learning Sciences* - ICLS 2022 (pp. 2100-2101). International Society of the Learning Sciences. https://2022.isls.org/proceedings/

Nagar, G. G., Hegedus, S., & Orrill., C. H. (2022). High school teachers' discernment of invariant properties in a dynamic geometry environment. *Educational Studies in Mathematics, 111*(1), 127-145. https://doi.org/10.1007/s10649-022-10144-6

Nagar, G.G., Hegedus, S., & Orrill, C. H. (2022). Teachers' understanding of draggable geometric objects: Variance and invariance in a dynamic geometry environment. *Digital Experiences in Mathematics Education, 8*(3), 259-286.

Orrill, C. H., & Brown, R. E. (2022). Mathematics teachers' knowledge for teaching proportion: Using two frameworks to understand knowledge in action. In C. Damşa, & A. Barany (Eds.), *Advances in quantitative ethnography. ICQE 2022.* (pp. 239-253). Springer. https://doi.org/10.1007/978-3-031-31726-2_17

Orrill, C. H., Brown, R. E., Thapa, R., & Nti-Asante, E. (2022). One teacher's knowledge of proportions in practice. In A. E. Lischka, E. B. Dyer, R. S. Jones, J. N. Lovett, J. Strayer, & S. Drown (Eds.), *Proceedings of the 44th annual meeting of the North American Chapter of the International Group for Psychology in Education* (pp. 684-688). Middle Tennessee State University.

Orrill, C. H., Brown, R. E., Thapa, R., & Nti-Asante, E. (2022). Adapting the knowledge quartet for non-didactic classrooms. In A. E. Lischka, E. B. Dyer, R. S. Jones, J. N. Lovett, J. Strayer, & S. Drown (Eds.), *Proceedings of the 44th annual meeting of the North American Chapter of the International Group for Psychology in Education* (pp. 743-744). Middle Tennessee State University.

Richard, E., & Kayumova. S. (2022). Examining Early Elementary Computer Science Identity Repertoires within a Curriculum: Implications for Epistemologically Pluralistic Identities. *Journal of Computer Science Integration*, 1(1): X, pp. 1–14. DOI: https://doi.org/10.26716/ jcsi.2022.X.X.36.

Takeuchi, M. A., Kayumova, S., de Araujo, Z., & Madkins, T. C. (2022). Going beyond #RetireELL: A call for anti-colonial approaches to languages in STEM education. Journal of Research in Science Teaching, 1–4. https://doi.org/10.1002/ tea.21764

Waight, N., Kayumova, S., Tripp, J., & Achilova, F. (2022). Towards equitable, social justice criticality: Re-constructing the "Black" box and making it transparent for the future of science and technology in science education. Science & Education, 1-23. https://doi.org/10.1007/s11191-022-00328-0.

2023 & In Press

Adams, J., Rahm, J., Kayumova, S., & Brandt, C. (2023). Introduction Unpacking "Signs of Learning" in Complex Sociopolitical Environments. *Mind, Culture, and Activity*. DOI: 10.1080/10749039.2023.2185258

Epstein, M. L., Malik, H., Wang, K., & Orrill, C. H. (accepted). Unpacking response process issues encountered when developing a mathematics teachers' pedagogical content knowledge. *Investigations in Mathematics Learning*.

Kayumova, S., & Harper, A. (2023). Centering Critical Youth Research Methodologies of Praxis and Care in Post-Pandemic Times: From Respectful Relations and Dialogue towards New Imaginaries. *International Conference of the Learning Sciences* (ICLS) 2023, Montreal, Canada.

Kayumova, S., & Kahveci, E. (2023). Joint sensemaking among multilingual youth: A case from a science classroom. *International Conference of the Learning Sciences* (ICLS) 2023, Montreal, Canada.

Kayumova, S., & Strom, K. (2023). Ontology, epistemology, and critical theory in STEM education. In *Oxford Research Encyclopedia of Education.*
DOI: https://doi.org/10.1093/acrefore/9780190264093.013.1508

Orrill, C. H., & Brown, R. E. (2023). Using design-based research to develop a professional development model. In J. M. Spector, B. B. Lockee, & M. D. Childress (Eds.), *Learning, design, and technology: An international compendium of theory, research, practice, and policy*. Springer. https://doi.org/10.1007/978-3-319-17727-4_177-1

Orrill, C. H., Gearty, Z., & Wang, K. (in press). Continuing evolution of research on teaching & learning: Exploring emerging methods for unpacking research on teachers, teaching, and learning. In A. Manizade, N. Buchholtz, & K. Beswick (Eds.), The evolution of research on teaching mathematics: International perspectives in the digital era. Springer.

Congratulations to Our Ph.D. Graduates

Pictured (starting bottom left and going counter-clockwise): Rob Nanna '23, Jinsook Park '23, Chandra Orrill, Shakhnoza Kayumova, Zarina Gearty '23, Marty Epstein '22, and Stephen Witzig.