



Rusty, Rosy, and Autism: Disabilities in the Digital Age

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USA

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EARLY EDUCATION AND
TECHNOLOGY FOR CHILDREN

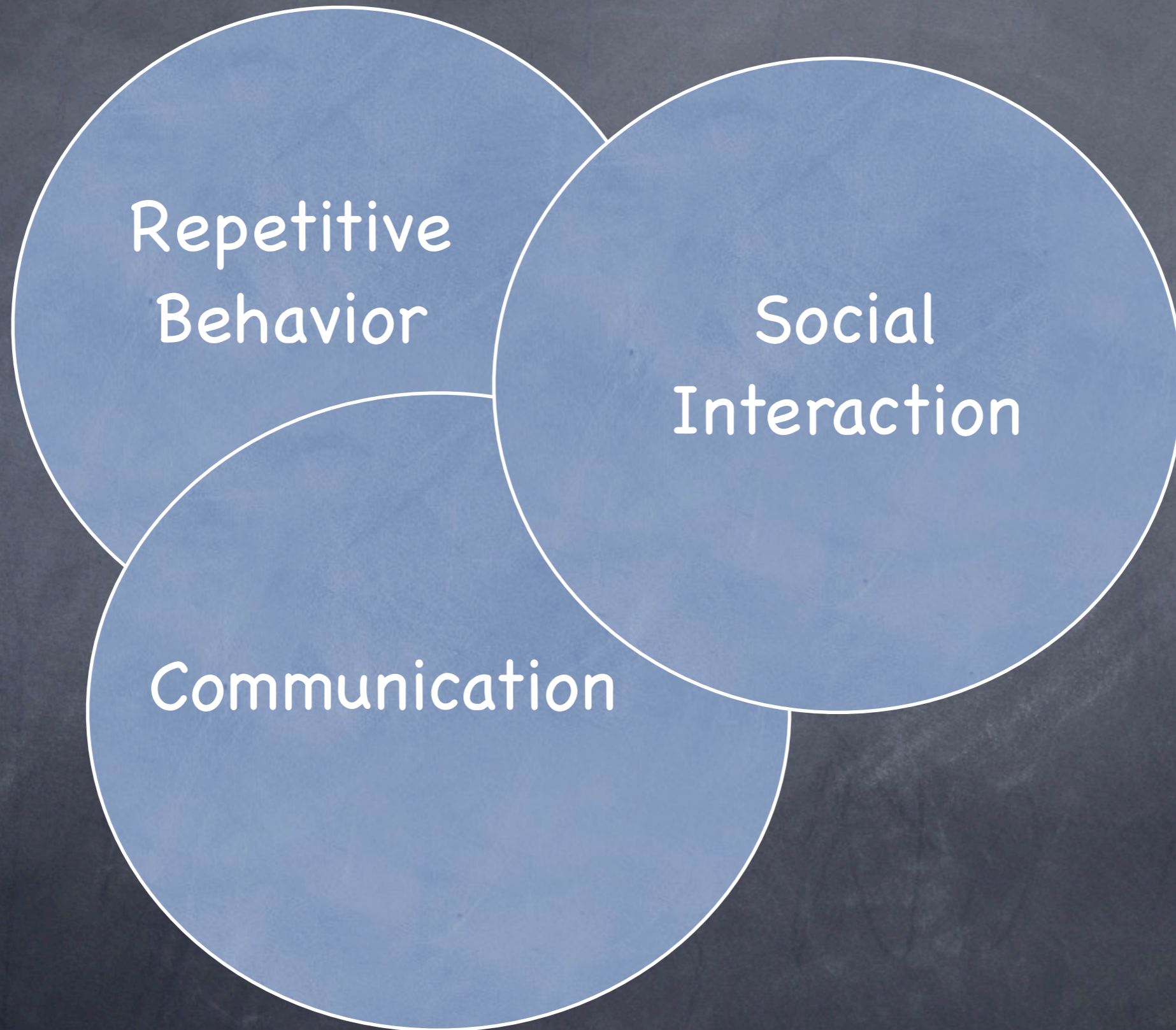
Rusty, Rosy, and Autism: Disabilities in the Digital Age

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What is Autism?



What is Autism?

- A “spectrum disorder”
 - Lots of variability in language and behavior
 - Multiple causes = multiple treatments
 - Outcome research is a challenge!

Abrahams & Geschwind, 2010: “a study of 10 or 20 randomly selected autistic patients may be best described as individuals with 10 or more different disorders”

Along for the ride: secondary symptoms

- Cognitive impairment (40–60%)
- Seizures + other medical conditions (10–30%)
- Comorbid psychiatric conditions
 - Depression, anxiety, tics, OCD, ADHD
- Other regulatory issues
 - Sleeping, eating, gastrointestinal

Areas of learning difference and difficulty

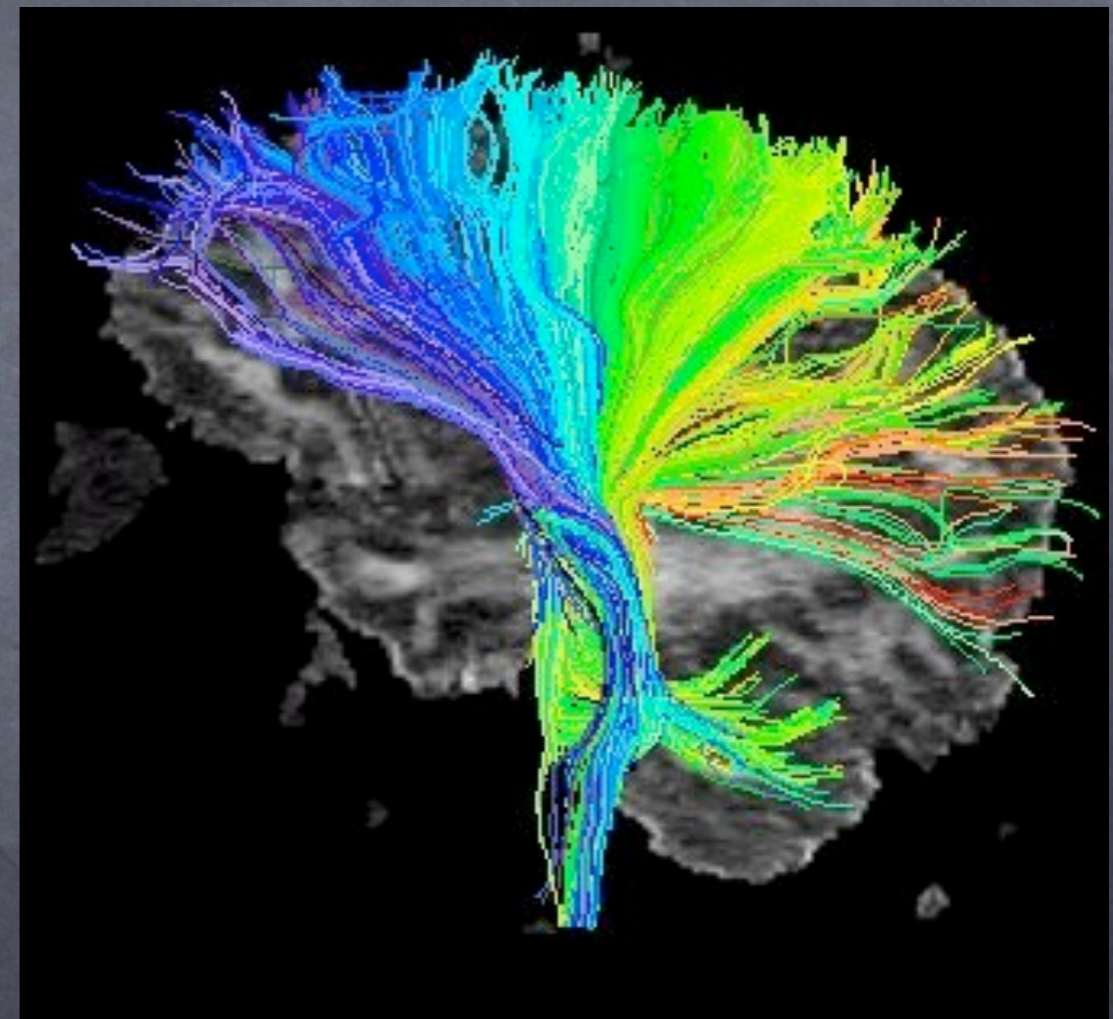
- Language
- Abstraction, meaning, relationships
- Imitation
- Sequencing
- Organization
- Attention span and focus
- Motivation

