Using Computational Tools to Increase Academic Inclusion of K-6 Students with Autism in Self-Contained Classrooms

Michael Ryan Hunsaker, Ph.D
Hunsaker Consulting

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hunsakerconsulting@gmail.com

Disclosures

I certify I receive no financial or professional benefit from any information contained within this presentation. As such I am free from conflicts of interest

Programs and methods described in this presentation are open source on CC or AGPL-3 licenses

All necessary code and methods I discuss are freely available for download

https://github.com/mrhunsaker/MainstreamingAlgorithm

Participant Outcomes

1. Identify implicit biases that interfere with LRE
2. Use computer based tools to remove bias from LRE
    - Decision trees generated from student data
3. Apply student data to make LRE-related decisions
    - Seek data sources to accurately represent ability
    - Apply data, not instinct, to guide placement

Ineffective LRE: Problem with lasting consequences

Ineffective LRE

Self-contained classes are separate **and** unequal

Segregation of students with disabilities from GenEd

Special education case law

de minimis standard - Rowley (1982)

appropriately ambitious standard - Endrew (2017)

Autism and LRE

In Utah,

33% of students with autism receive 80% of education in a GenEd setting

24% receive only 40-79% of education in GenEd

35% are self-contained

36% of 3-5 year old children with autism attend a separate class from peers, in a separate school, or are educated in a residential facility

National Center for Education Statistics 2017; National Council on Disability 2018

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24% receive only 40-79% of education in GenEd

35% are self-contained (>80% in Special Education)

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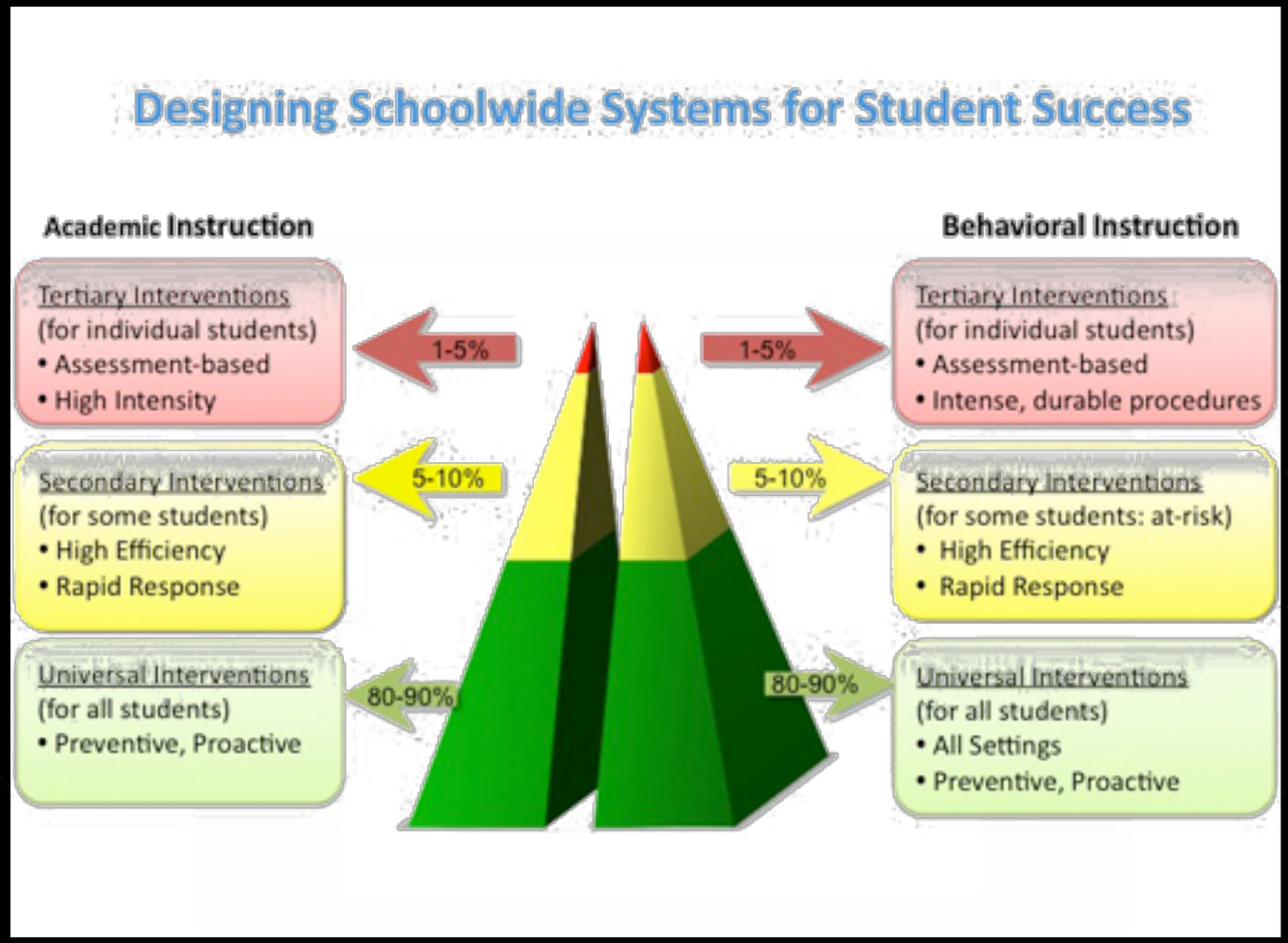
Structural Barriers

Decisions not modeled on RtI/MTSS

No “Reverse LRE”



https://www.pbis.org/school/mtss

Implicit Bias

Desire to keep student as “good example"
Behavioral data from self-contained classroom
Past lack of success with mainstreaming
Past lack of school skills
Anecdotal reports not supported by data
Requirement for paraeducator time
Requirement for increased resources
Student idiosyncrasies/peculiarities
Student personality
Parent concerns about academic ability
Parent concerns about behavioral abilities
Social skills deficits
Student mobility issues
- Need for O&M
- Wheelchair
- Need for Assistive Technology
- Cerebral Palsy
- Traumatic Brain Injury

Special education classification
Information regarding disability severity
Status as non-native English speaker
Need for ELL services
Requirements for AAT

Student speech issues
- Selective mutism
- Aphasia
- Apraxia
- Stuttering
- Prosody errors

Medical/Psychiatric diagnoses
- Autism
- Epilepsy
- Tic Disorder/Tourette’s Syndrome
- ODD, OCD, Bipolar, etc
- Anxiety/Depression status

Sensory impairments
- Visual Impairments/Blindness
- Hearing Impairment/Deafness
- Deafblind
- Sensory Needs / Sensory Diet

Current or past medications
Medication compliance or noncompliance
Hesitation of parents to pursue psychiatric help
Quality of teacher relationship with parent
Red Flag or helicopter parent.

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Section 504 of the Rehab Act (1973) and Title II of the ADA (1990) prohibits discrimination based on disability by public entities, regardless of whether they receive federal financial assistance.

