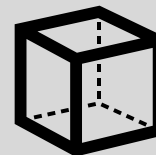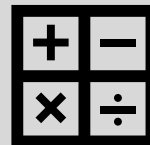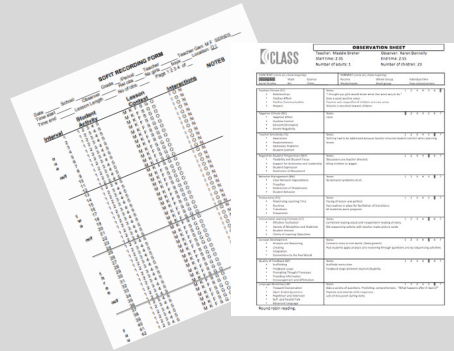# Observational Coding Methods Applied to Child Play Behavior

Lindsey M. Bryant, Ph.D.
Advanced Methods at Purdue
August 19th, 2022

# Overview

**Part 1: Introduction to Observational Methods**
- Observational Coding - General
- Methodological Challenges and Considerations
- Theoretical Considerations
- Courses and Resources

**Part 2: Applied Examples and Conclusions/Questions**
- The Great Recess Framework
- Spatial and Mathematical Language Coding System
- Conclusions
- Questions

PURDUE
HEALTH & HUMAN SCIENCES
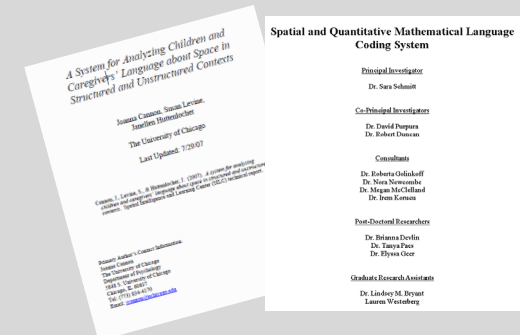
# Observational Coding

- Utility
- Types

- Coding System Approaches

# Observational Coding

**Utility: Why use observational coding?**
- Context
- Rich data

**Types of Observational Coding**
- Contemporaneous
  - Pros
    - Naturalistic settings
    - Less time intensive

# Observational Coding

**Utility: Why use observational coding?**
- Context
- Rich data

**Types of Observational Coding**
- Contemporaneous
  - Pros
    - Naturalistic settings
    - Less time intensive
  - Cons
    - Missing events
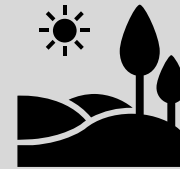    - Coding system must be established

# Observational Coding

**Utility: Why use observational coding?**
- Context
- Rich data

**Types of Observational Coding**
- Contemporaneous
  - Pros
    - Naturalistic settings
    - Less time intensive
  - Cons
    - Missing events
    - Coding system must be established
  - Examples
    - Classroom Assessment Scoring System® (CLASS)
    - Early Childhood Environment Rating Scale®, Revised (ECERS-R)
    - System for Observing Fitness Instruction Time (SOFIT Protocol)

# In-Person Coding

## System for Observing Fitness Instruction Time (SOFIT)

### 9.4. Observation procedures

1. The target student is the <u>major</u> focus of the observation, however, place yourself in a position so you can also hear the teacher and observe what the class as a whole is doing. Be as inconspicuous as possible and do not interfere with class activities. Be prepared to relocate frequently.

2. Do not begin observations until the teacher is present.

3. Start the audio player/computer and begin observing when 51% of the students reach the instructional station (gymnasium or designated outdoor space) and the teacher is present. Enter the <u>start</u> time on the first cover page.

4. Data should be representative of the entire class period. Even in emergency situations (e.g., can't find the class), do not begin observations if the lesson has been underway for over five minutes.

5. Observe the <u>student activity</u>, <u>lesson context</u>, and <u>interaction/involvement</u> throughout the 10-second "**observe**" interval. Enter codes by entering the appropriate symbols during the 10-second "**record**" interval.

5. Code Student One for four consecutive minutes (12 observations). Then code Students Two, Three, and Four in sequence. Continue in this manner, rotating the focus on a different target student every four minutes until the lesson ends.

