Using Technological Advances to Enhance EI/ECSE Research

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discuss
lessons learned
describe studies
examples of technology

challenges and advantages to the use of advanced technological systems in EI/ECSE.

Big Bold Goals

Develop tools for researchers to more precisely measure early childhood education environments and interactions.

Big Bold Goals

Answer research questions that cannot be addressed with current observational or self-report measures

Big Bold Goals

Develop usable measurement tools to inform teacher practice.


LENA
Recording
REC

Study 1

Kentucky Tiered Quality Rating and Improvement System Pilot Study

Beth Rous, Mary Howard, John Nash, Dwight Irvin, Joanne Rojas, Ying Luo, Patti Singleton

Funding: Kentucky Race to the Top Early Learning Challenge Grant #S412A130045

Study 1: Design

Explanatory Correlational Design

Study 1: Research Question

What is the link between and among classroom quality, time spent in classroom designated areas?

What are child-playmate language interactions within activity areas of the classroom?

Study 1: Approach

Collect quality data via ECERS/ITERS

Movement data via Ubisense (children and materials)

Language data via LENA (adults and children)

Study 2

Examining Language and Movement on the Playground

Dwight Irvin, Beth Rous, Ying Luo, Justin Lane, Heather Bergstrom, Joanne Rojas, Jay Buzhardt

Funding: Kansas Intellectual and Developmental Disabilities Research Center (KIDDRC) U54HD090216 & Early Childhood Research and Development Initiative, University of Kentucky

Study 2: Design

Explanatory Correlational Design

Study 2: Research Questions

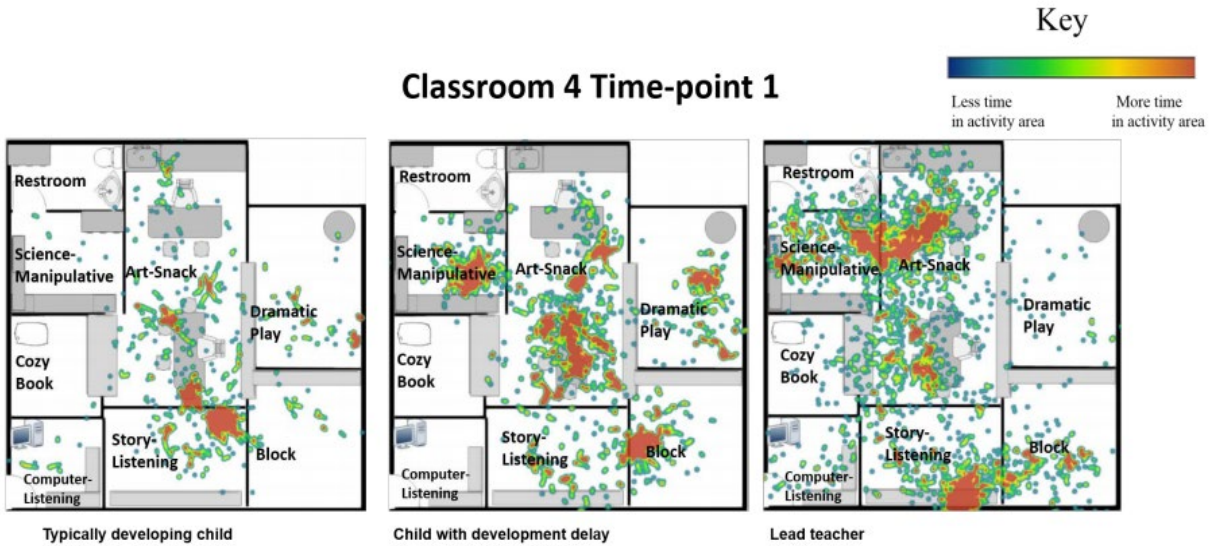
For children from underserved backgrounds and those at-risk or with disabilities, are there differences in:

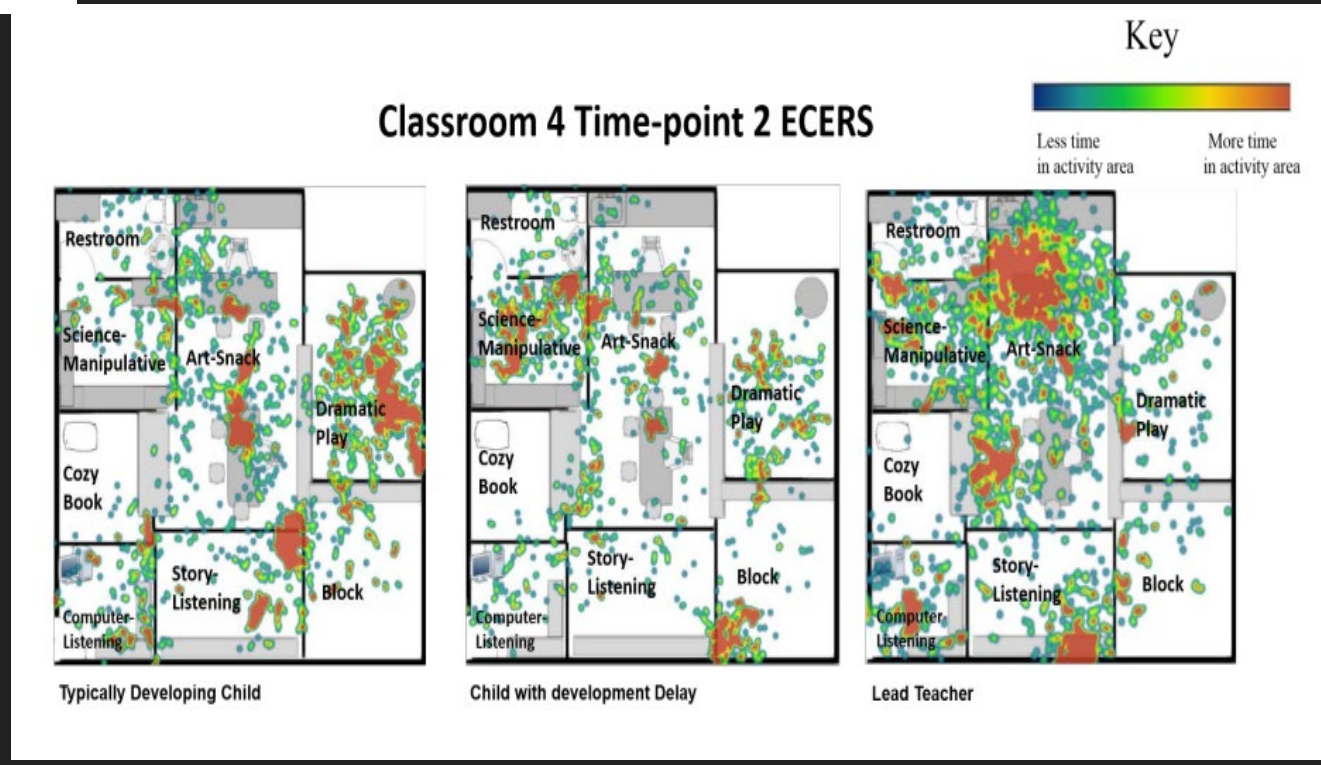
a. the frequency and amount of time spent on playground equipment?
b. levels of physical activity on a child care playground?
c. amount of talk and time spent around/on specific pieces of playground equipment?

Study 2: Approach

- Movement data via Ubisense and Accelerometers (children)
- Language data via LENA (adults and children)
- Video recording


A sample of
Successes





Data Outputs

Data Outputs

Target Child & Playmates Vocalizations by Activity Area (per minute)

	Vocalizing						
	Jo	Kay	Dereck	Jo next to Kay	Kay next to Jo	Jo next to Dereck	Dereck next to Jo
Art	2.1	4.05	0.87	0.0	0.0	0.0	0.1
Blocks	12.0	14.47	18.80	4.0	3.5	3.6	3.0
Dramatic Play	3.9	2.0	1.65	0.0	0.0	0.3	0.1
Manipulatives	0.98	1.92	2.65	0.0	0.0	0.5	0.4
Science	8.98	1.53	4.47	0.0	0.0	1.8	1.8
Sensory	0.38	0.37	0.32	0.0	0.0	0.0	0.0
Cubbies	1.55	0.12	0.08	0.0	0.0	0.0	0.0
Books	0.35	0.02	0.00	0.0	0.0	0.0	0.0
Diaper Changing	0.13	0.02	0.12	0.0	0.0	0.0	0.0

TagID	Total	Valid	Missing Inside	Outside (99)	Between shrinked & original (88)	Hippo	Caterpillar	Oval	Rainbow	Red Roof House	Tree
020-000-153-003	2778	1916	9	773	80	14	26	0	253	79	112
Totals	43284	25633	1668	14456	1527	2647	868	353	961	847	2100