A Solution

Solution: Jump Barriers

Computational method to guide decisions

Uses only data collected during psychoeducational evaluations and Academic CBM/CFA

Mitigate judgment calls, gut feelings, prejudices and/or biases regarding student potential

Evaluation Data

Adaptive	Intelligence	Academic Achievement		Emotional
GAC	**FSIQ/PRI**	**WJ-IIINU**	**CBM**	**BSI/Anxiety**
VABS II/3	SB-V	B Read Skills	Benchmarks	BASC 2/3
ABAS II/3	WNV	Read Comp	UT Compose	Connor's 3
BASC 2/3	WISC III,IV,5	Math Calc	AIMS Web	Achenbach CBCL
ECI	WJ-IIINU	Math Reason	DRA 2	SCAS
DABS	KBIT 2	Broad Writing	DIBELS	SCARED
DP-3	Leiter R	Broad Math	SuccessMaker	RCADS
	UNIT 2		Imagine Learning	CARS
	DAS		CFA	YAM-5
	Batelle			ASC-ASD
	VAS			MASC-2
	K-ABC			
	Raven's Matrices			

Evaluation Data

Measure	Value Definitions	Value Range
Adaptive • GAC Standard Score • BASC2/3 Adaptive T Score	SS 0-59 = 0 T 0-29 = 0 SS >60 = 1 T ≥ 30 =1	[0,1]
Intelligence • FSIQ Standard Score • PRI Standard Score	SS 0-70 = 0 SS 70-100 = 1 SS >100 = 2	[0,1,2]
SocioEmotional • Anxiety T Score • BSI T Score • Conduct T Score	T 0-70 = 1 T>70 = 0	[0,1]
WJ-III NU / WIAT-III • Achievement Standard Scores	SS 0-70 && RPI 0-18 = 0 SS 70-100 && RPI 18-34 = 1 SS>100 && RPI >35 = 2	[0,1,2]
CBM • Benchmark Percentiles	<35%ile = 0 >35%ile = 1	[0,1]

Adaptive Function

Measures competence of social and practical daily living skills

Adjusting behavior to novel situations or contexts

Effectively and independently take care of oneself

Crucial to achieving success in a general education classroom because of its pivotal role in behavioral flexibility when encountering novel or difficult situations

Note: Parent/Caregiver survey often under-estimates skills. *Interview form is preferred*

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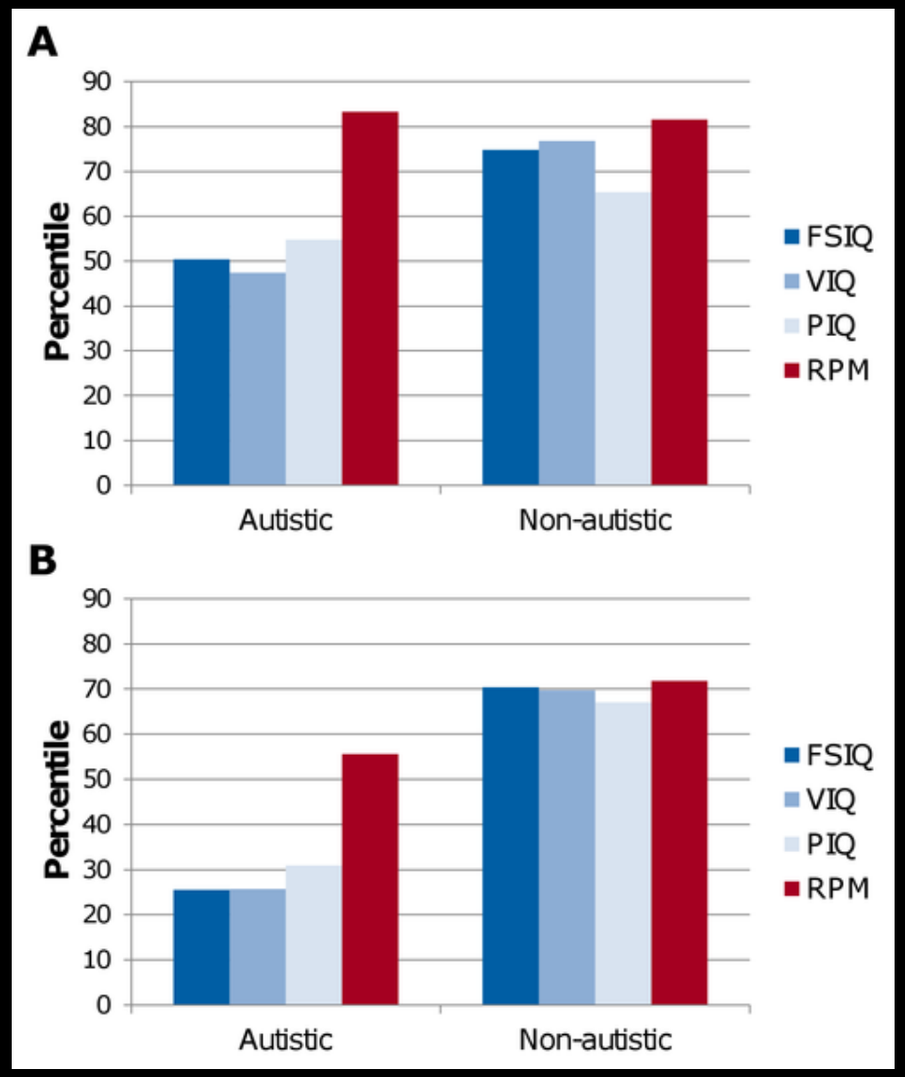
Full Scale IQ (FSIQ)

At best only weakly correlated with academic achievement measures

FSIQ is a poor predictor of cognitive ability and academic success in developmentally disabled students