6. End observing when 51% of the students have departed the instructional area. Record <u>end</u> time on the cover page.

7. Cue the audio for the next lesson.

# In-Person Coding

## System for Observing Fitness Instruction Time (SOFIT)

**Series #:** The series number is used along with the ID and Seq # (described below) to uniquely identify a form. The series number identifies a new data collection visit. During the baseline measurement period, Series=01, 02, and 03 will be used to identify the first, second and third visits to the school, respectively.

**Date:** Enter numbers for Month (**MM**), Day (**DD**), and Year (**YYYY**)

**Period:** Enter the class period being observed at the school that day.

**Grade:** Enter the school grade of the class (enter median grade for combination classes).

**Start Time:** Enter time the lesson actually started (Use 24-hr clock; e.g., 13:30 is 1:30PM).

**End Time:** Enter time the lesson actually ended (Use 24-hr clock; e.g., 13:30 is 1:30PM).

**No. girls/boys:** At minute 16 (at the end of page 1) enter the total number of girls and boys participating in the lesson (students need not be physically active at that time). Do not include those enrolled in the class, but absent (e.g., in library or at home).

Listed above

**Student activity:** Identify the activity level of observed student at the "record" signal: **1**=lying down; **2**=sitting; **3**=standing; **4**=walking; **5**=vigorous.

**Lesson context:** Identify the lesson context occurring at the "record" signal: **M**=management; **K**= knowledge; **F**=fitness activity; **S**=skill drills; **G**=game play; **O**=Other (e.g., free play).

**Interactions:** Identify teacher verbal or nonverbal interactions to promote physical activity and fitness during the "observe" interval. **I**=in class; **O**=out of class; **N**=none.)

**Comments:** Write notes to describe the target student, lesson activities, or unusual events.

# In-Person Coding

## System for Observing Fitness Instruction Time (SOFIT)

# Retroactive Coding

**Types of Observational Coding**
- Retroactive
  - Pros
    - Luxury of deciding what your coding system can look like
    - Training
  - Cons
    - Time intensive
    - Technology Issues
    - IRB Approval
  - Examples
    - Micro-level coding (microanalytic/micro-genetic)
      - Dyadic Interactions in Children Exhibiting the Broader Autism Phenotype
    - A System for Analyzing Children and Caregivers' Language about Space in Structured and Unstructured Contexts

# Approaches to Coding Systems

**Deductive**
- Developing indicators thought to support the construct of interest
- Then create items/criteria to reflect that
- Apply the coding system

**Inductive**
- Grounded Theory
- Thematic Analysis

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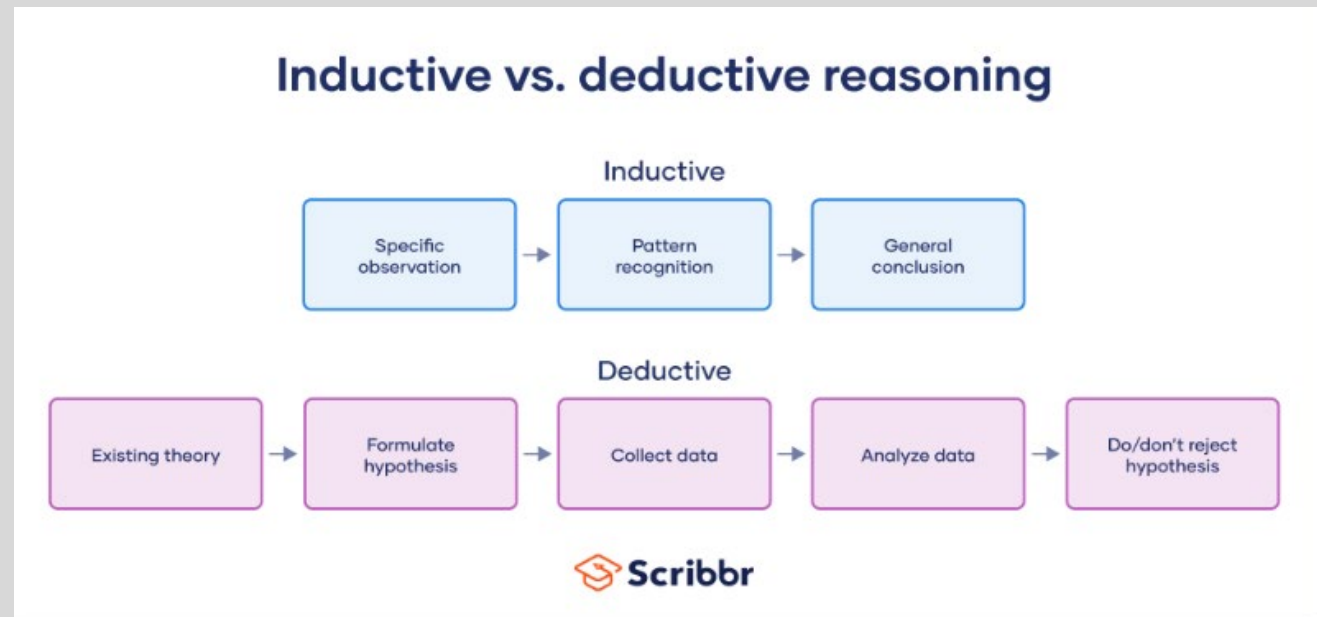
# Methodological Considerations