Because I have autism, I live by concrete rules instead of abstract beliefs. And because I have autism, I think in pictures and sounds. I don't have the ability to process abstract thought the way that you do. Here's how my brain works: It's like the search engine Google for images. If you say the word "love" to me, I'll surf the Internet inside my brain. Then, a series of images pops into my head. What I'll see, for example, is a picture of a mother horse with a foal, or I think of "Herbie the Lovebug," scenes from the movie Love Story or the Beatles song, "Love, love, love... Some people might think if I could snap my fingers I'd choose to be "normal." But I wouldn't want to give up my ability to see in beautiful, precise pictures. I believe in them.



Potential causes of autism

- Inefficient long-range connectivity across the brain makes integration of information difficult
 - social information specifically challenged?
 - academic learning related to autism and/or connectivity?



Potential treatments for autism: is it a match?

- Applied behavioral analysis
 - discrete trials
 - positive and negative reinforcement
 - one-on-one
 - one skill at a time
- Group social skills training
 - focus on everyday emotion coping and explicit skill building

Motivation and Attention in Autism: “can’t they” or “won’t they”?

- Differential between knowledge and performance may be especially potent in autism
 - Tolman’s “latent learning”
 - Neural connectivity and complexity

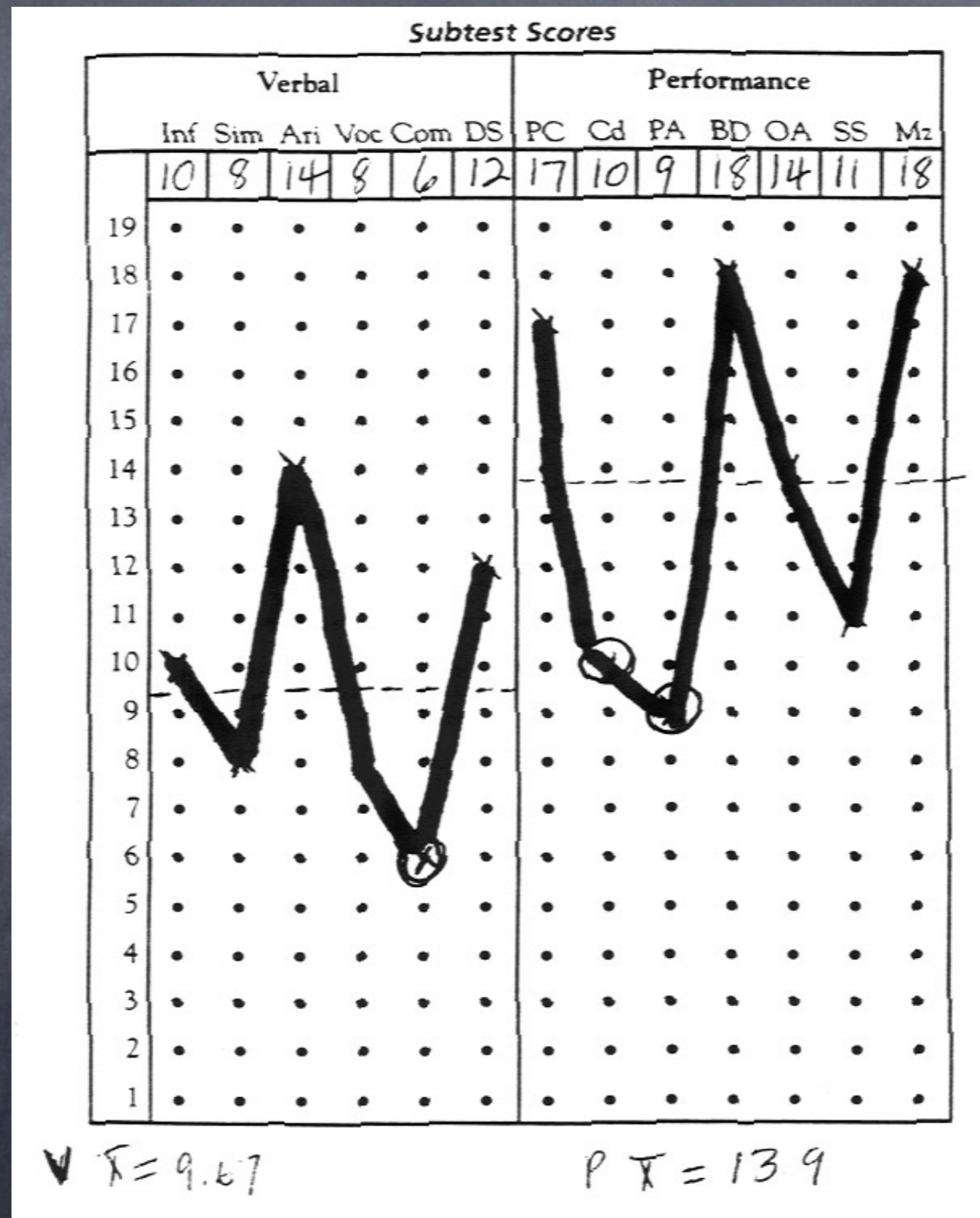
Measurement Issues in Autism

- Not everything is as it seems!
 - Even the most reliable measures suffer

Measurement Issues in Autism

- Outcome measures are especially problematic in autism (Ballard, South et al., under review)
 - No autism-specific outcome measures - what is important to track?
 - Existing measures do not match with parent-generated concerns

Measurement Issues in Autism



Waterford Early Learning Software



- Engaging sound and animation
- Specific skill-building progresses toward integration
- Technology based may increase motivation and attention in autism (see Ozonoff, 1995)
- Easy-to-use: basic computer skills (mouse click) and use at home

Intervention Plan

1. Random assignment to either Waterford Early Reading Program (ERP) or Early Math/Science (EMS)
2. Five months of use @15 minutes/day @5 days/week (expected total ~1500 minutes)
3. Repeat skills testing
4. Crossover to alternate treatment