Systematic biases in IQ tests result in underestimations of cognitive abilities

Placement decisions based on IQ are problematical



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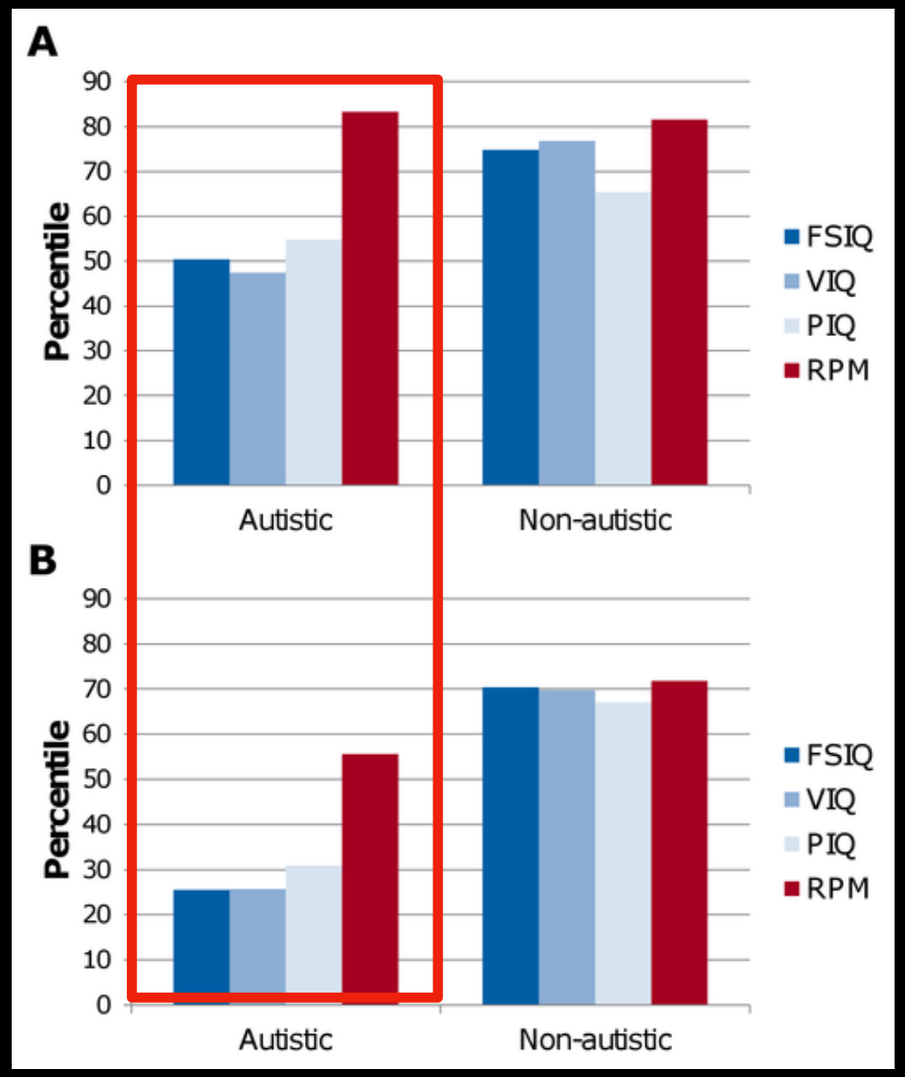

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Anxiety

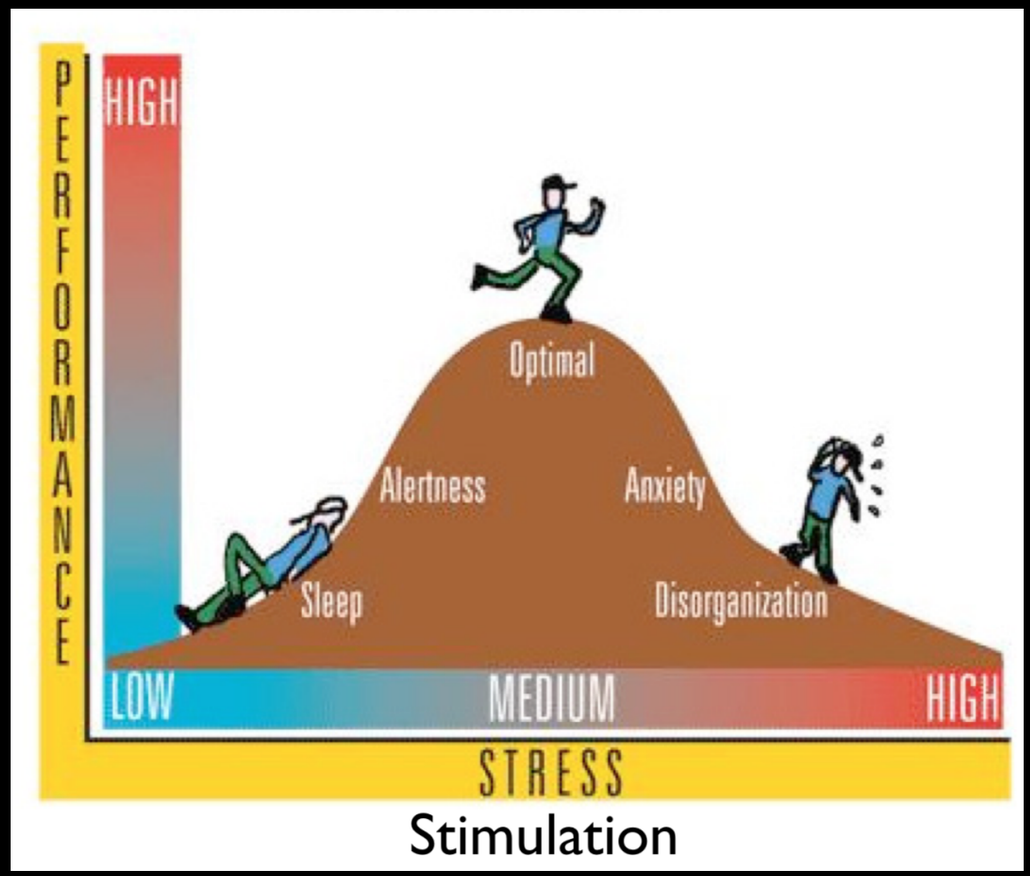
Affects academic performance

Impairments in social adjustment

Low global self worth

Significant Co-morbidity

- 12% Depression
- 15% ODD
- 17% ADHD
- 20-75% Additional anxiety disorders



Stimulation

Anxiety

Student A - Healthy Anxiety

- FSIQ= 63, VCI= 65, PRI= 61, WMI= 83, PSI= 77
- ADAPTIVE GAC= 64, Conceptual= 69, Social= 84, Practical= 56
- WIAT-II
  - READING Composite=80
  - MATH Composite=58,
  - WRITTEN LANGUAGE Composite=83
- Anxiety: SCAS (T Scores)

Scale	Child	Parent
Panic/Agoraphobia	56	45
Separation Anxiety	53	47
Physical Injury	57	50
Social Phobia	38	40
OCD	57	45
GAD	53	47

Integrated into her community, is well-liked and has a positive sense of self-esteem. She also has good rote learning skills that support the development of basic academics (e.g., word reading, spelling).

Student B - High Anxiety

- FSIQ= 91, VCI= 93, PRI= 106, WMI= 88, PSI= 83
- ADAPTIVE GAC= 66, Conceptual= 67, Social= 84, Practical= 62
- WIAT-II
  - READING Composite=97
  - MATH Composite=87
  - WRITTEN LANGUAGE Composite=83
- Anxiety: SCAS (T Scores)

Scale	Child	Parent
Panic/Agoraphobia	68*	68*
Separation Anxiety	82**	64*
Physical Injury	47	50
Social Phobia	64*	70**
OCD	73**	70**
GAD	66*	71**

Despite average intelligence and academic skills, this child is anxious, has low self-esteem, is viewed by others as inattentive, disorganized, oppositional and unmotivated. She engages in risky behaviors.

Anxiety

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Importance of Factors?