- Research Questions
- Coding Systems
- Reliability and Validity
- Additional Considerations

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# Methodological Considerations

**Choosing Observational Tools/Systems**
**Research Questions**
**Reliability**
- How do determine?
  - Data-specific
  - Approach

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# Methodological Considerations

**Choosing Observational Tools/Systems**
**Research Questions**
**Reliability**
- How do determine?
  - Data-specific
  - Approach

**Validity**
- Are you measuring the intended construct?
- Is your measure linked to constructs of interest that we would expect?
- Example: Variability in Preschool CLASS Scores and Children's School Readiness

**Additional considerations:**
- Feasibility
- Sensitive to Change
- Time Intensive
- Analyses – Temporal Dependence, Multivariate Structures

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# Extensions and Theoretical Considerations

# Theoretical Considerations in Observational Coding

**Repeated Measures**

- Direct assessments
- Naturalistic observation



Figure 5
Heat Map of Individual Children's Multi-dimensional Engagement with the Block Play Intervention

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# Courses and Resources

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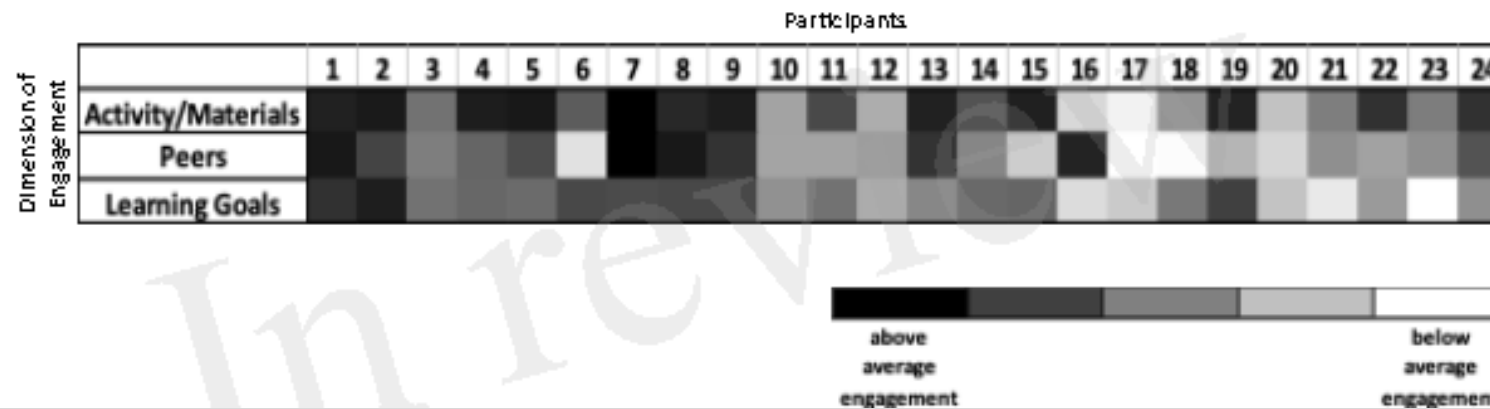
# Courses and Resources