Intervention Details

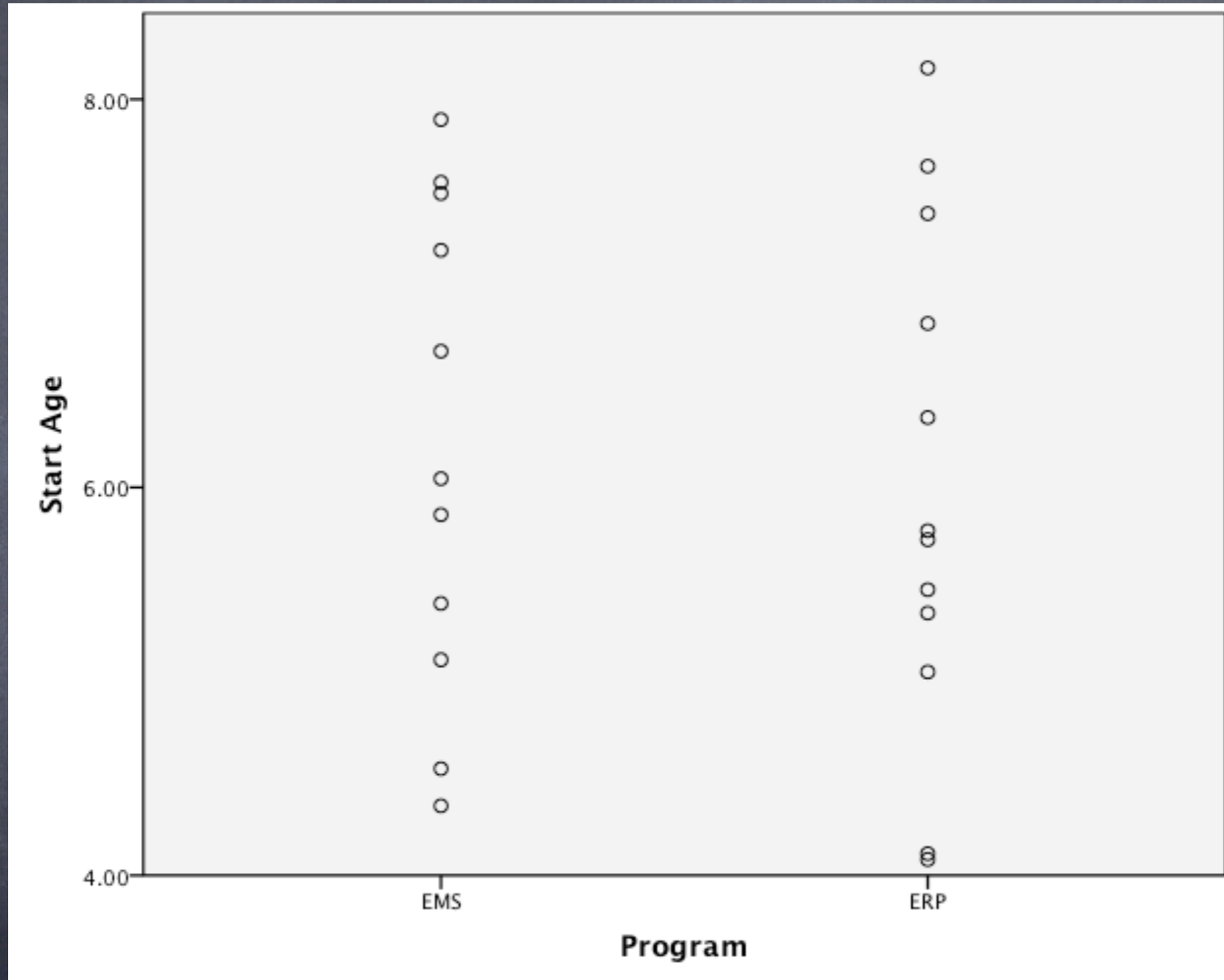
- Each family loaned a small hard drive with everything installed
 - runs off of home personal computer
 - we provide kitchen timer to keep track
- Each child has own account with self-picked icon
- Families receive support calls when usage

Off we go!



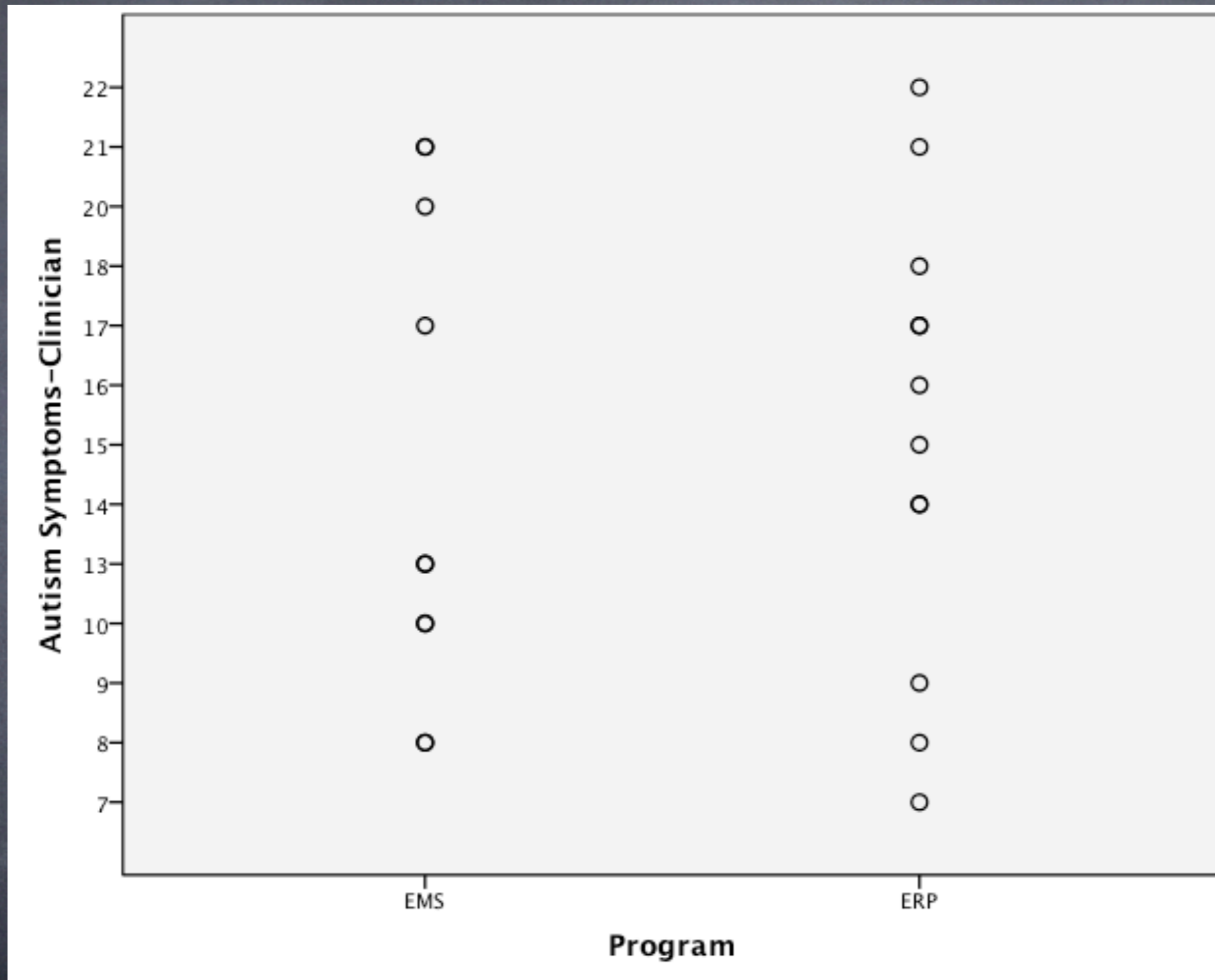
- 27 children in 23 families
- +4-5 children assessed by did not begin intervention
- Enrolled over 7-month period
- Everybody eager