Recursive partitioning

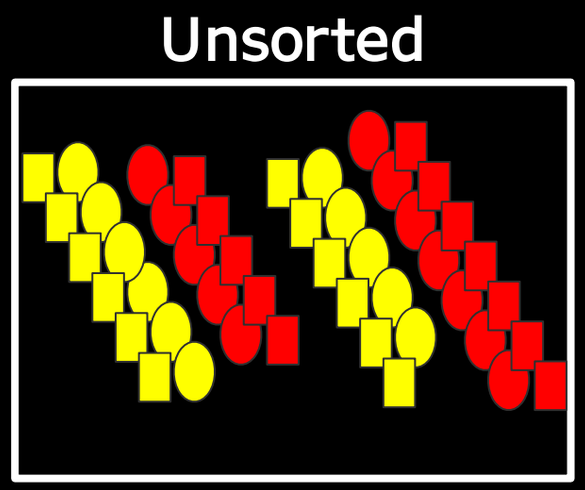
Split data in 2 groups

Repeated on subgroups

Result looks like a flowchart

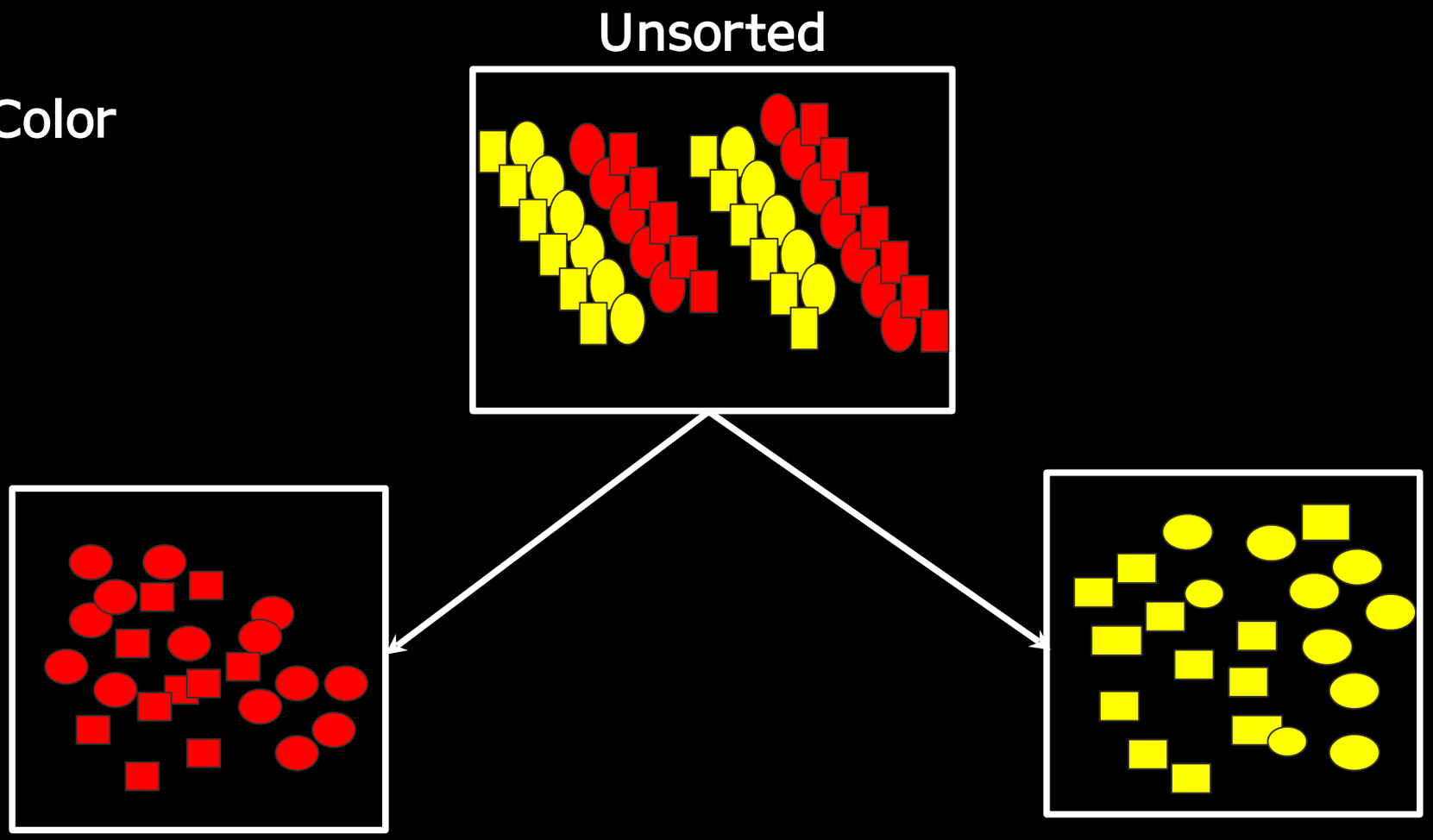
Most influential factor is on top

Importance of Factors?



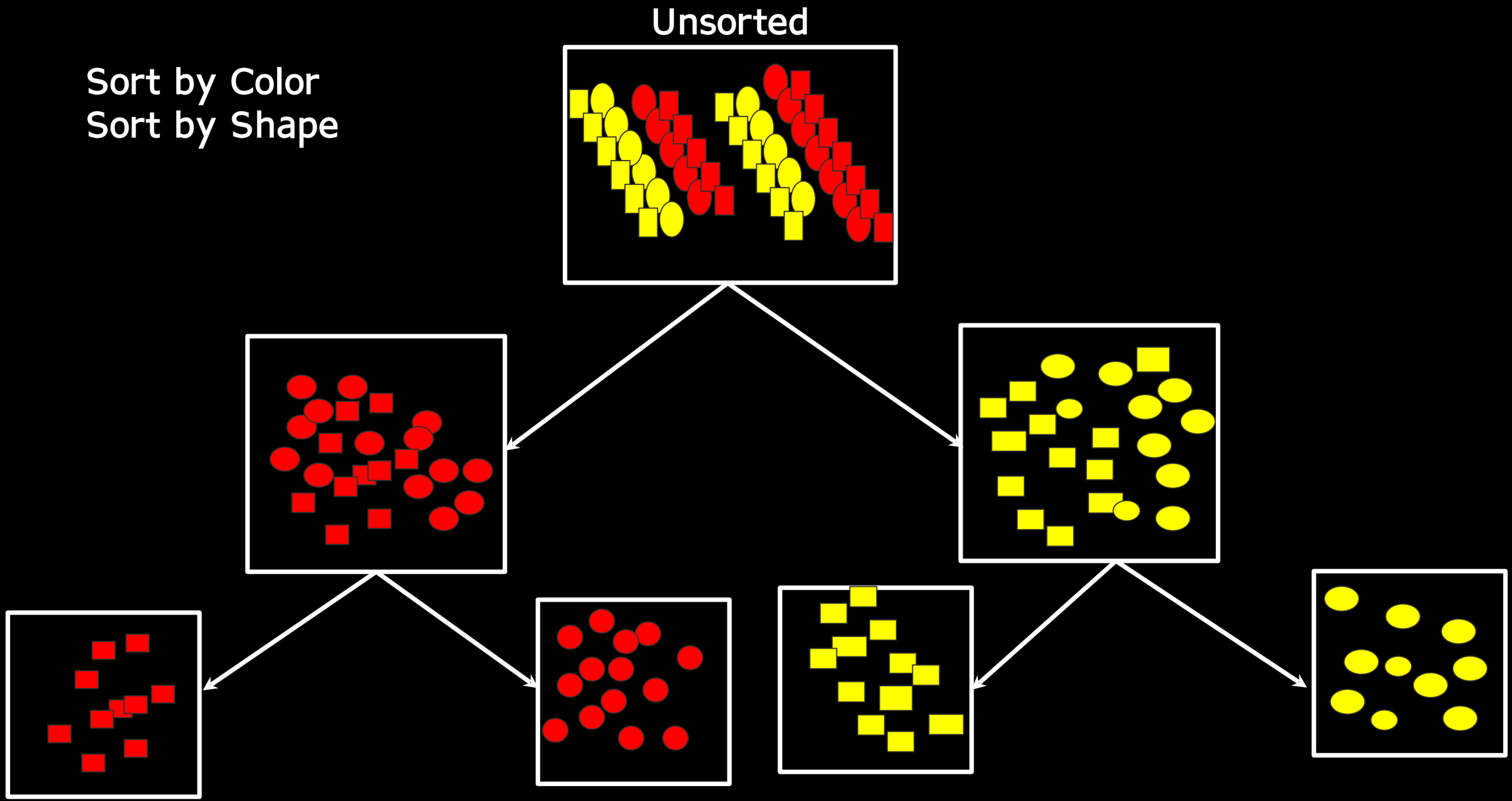
Importance of Factors?