**Courses**

- Qualitative Methods (SOC, POL, COM)
- Multilevel Modeling
- Introduction to Computational Text Analysis
- Field Research Methods
- Intensive Repeated Measures
- Focus Groups and Interviewing for Strategic Communication
- Interview Methods

**Coding Protocol Development and Examples**

- System for Observing Fitness Instruction Time
- Classroom Assessment Scoring System Overview
- Chorney, J. M., McMurtry, C. M., Chambers, C. T., & Bakeman, R. (2015). Developing and modifying behavioral coding schemes in pediatric psychology: a practical guide. *Journal of pediatric psychology*, *40*(1), 154–164. https://doi.org/10.1093/jpepsy/jsu099

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# Break

# Great Recess Framework

- In-person coding
- Future Directions

- Applying an existing scheme to a different population (i.e., pre-k)

# The Great Recess Framework

**Background:**

- The Great Recess Framework
  - Evaluation to measure contextual and behavioral components of recess
    - Massey, W. V., Stellino, M. B., Mullen, S. P., Claassen, J., & Wilkison, M. (2018). Development of the great recess framework–observational tool to measure contextual and behavioral components of elementary school recess. *BMC Public Health*, *18*(1), 1-11.
- Scoresheet
- Manual 1 – Example

| CIRCLE SCORE FOR EACH | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | Notes |
| **(1) Safety Concerns- Hazards.** Play space ≠ entire playground. Focus on proximity to where kids play | | | | |
| 1- Significant safety concerns in **almost all** of the play space | 2-Significant safety concerns in a **majority** of the play space | 3-Significant safety concerns in **some** of the play spaces | 4- The play space has **no** safety concerns. | Note specific hazards and where they exist: |

- Centered around elementary-aged children
  - Can we apply this to younger children?

# The Great Recess Framework

**Development:**

- Field notes

# The Great Recess Framework

**Development:**
- Field notes
- Modifications

**GRF-OT Scale Items – Modified for Preschool** | *Number of teachers*: _____ | *Number of children*: _____

| Item | 1 | 2 | 3 | 4 | Score | NOTES |
|---|---|---|---|---|---|---|
| Hazardous/ Unsafe Areas<br><br>Safety and Structure 1<br>*Training Manual: 1* | The play space for outdoor play is unsafe due to hazards not identified as "no play" zones. There are significant safety concerns in almost all of the play spaces | The play space for outdoor play has safety concerns due to hazardous areas on the majority of the playground not identified as "no play" zones | The play space for outdoor play has some safety concerns. There are a few hazardous areas not identified as "no play" zones | The play space for outdoor play has no safety concerns. It is clearly free of hazards and/ or all unsafe areas are identified as "no play" zones | | |
| Clear Boundaries<br><br>Safety and Structure 2<br>*Training Manual: 2* | The play space for outdoor play has no clearly identified boundaries for games (no cones, chalk, paint) | The play space for outdoor play has a few boundaries identified but a large percentage of the play space does not have any game space marked | The play space for outdoor play has many boundaries identified but a small portion of the play space does not have any game space marked | The play space for outdoor play is well marked (cones, chalk, paint) and all game boundaries are clear | | |
| Fixed/Unfixed Equipment<br><br>Safety and Structure 3 | No fixed or unfixed outdoor play equipment is available | Only fixed outdoor play equipment is available OR only non-fixed outdoor play equipment is available | Fixed outdoor play equipment is available and there are limited amounts of non-fixed equipment | More than one fixed and more than one non-fixed outdoor play equipment is available to support multiple games and activities | | |