Data Outputs

Data Output

TagID	Total	Valid	Missing Inside	Outside (99)	Between shrinked and original (88)	Hippo	Caterpillar	Oval	Rainbow	Red Roof House	Tree
020-000-153-003	2778	1916	9	773	80	14	26	0	253	79	112
020-000-153-058	2765	1896	35	792	42	294	1	2	31	92	127
020-000-153-084	2794	1852	191	679	72	71	82	1	182	98	51
020-000-153-116	2453	1709	13	643	88	92	105	84	50	58	241
020-000-153-193	2489	1816	395	209	69	83	301	13	21	0	80
020-000-153-206	671	174	0	495	2	0	0	1	0	0	0
020-000-153-230	2040	1152	72	784	32	606	1	11	5	50	0
020-000-187-177	2780	2611	28	132	9	12	0	0	137	0	79
020-000-187-178	2532	380	143	1985	24	0	0	5	2	0	1
020-000-187-253	2818	1434	73	583	728	177	18	24	42	57	2
020-000-188-000	2811	2116	73	566	56	123	3	5	58	184	63
020-000-188-034	2464	1846	38	530	50	363	92	94	80	9	151
020-000-188-058	3794	867	236	2616	75	0	1	7	24	0	0
020-000-188-071	2443	1981	0	407	55	34	152	85	0	0	848
020-000-188-104	2781	1396	131	1190	64	1	2	14	65	0	229
020-000-188-174	733	363	54	297	19	10	0	2	10	0	11
020-000-189-008	2021	401	9	1591	20	6	1	5	0	31	0
020-000-193-216	2117	1723	168	184	42	761	83	0	1	189	105
Totals	43284	25633	1668	14456	1527	2647	868	353	961	847	2100


A sample of
Challenges

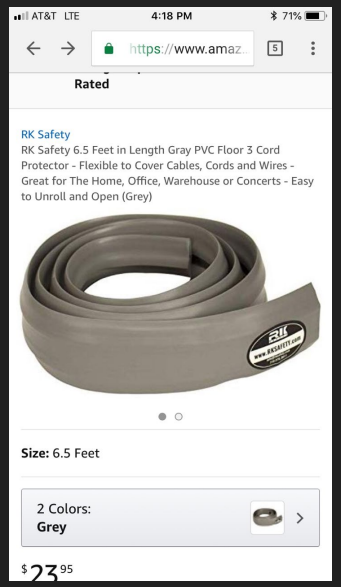
Classroom

Working in the evening

Running cord above ceiling tiles

Putting Ubisense on materials in toddler classroom

Playground


AT&T LTE
4:18 PM
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RK Safety
RK Safety 6.5 Feet in Length Gray PVC Floor 3 Cord Protector - Flexible to Cover Cables, Cords and Wires - Great for The Home, Office, Warehouse or Concerts - Easy to Unroll and Open (Grey)
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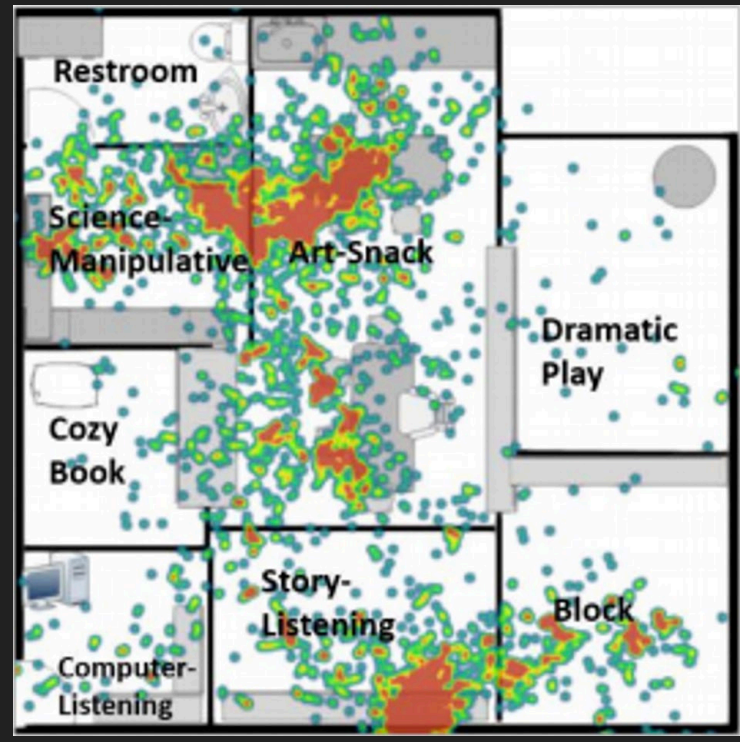
The Next Frontier
Moving Beyond Frequency Counts

Secondary analysis of Study 1 data

Develop algorithms to detect indicators of inquiry & exploration during science activities using classroom recordings.