Sort by Color



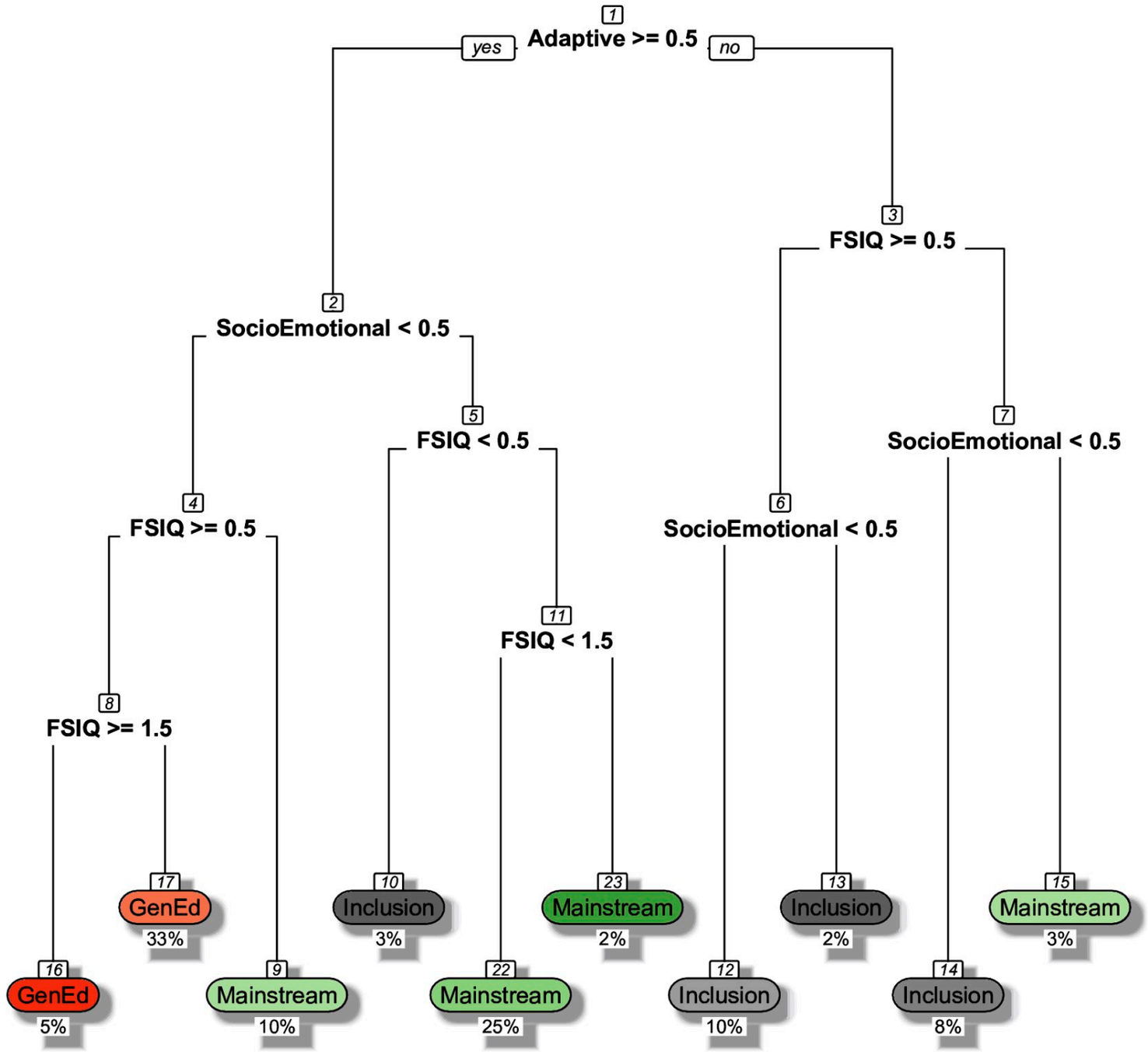
Importance of Factors?