BASELINE: EQUIVALENT AGE



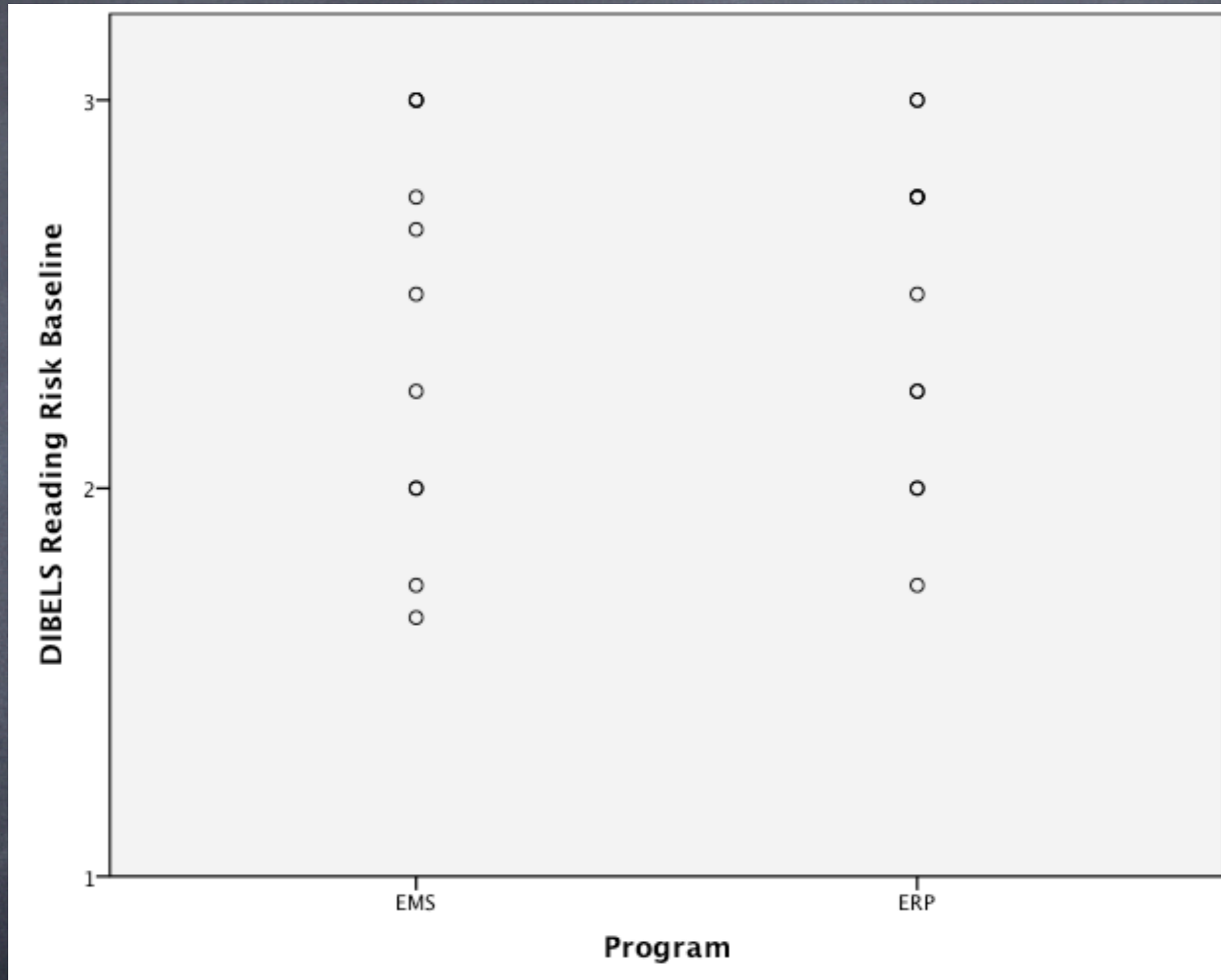
$p < .05$ for all independent samples t-tests

BASELINE: EQUIVALENT AUTISM SYMPTOMS



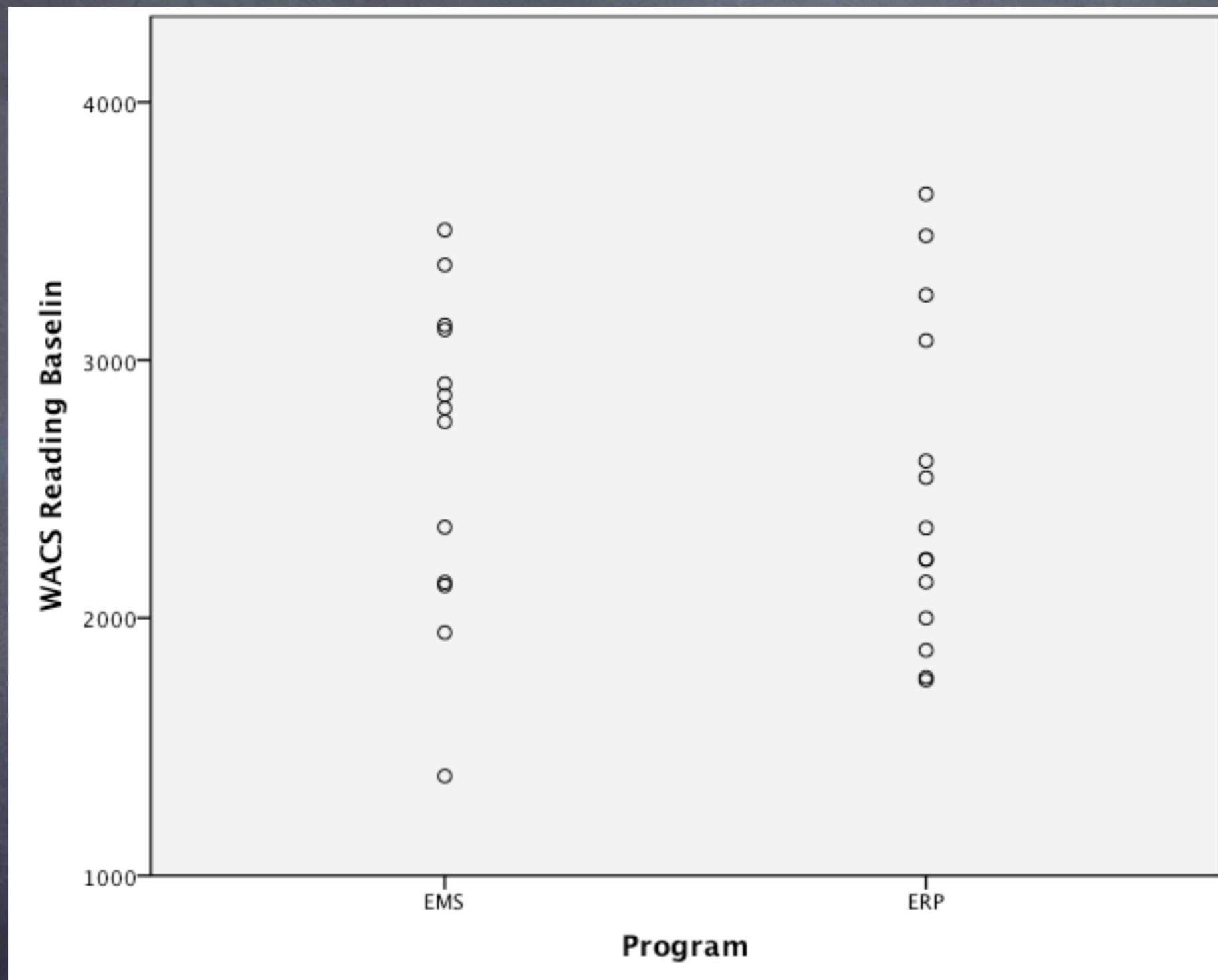
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BASELINE: EQUIVALENT READING RISK