- Goal of K-3 Science Education = promoting inquiry & exploration of natural phenomena

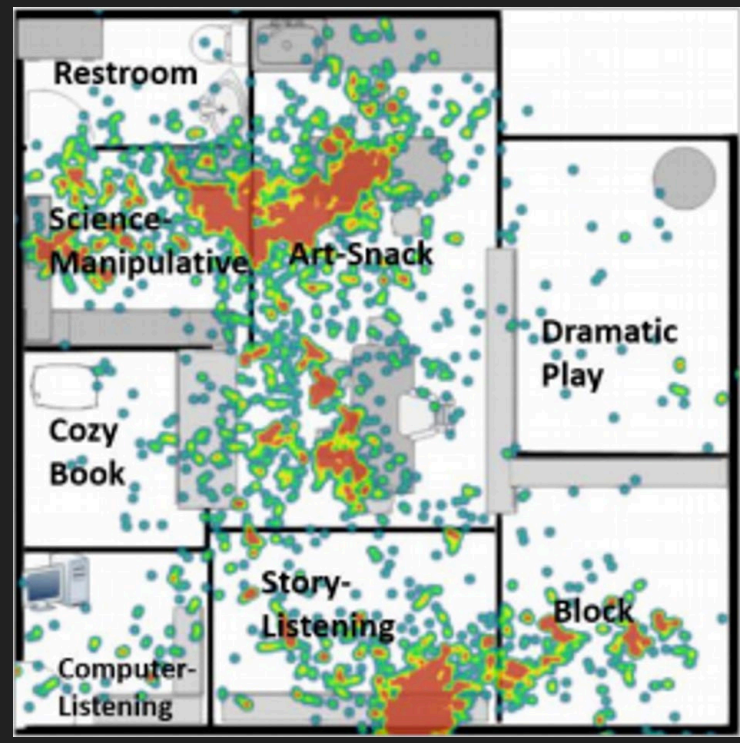
Next Generation Science Standards



The Next Frontier
Moving Beyond Frequency Counts

Requires

- Precise location sensing data (Ubisense)
- Ongoing audio recordings (LENA, or other portable recorder?)
- Algorithms that can detect specific key words



Proof of Concept
Accuracy of Keyword Spotting Algorithms

How accurately do algorithms detect adults' use of "WH" words?

who, what, why, where, how

Recordings from 2 Pre-K classrooms

- 14 children
- 7 teachers (2 lead, 5 assistant)

Proof of Concept
Accuracy of Keyword Spotting Algorithms

Compared algorithm output to transcribed recordings

Accuracy across all activity areas:

58.6%
When accepting one or less false positives

44.5%
With no false positives

Accuracy across science activity areas:

79.6%
When accepting one or less false positives

59.3%
With no false positives

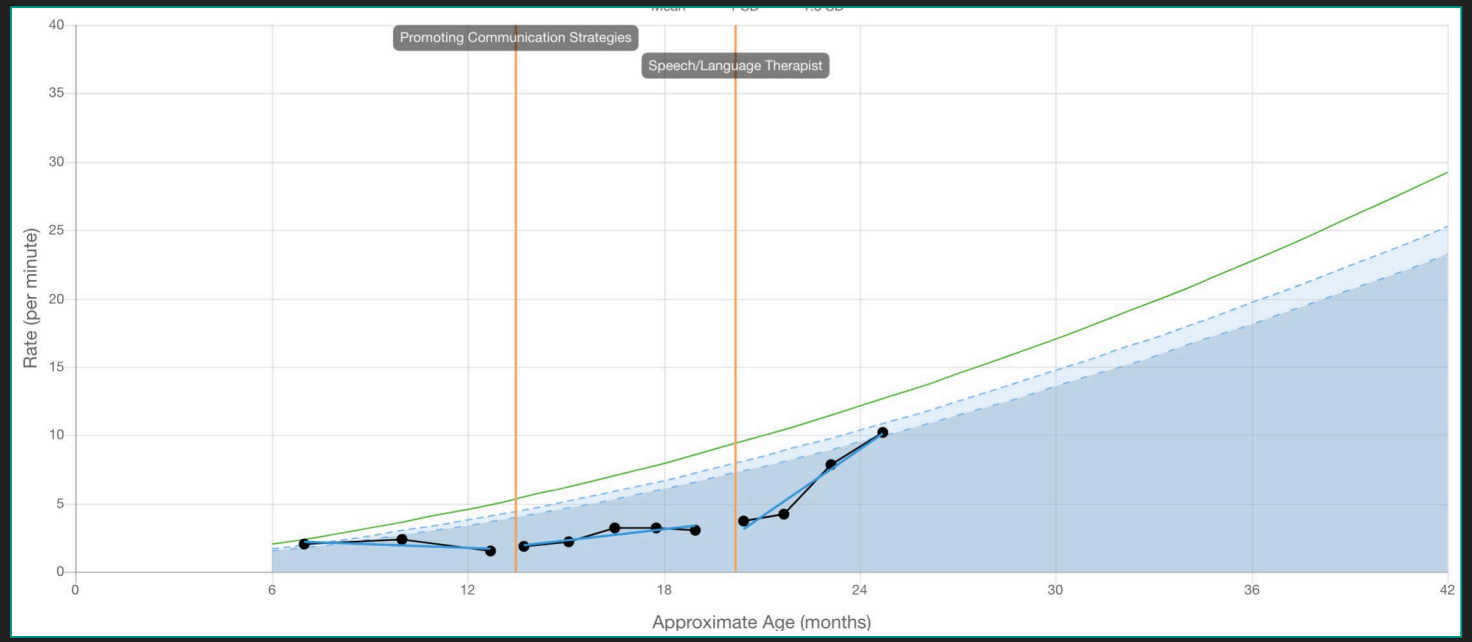
Future Directions
Data to Inform Teacher Practice