Sort by Color
Sort by Shape

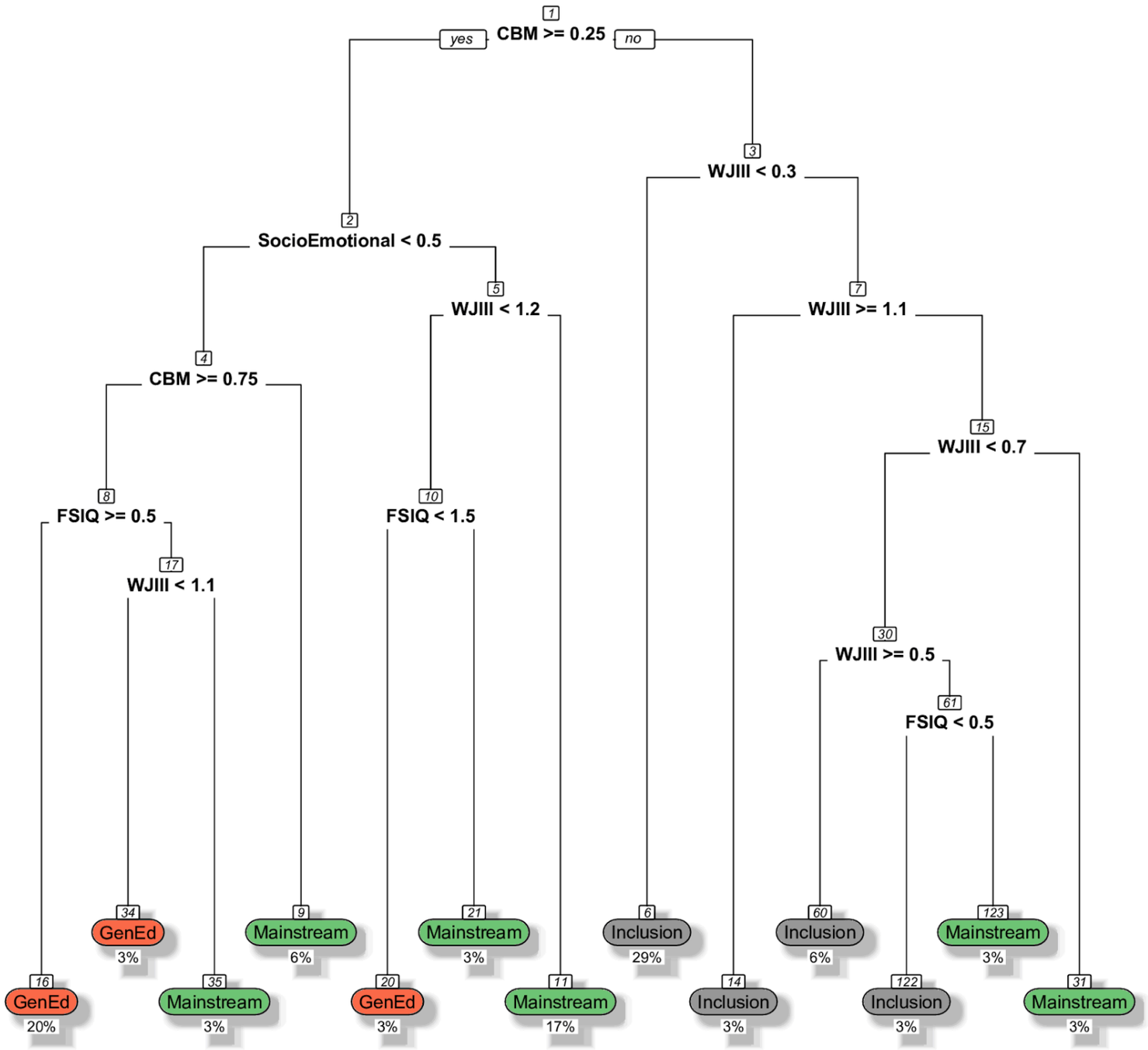


Results

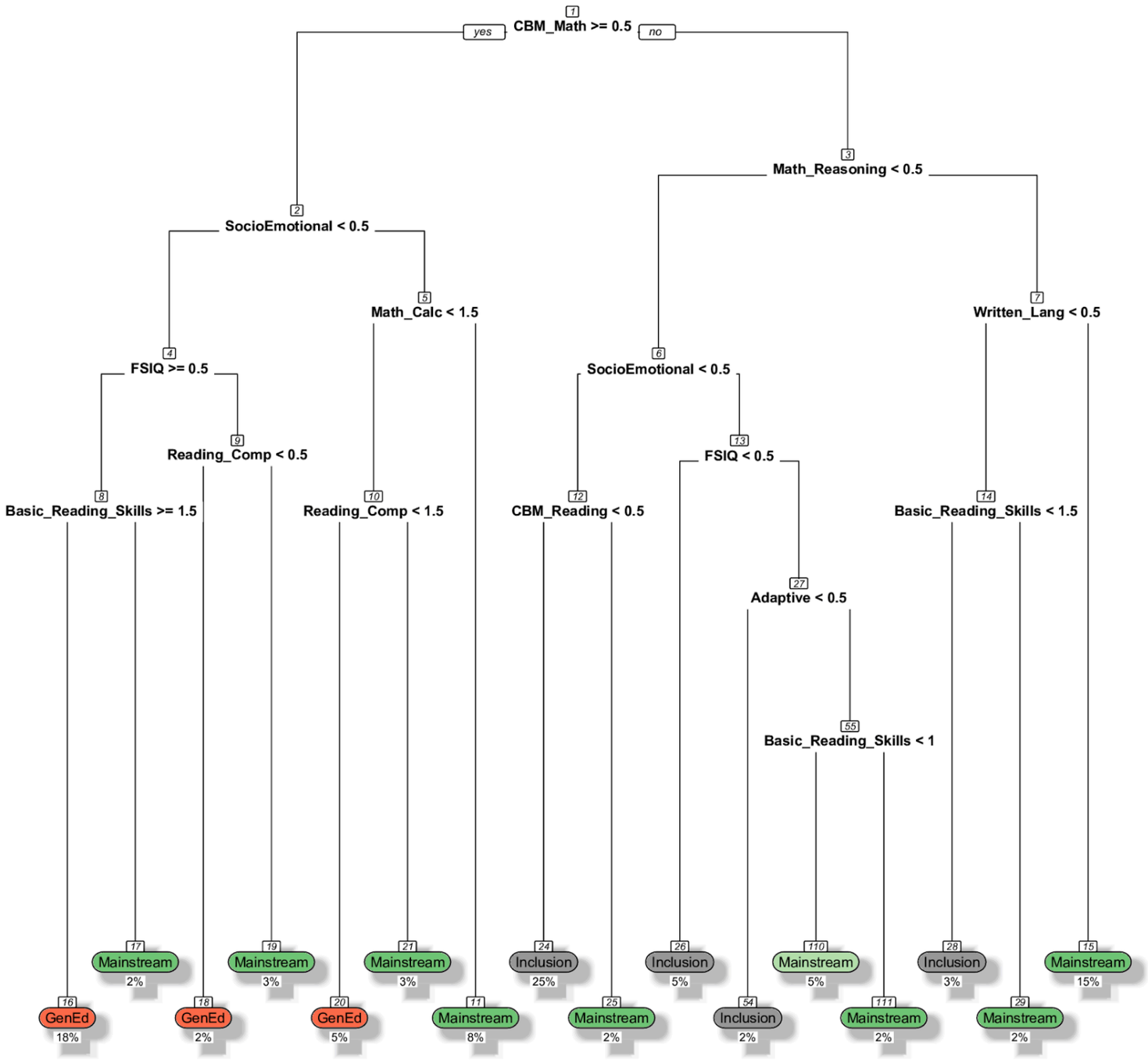
Decision Tree (Academic Testing Absent)