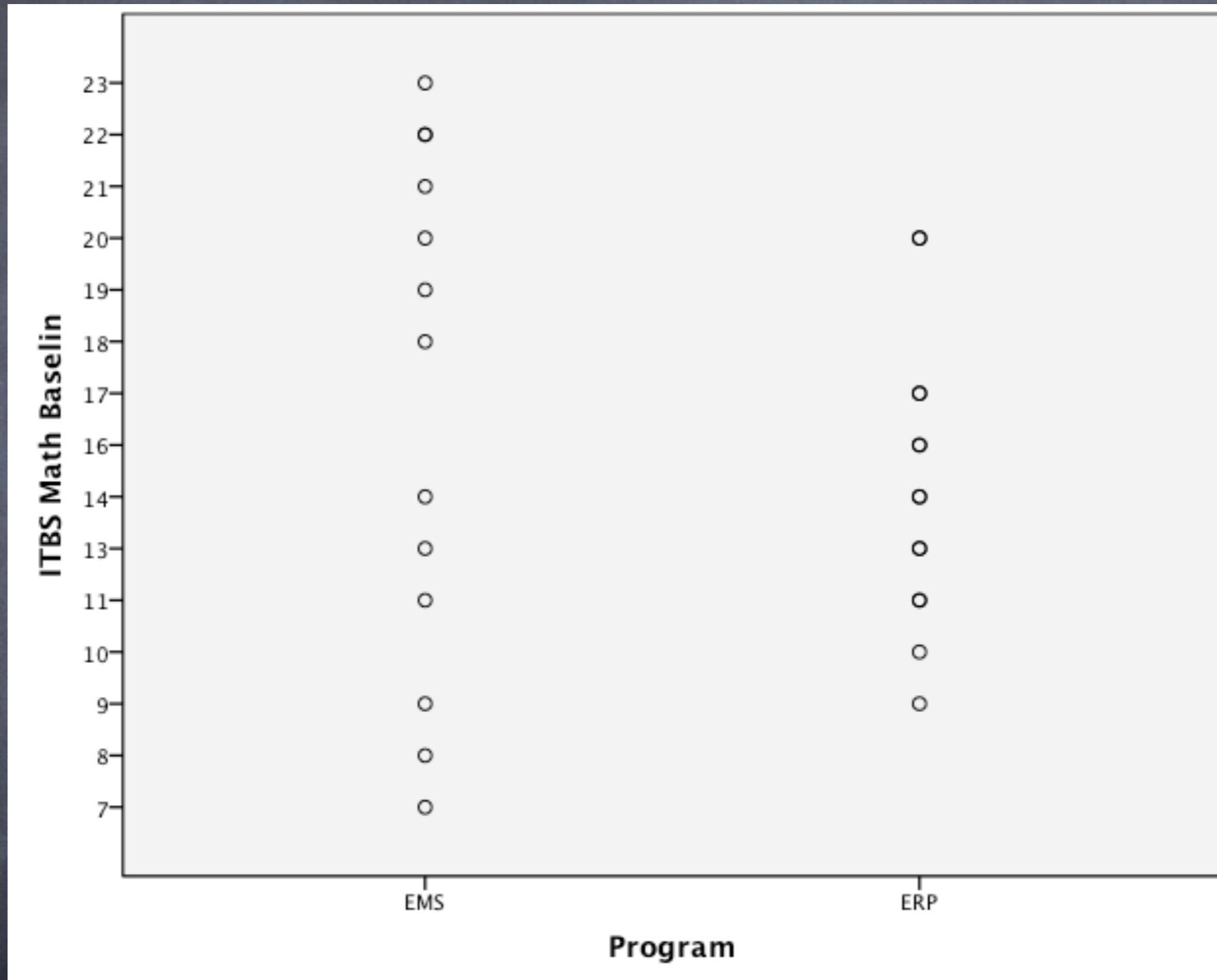
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BASELINE: EQUIVALENT WACS READING SKILL



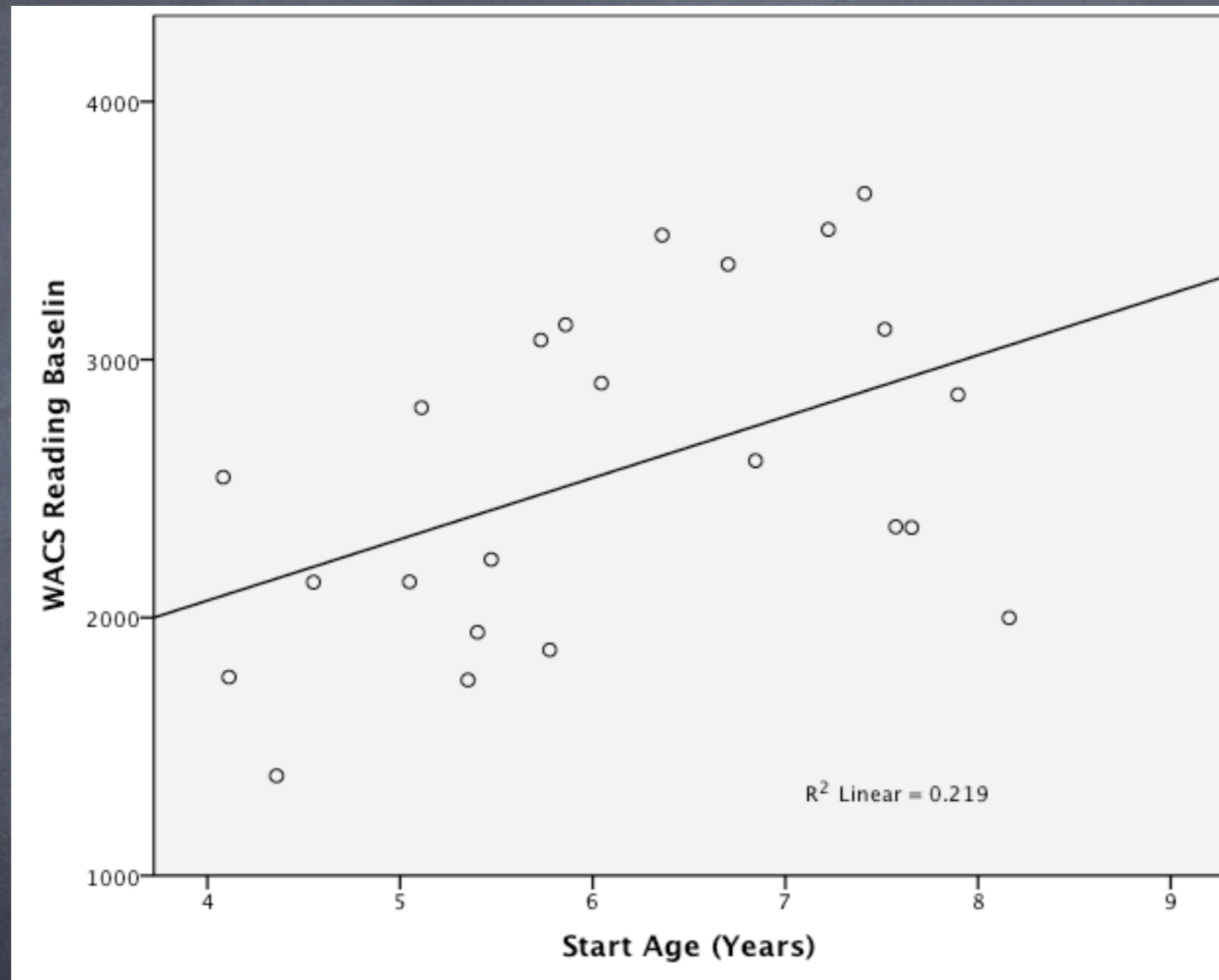
$p < .05$ for all independent samples t-tests