Formative assessment, progress monitoring, data-driven decision-making are too rare in most EC settings

With high fidelity decision making, children show superior gains*

Barriers

- Time to administer
- Ability to interpret data
- Ability to make meaningful decisions



*Buzhardt, J., et al (2018). Web-Based Support for Data-Based Decision Making: Effect of Intervention Implementation on Infant–Toddler Communication. *Journal of Early Intervention, 40(3),* 246-267.
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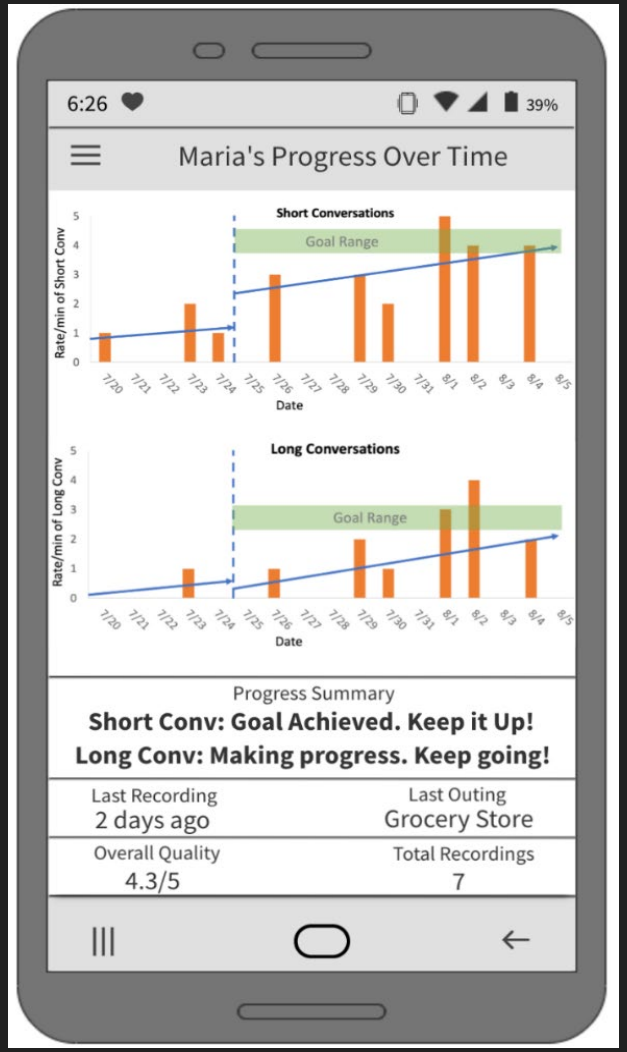
Future Directions
Data to Inform Teacher Practice

Sensor technology provides data w/o detracting from instructional time or classroom activities

Barriers:

- Setup time/equipment
- Costs
- Lack of model to integrate sensors into classroom routines
- Lack of scalable infrastructure to process audio and provide meaningful output



Now…it’s all about the conversation!

Tell us about your experiences?

How could technology help us answer other important unanswered question in the field?

Are there concerns administrators, providers/teachers and parents might have with the use of these technologies?

What are advantages/challenges to the use of advanced technological systems in EI/ECSE research?

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