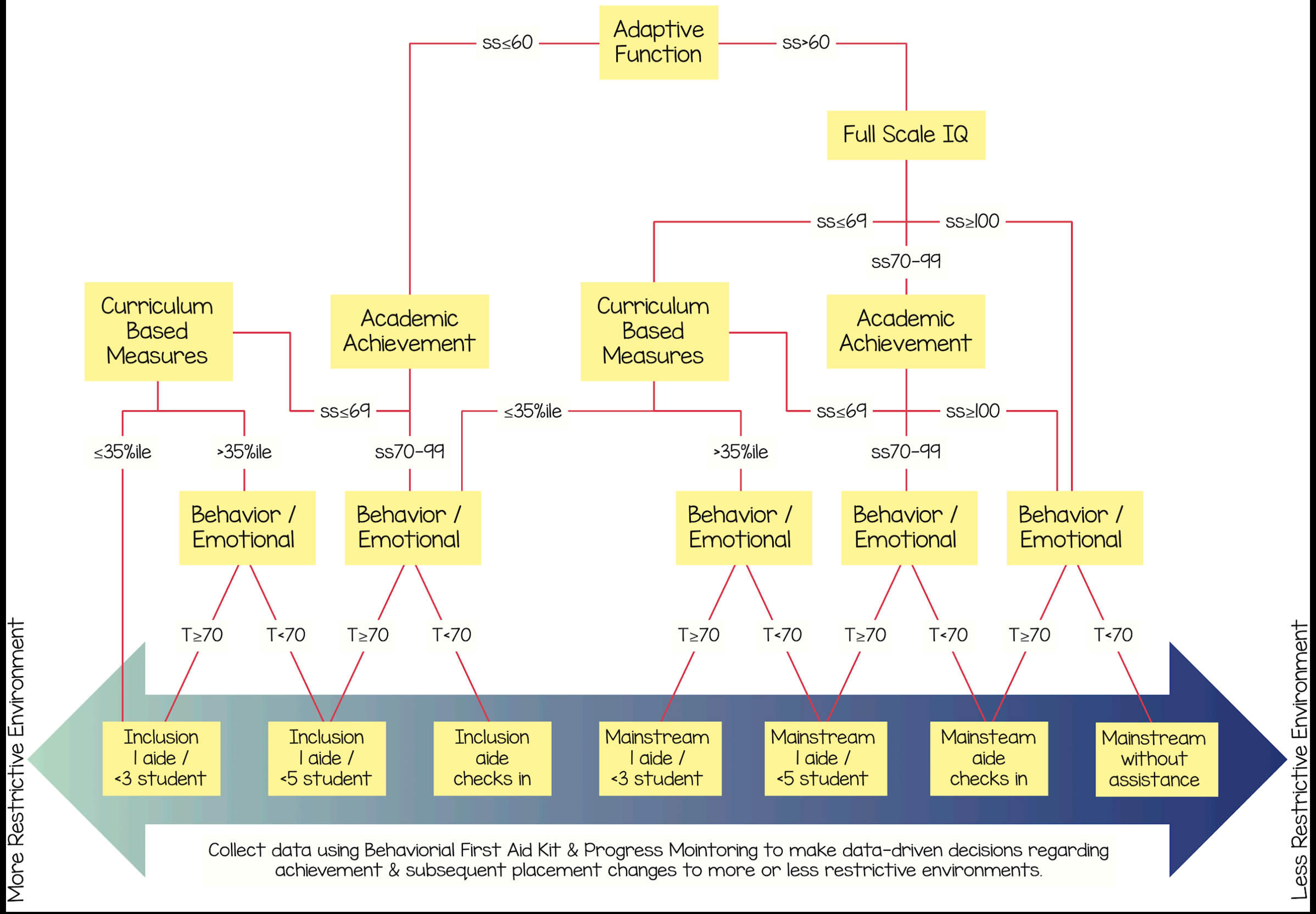
Decision Tree (Academic Testing Present)



Decision Tree (Academic Testing Separated)



Inclusion / Mainstream Initial Placement Decision Tree



Behavior is Separate

Designed for B/ED, SEL, CBTU cluster units

Relies on behavioral data routinely collected

Independent checks by assigned social workers

Excludes classroom contract or level systems

Mitigates influence of bias in data collection

Behavior Mainstreaming Progress Decision Tree

Seclusionary Time-Out
Manual Restraint

yes

Physical Aggressions

unprovoked

Inapporpriate Verbal

yes

Inclusion
I aide /
<3 student

no

Inclusion
I aide /
<5 student

with provocation

Inapporpriate Verbal

yes

Inclusion
aide
checks in

no

Mainstream
I aide /
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no

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More Restrictive Environment

Less Restrictive Environment

Collect data using Behaviorial First Aid Kit & Progress Mointoring to make data-driven decisions regarding achievement & subsequent placement changes to more or less restrictive environments.

Implementation

Transdisciplinary

Speech/Communication	Speech/Language Pathologist
Mobility	Physical Therapy Orientation and Mobility
Fine Motor	Occupational Therapy
Achievement	Relevant Teacher
FSIQ	School Psychologist
SocioEmotional	School Psychologist Social Worker
Sensory Needs	Occupational Therapy
Behavior	School Psychologist Social Worker Behavior Specialist

Academic LRE Process

1. Identify candidate students
2. Identify classroom placements
3. Perform a classroom ecological inventory
4. Initiate student placement in general education setting

    Amend IEP to reflect change in service time

5. Increase time in general education setting
6. Formal transition from special education to general education (± part-time special education)
7. Transition from unit school to neighborhood school

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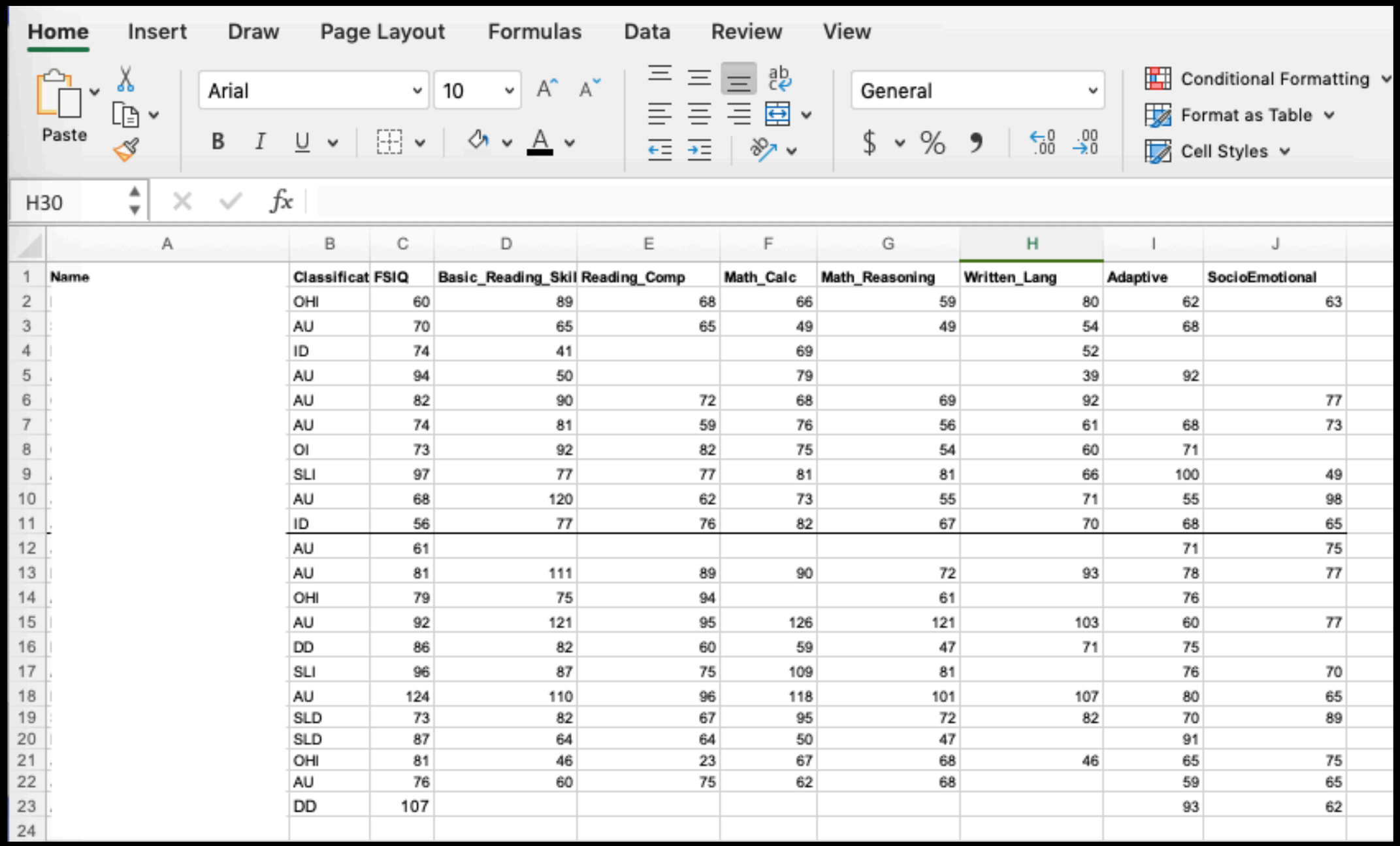
Academic LRE Pilot Results