## Adaptations to score sheet

- ☐ "Recess" is changed to "outdoor play" throughout the measure
- ☐ Physical activity count added to right side
- ☐ Adult Engagement 1 – using student ratios specific to elementary school – were removed
- ☐ Student Behaviors 1 – Examples provide for games – these numbers not provided in manual
- ☐ Safety and Structure 5 – Added percentages from the GRF-OT Training Manual
- ☐ Physical Activity – Added percentages from the GRF-OT Training Manual
- ☐ Physical Activity – Added instruction from the GRF-OT Training Manual
- ☐ Adult Engagement and Supervision 2 – Added examples from the GRF-OT Training Manual
- ☐ Added manual numbers

| | ...nber of organized games ...ties are available during ..., but there is variety | | A variety of organized games and/or activities are available during outdoor play | | |
|---|---|---|---|---|---|
| | ...equipment provided is ...ppropriately but there are ...es of inappropriate use | | Almost all of the equipment provided is being used as intended and in a safe manner (90%) | | |
| | ...y model positive culture ...language, getting children ...porting conflict resolution ...more than half | | Adults always model positive culture (e.g. positive language, getting children involved, supporting conflict resolution skills, etc.) – all adults | | |
| | ...dults are usually ...positioned to view children ...or play space, but some ...unsupervised | | Supervising adults are always strategically positioned to view children in the outdoor play space | | |
| Adult Engagement /Supervision 4<br>*Training Manual: 23* | engaged with children – no adults | ...and/or are engaged with children | ...ually playing games and/or are engaged with children | Adults always are playing games and engaged with children | | |
| Child Initiation<br><br>Child Behaviors 1<br>*Training Manual: 10* | Hardly any games are initiated by children (10%) | A few games are initiated by children (11-50%) | Some games are initiated by children (51-89%) | Almost all games are initiated by children (90%) | | |

# The Great Recess Framework

**Development:**
- Field notes
- Modifications
- Codebook

Training Manual
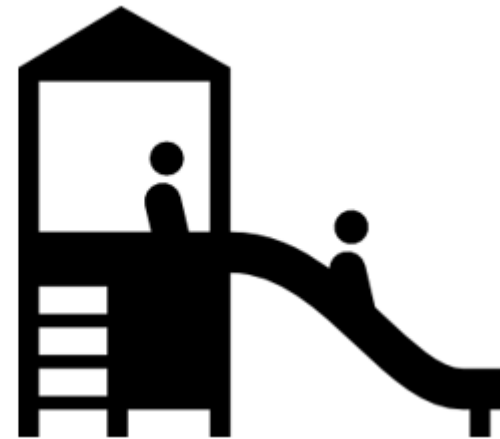
The Great Recess Framework
Observational Tool: Adapted for
PreK (GRF-OT-PREK)

Bryant, Finders, & Schmitt, 2019

# The Great Recess Framework

**Development:**
- Field notes
- Modifications
- Codebook

# The Great Recess Framework

**Development:**
- Field notes
- Modifications
- Codebook
- Training/Reliability
- Coding
- Reflections
- Questions?

## Section 4: Reliability Criteria

Observers will be introduced to the items on the GRF-OT-PREK, the updated operational definitions, and trained in the scoring procedures. Each item will be discussed in a series of trainings to allow the observers to ask clarifying questions regarding scoring procedures. Discussions of each GRF-OT-PREK item will be supplemented with information in the hard copy training manual adapted for the GRF-OT-PREK and the original GRF-OT scoring manual available online. These training manuals include each item, operational definitions, and examples for each item, scoring criteria for each item, as well as corresponding photos and videos to enhance the training process.

Prior to training, a team of "master coders" watched 4 videos publicly available on the web and derived master codes with justification that aligned with the GRF-OT-PREK. The master codes were decided by balancing how the observations would fit within the original GRF-OT and making any adjustments so that the concepts were relevant to preschoolers under the adapted GRF-OT-PREK. One video was subsequently dropped from the master coding list because it was decided that the outdoor play activities were not comparable with what would be expected in preschool contexts.

Trained research assistants will be required to score correctly on 75% of the master codes in each of the three videos to be considered reliable coders (e.g., correctly score at least 12 out of 16 items). Additionally, if trained research assistants score any single item more than 1 point away from the master codes it will be reviewed and re-tested in a subsequent session using the exemplar videos (see appendix b). Trained research assistants will be required to report the number of teachers and number of students within 2 points.