BASELINE: ITBS MATH EQUIVALENT MEANS BUT SOME DIFFERENCE IN VARIABILITY



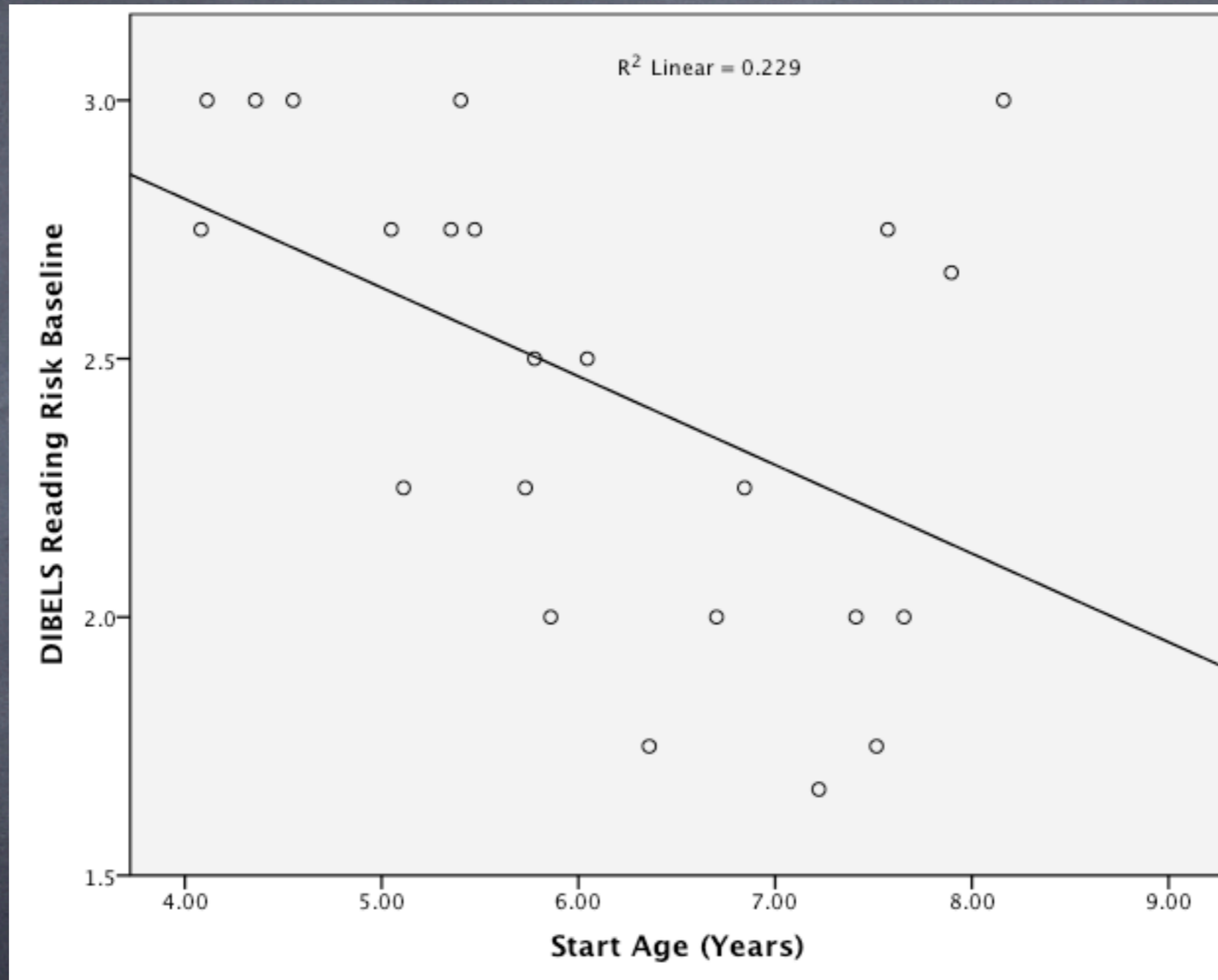
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Individual Difference Factors



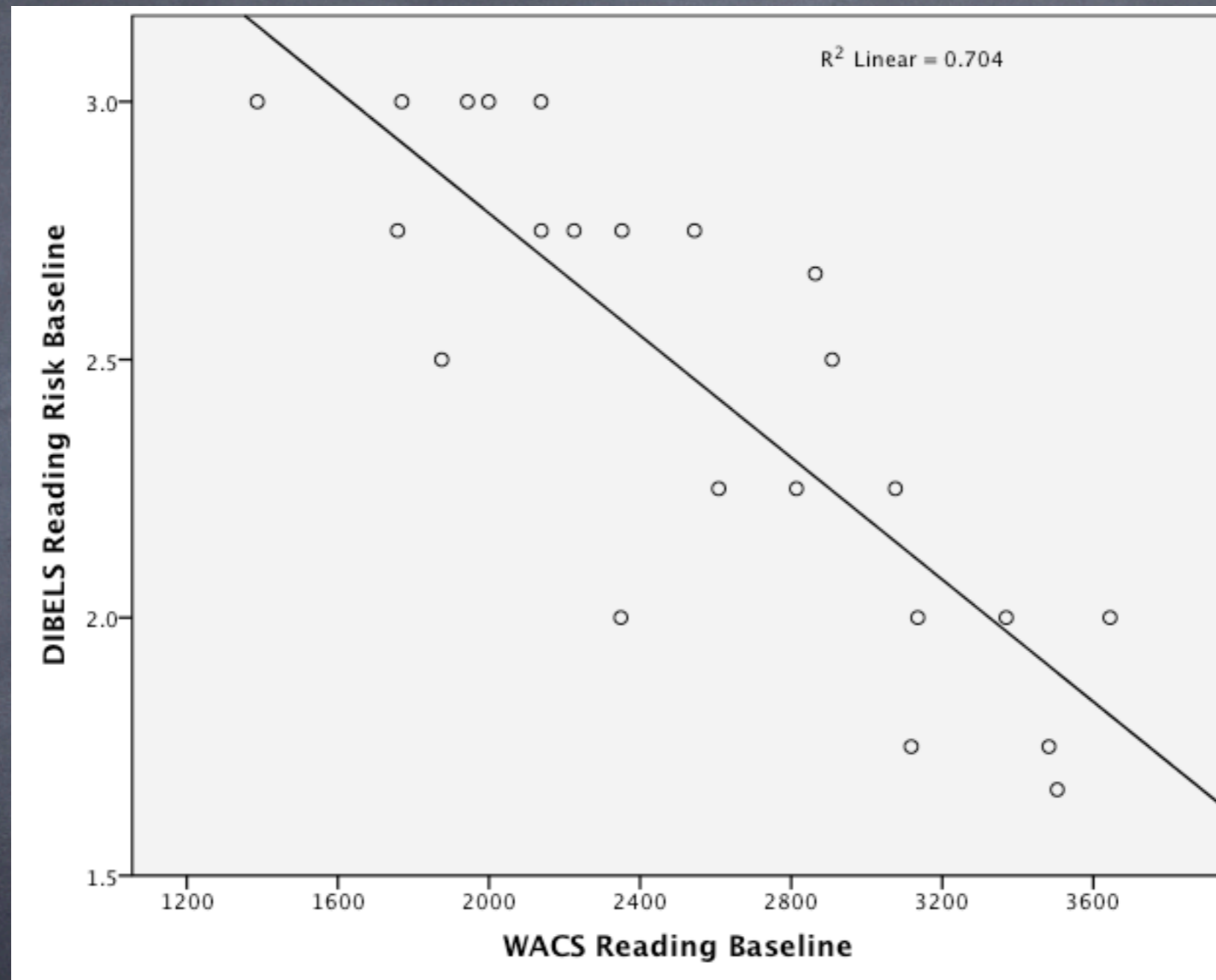
Significant positive correlation between age and reading skill