The final step of reliability training will involve live coding at a local preschool. Trained research assistants and one master coder will observe an outdoor play session and score items immediately following. Trained research assistants will be required to match the master coder's scores on 75% of the items to ensure inter-rater reliability was met during live observations.

# The Great Recess Framework

**Development:**
- Field notes
- Modifications
- Codebook
- Training/Reliability
- Coding
- Reflections
- Questions?

| | Variable Name | Label | Possible Range |
|---|---|---|---|
| **Safety and Structure Items** | grfss1 | Safety and Structure Item 1 (Hazardous/Unsafe Areas) | 1-4 |
| | grfss2 | Safety and Structure Item 2 (Clear Boundaries) | 1-4 |
| | grfss3 | Safety and Structure Item 3 (Fixed/Unfixed Equipment) | 1-4 |
| | grfss4 | Safety and Structure Item 4 (Organized Activities) | 1-4 |
| | grfss5 | Safety and Structure Item 5 (Equipment Use) | 1-4 |
| **Adult Engagement and Supervision Items** | grfae2 | Adult Engagement and Supervision Item 2 (Positive Culture) | 1-4 |
| | grfae3 | Adult Engagement and Supervision Item 3 (Positioning) | 1-4 |
| | grfae4 | Adult Engagement and Supervision Item 4 (Engagement) | 1-4 |
| **Student Behaviors Items** | grfcb1 | Child Behaviors Item 1 (Student Initiation) | 1-4 |
| | grfcb2 | Child Behaviors Item 2 (Physical Altercations) | 1-4 |
| | grfcb3 | Child Behaviors Item 3 (Positive Communications) | 1-4 |
| | grfcb4 | Child Behaviors Item 4 (Disagreements) | 1-4 |
| | grfcb5 | Child Behaviors Item 5 (Conflict Strategies) | 1-4 |
| **Transitions Items** | grftrn1 | Transition 1 (To Outdoor Time) | 1-4 |
| | grftrn2 | Transition 2 (From Outdoor Time) | 1-4 |
| **Overall Physical Activity** | grfpa | Overall Activity Level | 1-4 |

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## Spatial and Quantitative Mathematical Language Coding System

- Transcription data
- Future Directions
- Extending an existing system to a different context (i.e., block play)

# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

○ **Background:** Block Play Intervention

## Using block play to enhance preschool children's mathematics and executive functioning: A randomized controlled trial

Sara A. Schmitt*, Irem Korucu, Amy R. Napoli, Lindsey M. Bryant, David J. Purpura

*Human Development and Family Studies, Purdue University, 1202 W. State Street, West Lafayette, IN 47907, United States*

**Table 1**
Description of Intervention Prompts.

| Weeks | Description of Prompt | Example Prompt |
|-------|----------------------|----------------|
| 1–2 | Simple prompt | Today, your job is to build a boat together. I can't wait to see the boat you build! |
| 3–4 | Simple prompt with story | I want you to use your imagination today. I want you to imagine that a river is running right through this room. A mama duck and her ducklings are trying to cross the river and they need your help. So, today, your job is to build a bridge that crosses the river so that the mama and her ducklings can cross. |
| 5 | Components prompt | Today, your job is to build a house. But, the tricky thing is that the house needs to have some things that other houses have. It needs to have four walls, a roof, a way to get inside like a door, and at least two rooms. |
| 6 | Components prompt with pictures | Today, I am going to show you some pictures. I would like you to build the same things you see in the pictures in your structure. Your job is to build two castles. But the castles have to have these three really important things shown in the pictures. They have to be connected by a bridge that looks like one of these (show picture). They both have to have a window that looks like this (show picture), and they each have to have a tunnel that goes underneath that looks like this (show picture). I will put the pictures right here on the ground for you to see. |
| 7 | Modeling pictures of complex structure | Today, I am going to show you a picture with a structure that I built on it. Your job is to work together to build the same structure you see in this picture (show picture). I would like you to build the structure exactly as you see it in the picture, okay? I know you can do it! I will put the picture right here so you can look at it as you build. |

# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

○ **Background:** Block Play Intervention

**A B S T R A C T**

The current study investigated the extent to which a semi-structured block play intervention supported growth in mathematics and executive functioning for preschool children using a randomized controlled design. A secondary aim was to explore whether differential intervention effects emerged for children from various socioeconomic backgrounds, indicated by parental education level. Participants included 59 preschool children. Children ranged in age from 38 to 69 months ($M = 55.20$, $SD = 7.17$), and 56% were female. Results from regression models indicated that, although not statistically significant, children who participated in the intervention demonstrated greater gains in three mathematics skills (numeracy, shape recognition, and mathematical language) and two indicators of executive functioning (cognitive flexibility and a measure of global executive functioning) compared to children in a control group. Further, three significant interactions were found, suggesting that for numeracy, cognitive flexibility, and global executive functioning, children of parents with low educational attainment benefited the most from intervention participation. These findings provide preliminary evidence for the effectiveness of a semi-structured block play intervention for improving children's school readiness and have implications for including intentional instruction using blocks in preschool classrooms.

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# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

◦ **Mathematical Language**

- Quantitative (e.g., more, less)

- Spatial (e.g., big, small)

◦ **Spatial and Quantitative Mathematical Language Coding System**

- Transcribing block play sessions from the pilot study (2016)

  - Issues with accuracy

- Coding for spatial and quantitative mathematical language during block play

- Led development effort of expanding an existing coding system

  - Manual

  - Show manual

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# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

◦ **Spatial and Quantitative Mathematical Language Coding System**

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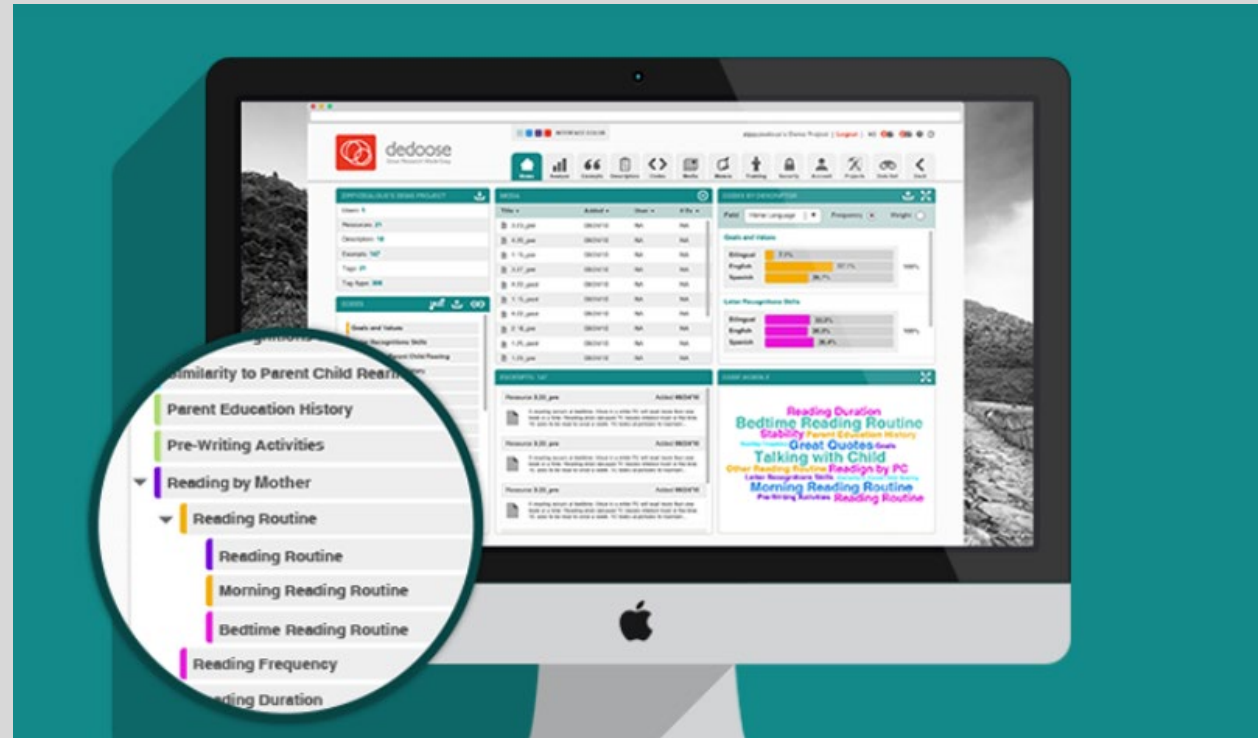
# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

**Future Directions:**

◦ Data science approaches to coding mathematical language

    ◦ How can we more efficiently code this language in our current study?