Individual Difference Factors



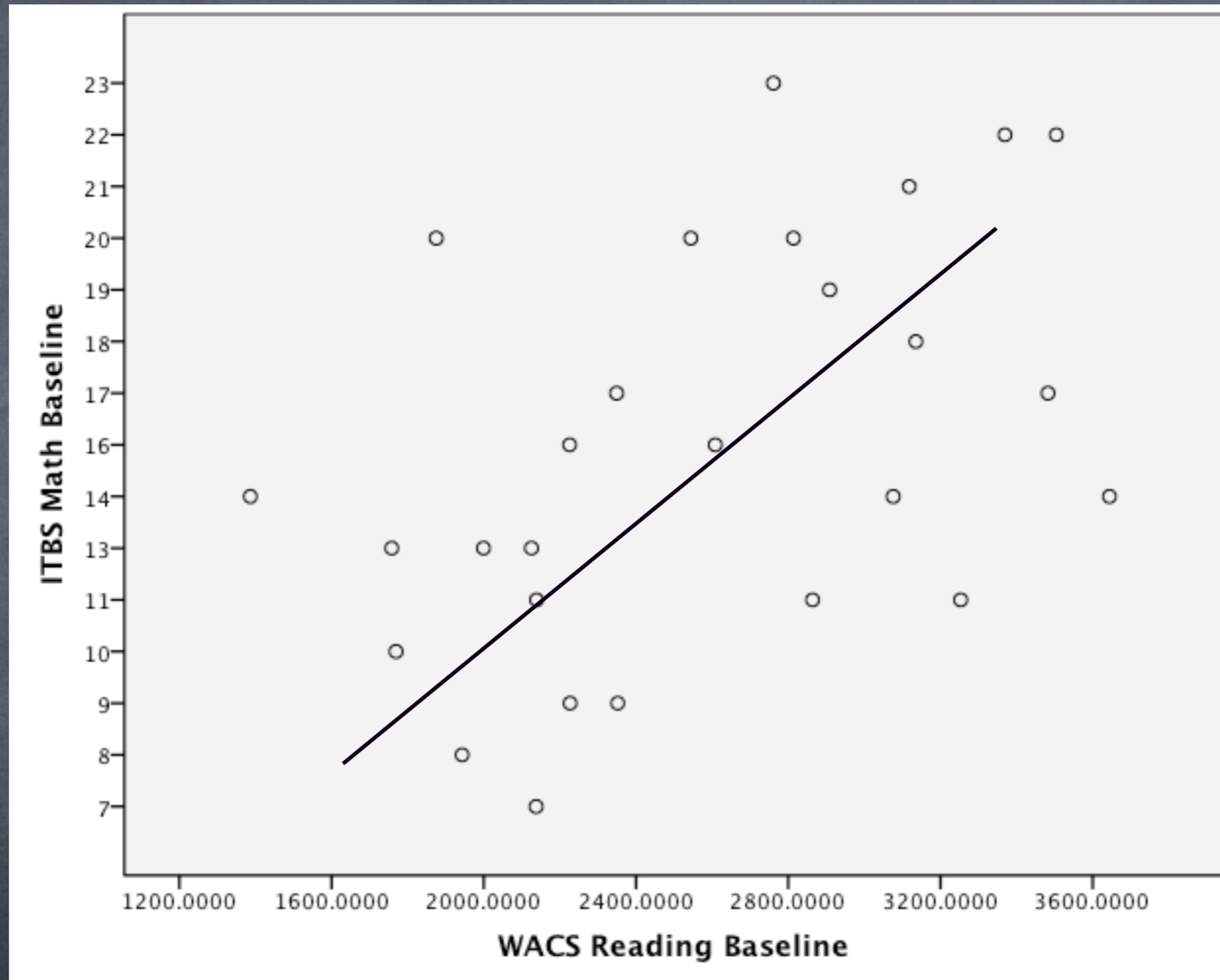
Significant negative correlation between age and reading risk

Individual Difference Factors



Significant negative correlation between reading skill and reading risk

Individual Difference Factors



Significant positive correlation between reading skill and math skill

The Wheels Fall Off: Everyday Reality in the Life of An Autism Family (and Everyone)

Family moves to Florida and Washington

sometimes, the software was too easy...

changes at Waterford and BYU

broken computers...

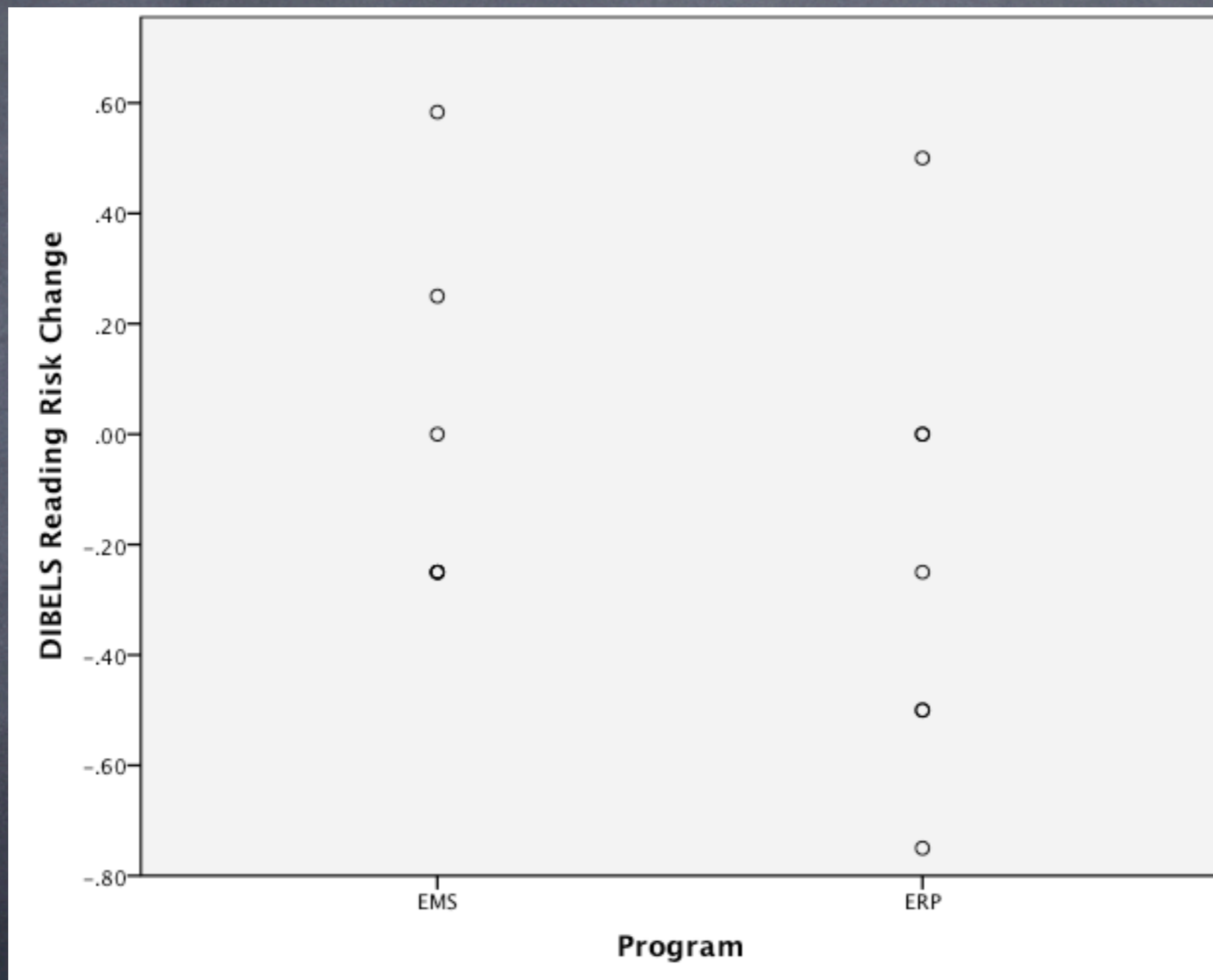
sometimes the software was too easy, but