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# Examining Causal Connections and Mechanisms Between Block Play and Mathematics

Graduate Research Assistant: August 2020-Present

○ **Using R to help with coding efforts**

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | id | school_session | sentence_before | sentence | sentence_after | word | promted_by_exp | category | domain |
| 2 | 15100 | 11_1 | 15102 But this one had smaller things | 15100 Okay the little one is at the back at the end Okay No on top of it like that You silly goose | 15102 Youre the one whos silly | back | No | | |
| 3 | 15102 | 11_11 | 15100 Fire | 15102 Ill fix this back here | 15100 1 2 3 2 1 2 3 blast off | back | No | | |
| 4 | 15102 | 11_12 | ExperimenterThen youd have to take the whole thing apart | 15102 Then like this Let me see the picture Theres a number on the back of it | Experimenter Mmhmm | back | No | | |
| 5 | 15102 | 11_12 | Experimenter Mmhmm | 15102 Why does it have a number on the back of it Do you think this looks like this | Experimenter I cant really see from here I think you can do it | back | No | | |

○ **Future direction: u**sing natural language processing (NLP) to help determine codes

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# Conclusions

# Conclusions

**Things to consider:**
- What are your research questions?
  - How will that inform your approaches to coding
    - In-person, retroactive
      - Do you have existing data that can be re-explored? (Probably!)
    - Individual-level, group-level
- Are there existing measures that you can utilize to inform your coding system?
  - Borrowing or creating something new!
  - Existing approaches (e.g., micro-genetic coding, dyadic, machine learning)
  - Determining reliability of coding, validity of evaluation
- What are some extensions of your existing work that you could use observational coding approaches for?
- The possibilities are endless!

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# Thank you!

**Slides:** Dyadic Data Analysis

**Books/Chapters:**

DeWalt, K. M., Musante, K., & DeWalt, B. R. (2011). *Participant Observation: A Guide for Fieldworkers 2nd Edition*. Rowman Altamira.

Ostrov, J. M., & Hart, E. J. (2013). Observational Methods 15. *The Oxford Handbook of Quantitative Methods in Psychology, Vol. 1*, *1*, 286.

Clarke, V., & Braun, V. (2013). Successful qualitative research: A practical guide for beginners. *Successful Qualitative Research*, 1-400.

Chandra, Y., & Shang, L. (2019). Inductive coding. In *Qualitative research using R: A systematic approach* (pp. 91-106). Springer, Singapore.

**Papers**:

Bai, J., Swanson, K. M., & Santacroce, S. J. (2018). Observational Coding Systems of Parent-Child Interactions During Painful Procedures: A Systematic Review. *Pain practice : the official journal of World Institute of Pain*, *18*(1), 130–145. https://doi.org/10.1111/papr.12588

Sullivan, Florence R., and P. Kevin Keith. "Exploring the Potential of Natural Language Processing to Support Microgenetic Analysis of Collaborative Learning Discussions." *British journal of educational technology* 50.6 (2019): 3047–3063. Web.

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International journal of qualitative methods*, *5*(1), 80-92.

Guajardo, N. R., Petersen, R., & Marshall, T. R. (2013). The Roles of Explanation and Feedback in False Belief Understanding: A Microgenetic Analysis. *The Journal of Genetic Psychology*, *174*(3), 225–252. https://doi.org/10.1080/00221325.2012.682101

Audette Sylvestre, Mélissa Di Sante, Élise Brassart, & Jean Leblond. (2021). Introducing the Coding Observations of Parent–Child Interactions (COPI): An Observational Measure of the Parental Behaviours That Matter for Language Development. *Canadian Journal of Speech-Language Pathology and Audiology*, *45*(2)