mostly, it got too hard, too fast

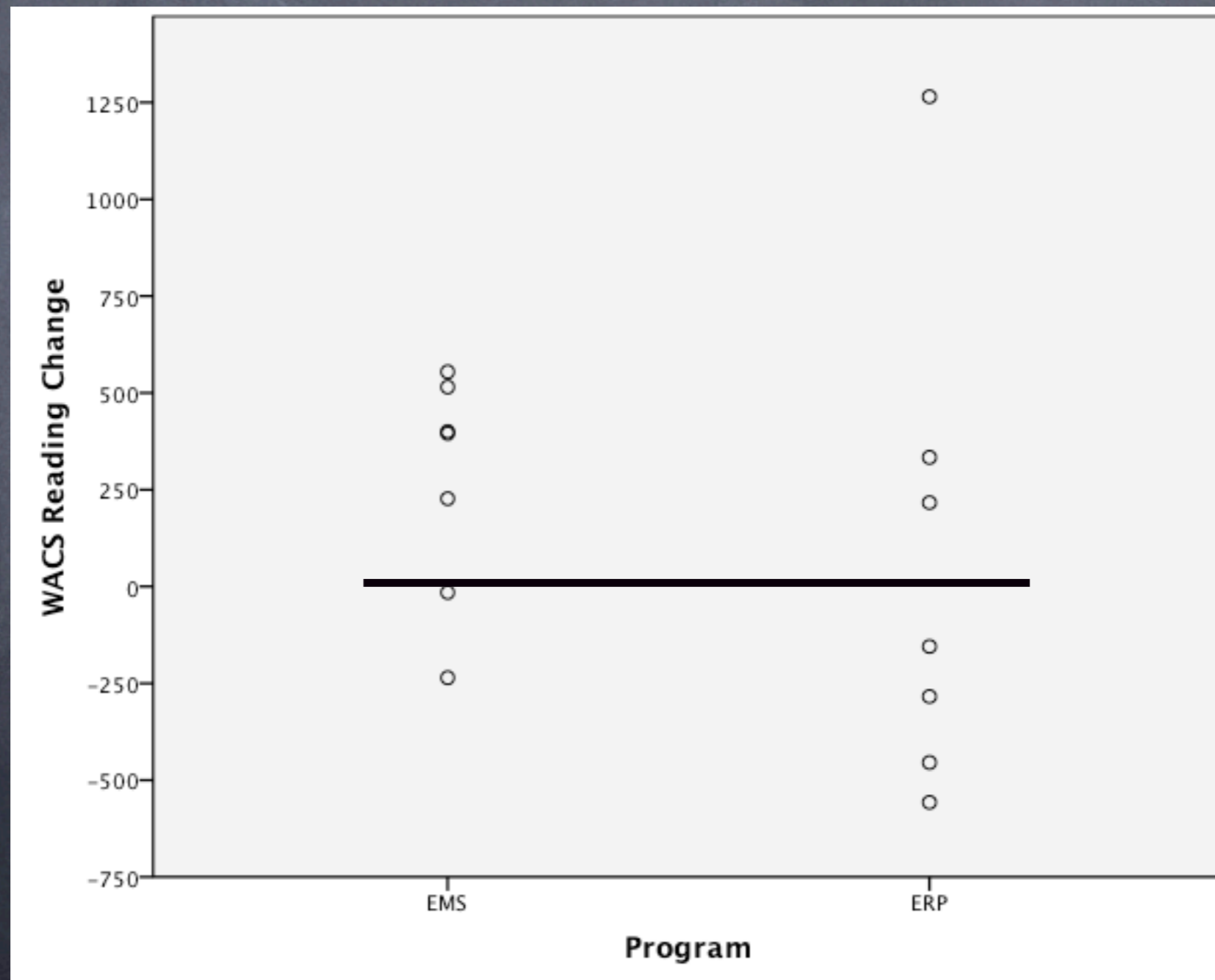
Follow-up Data

- 14 children from 12 families
 - 7 ERP and 7 EMS
 - 51% follow-up rate overall
- No significant difference in completers vs. non-completers in age, autism severity, baseline reading or baseline math skills

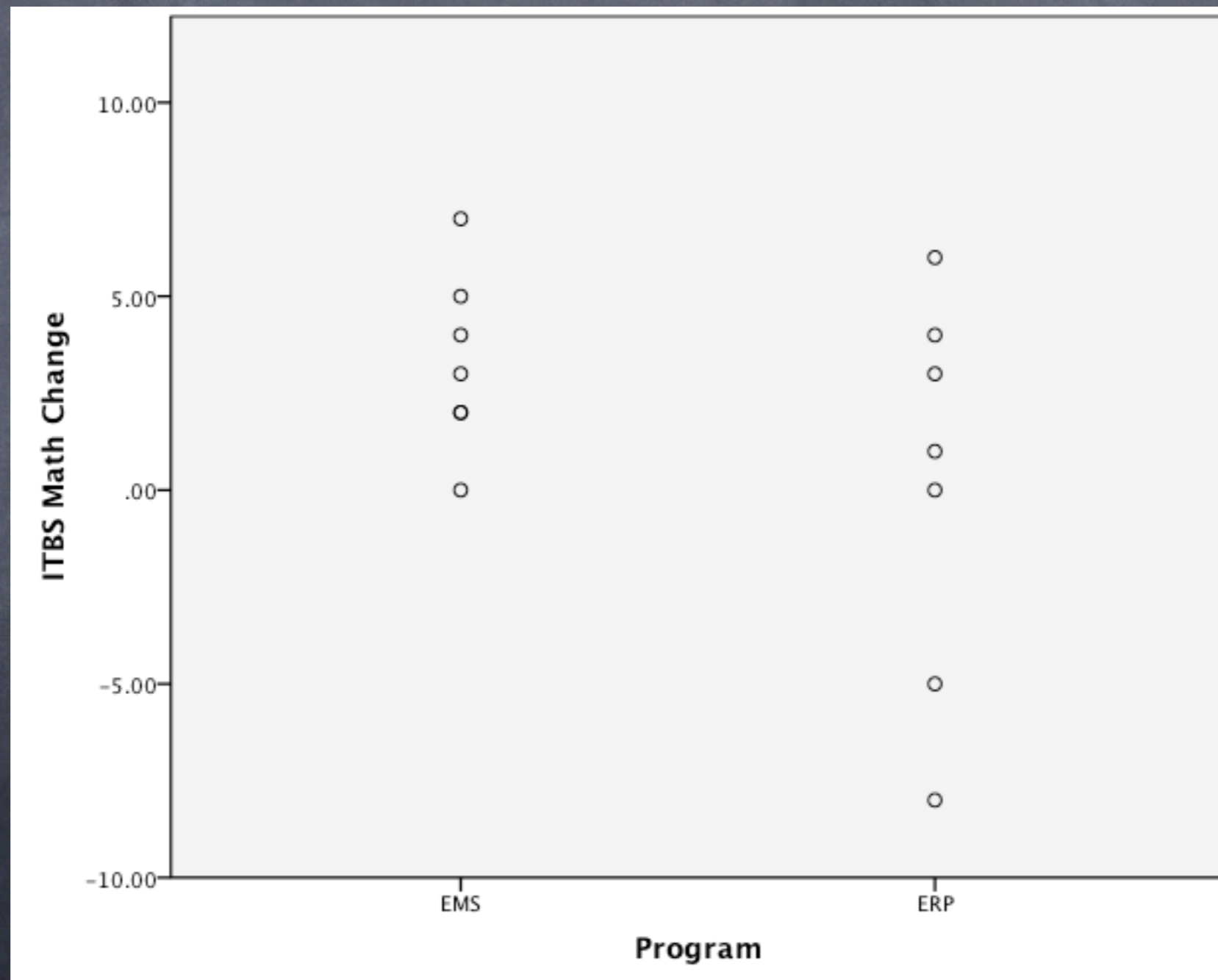
Slight downward movement in reading risk for ERP group ($M = .25$) vs. EMS ($M = .02$)



- EMS group mean for WACS reading skill change is higher than for ERP group (EMS = 263 ± 292 ; ERP = 52 ± 627)
- 4 ERP show decline vs. 2 EMS



EMS group also improves more in math, with less variability (EMS $M = 3.3 \pm 2.2$; ERP $M = .14 \pm 5.0$)



Case Studies: Two ERP Users

- J.R.: 5.78 years at start; moderate-to-severe autism severity; high baseline math, lowest baseline reading; 1763 minutes usage; highest WACS change score; end WACS score among the highest; lost 8 points (out of baseline 20) on ITBS math score
- S.T.: 6.36 years at start; moderate autism severity; moderate baseline math, third highest baseline reading; 2612 minutes usage; largest drop in WACS change score; gained 6 points on math score

Potential predictors?

- For completers: Usage time is associated with reading risk at baseline (-.73) and follow-up (-.30); and reading skill, baseline (.58) and follow-up (.42); no significant associations with change score
- For non-completers: Usage time is associated with WACS reading skill at baseline (.46) but less with DIBELS reading risk (.25).

Things the Grown-Ups Learned from Kindergartners

- One-shot measures aren't nearly adequate
 - attention and motivation may vary by the day (or hour!)
 - performance on math vs. reading varies even within a test session!
 - Cost for more measurement periods is extensive
- Need adequate change measures
 - especially for math, to remove the verbal comprehension components (or keep those in?!)
- Even with appealing, technology-based instruction, autism children need considerable direction/encouragement—and parents too!

But don't shoot the messenger

- Measures may be a problem, but the reality is: this intervention may not work for autism in its current form and implementation
 - who will it work for?
 - under what circumstances?
 - how much time is needed, how much outside intervention
 - school-based program?