Predictions

Data



Home Insert Draw Page Layout Formulas Data Review View

Paste | Arial | 10 | B I U | General | Conditional Formatting | Format as Table | Cell Styles

H30

	A	B	C	D	E	F	G	H	I	J
1	Name	Classificat	FSIQ	Basic_Reading_Skil	Reading_Comp	Math_Calc	Math_Reasoning	Written_Lang	Adaptive	SocioEmotional
2		OHI	60	89	68	66	59	80	62	63
3		AU	70	65	65	49	49	54	68	
4		ID	74	41		69		52		
5		AU	94	50		79		39	92	
6		AU	82	90	72	68	69	92		77
7		AU	74	81	59	76	56	61	68	73
8		OI	73	92	82	75	54	60	71	
9		SLI	97	77	77	81	81	66	100	49
10		AU	68	120	62	73	55	71	55	98
11		ID	56	77	76	82	67	70	68	65
12		AU	61						71	75
13		AU	81	111	89	90	72	93	78	77
14		OHI	79	75	94		61		76	
15		AU	92	121	95	126	121	103	60	77
16		DD	86	82	60	59	47	71	75	
17		SLI	96	87	75	109	81		76	70
18		AU	124	110	96	118	101	107	80	65
19		SLD	73	82	67	95	72	82	70	89
20		SLD	87	64	64	50	47		91	
21		OHI	81	46	23	67	68	46	65	75
22		AU	76	60	75	62	68		59	65
23		DD	107						93	62
24										

Representative Data from 2 classrooms - Algorithm sorted data from 241 Students

Computational Sorting

When all data are put together and allowed to self assemble using a greedy algorithm, three groups emerge along the left.

- Dark orange cluster = General Education
- Light orange cluster = >75% mainstreaming
- Middle purple cluster = social inclusion.

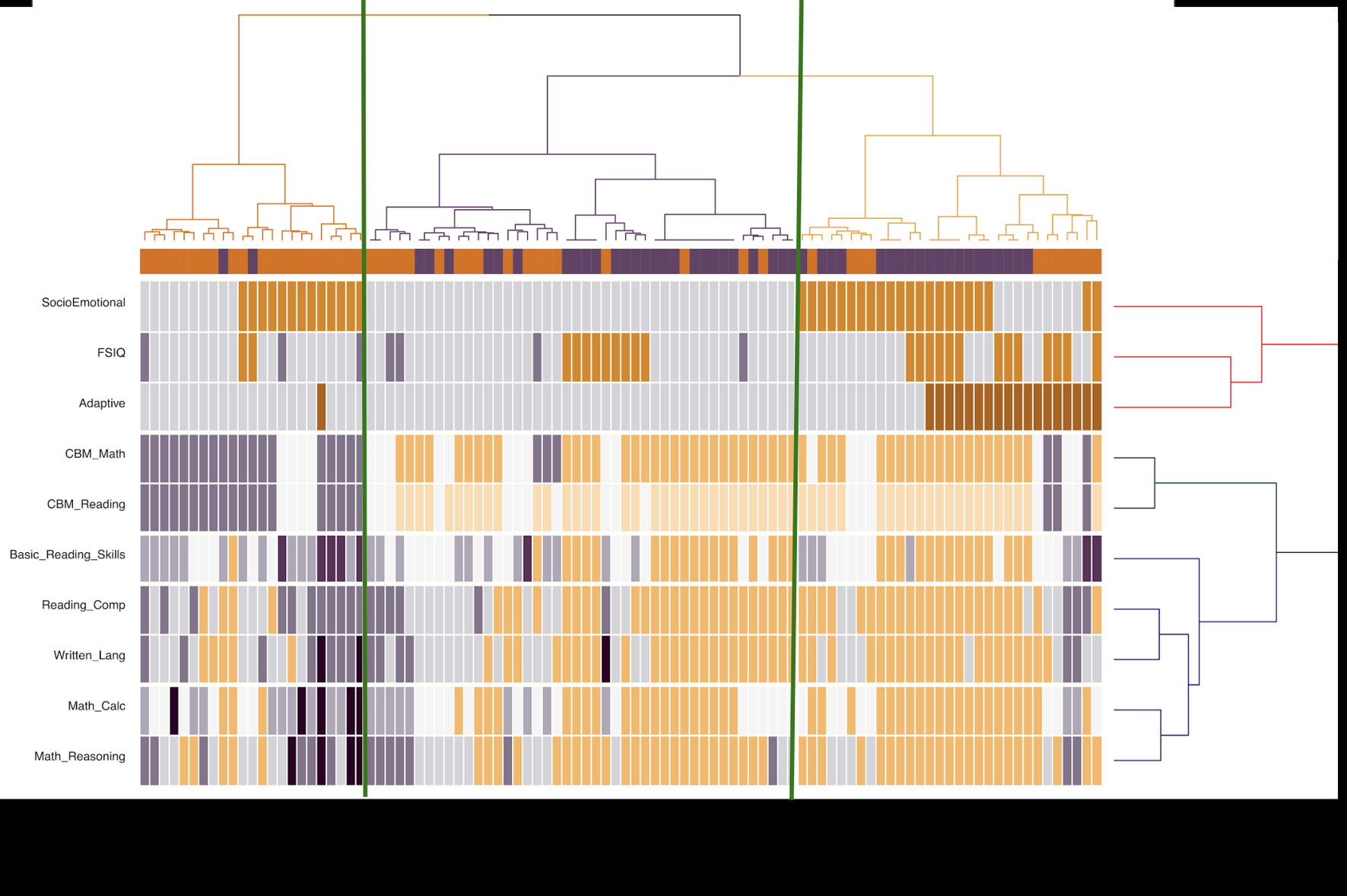
Data types input into the algorithm were also sorted

- Nonacademic factors clustered together
- The green cluster = CBM measures,
- Purple cluster = WJ-III NU factors,
  - Reading/Writing separated from Math Skills
  - Writing and Reading Comp sorted separate from Basic Reading Skills

General Education

Social Inclusion

Mainstreaming



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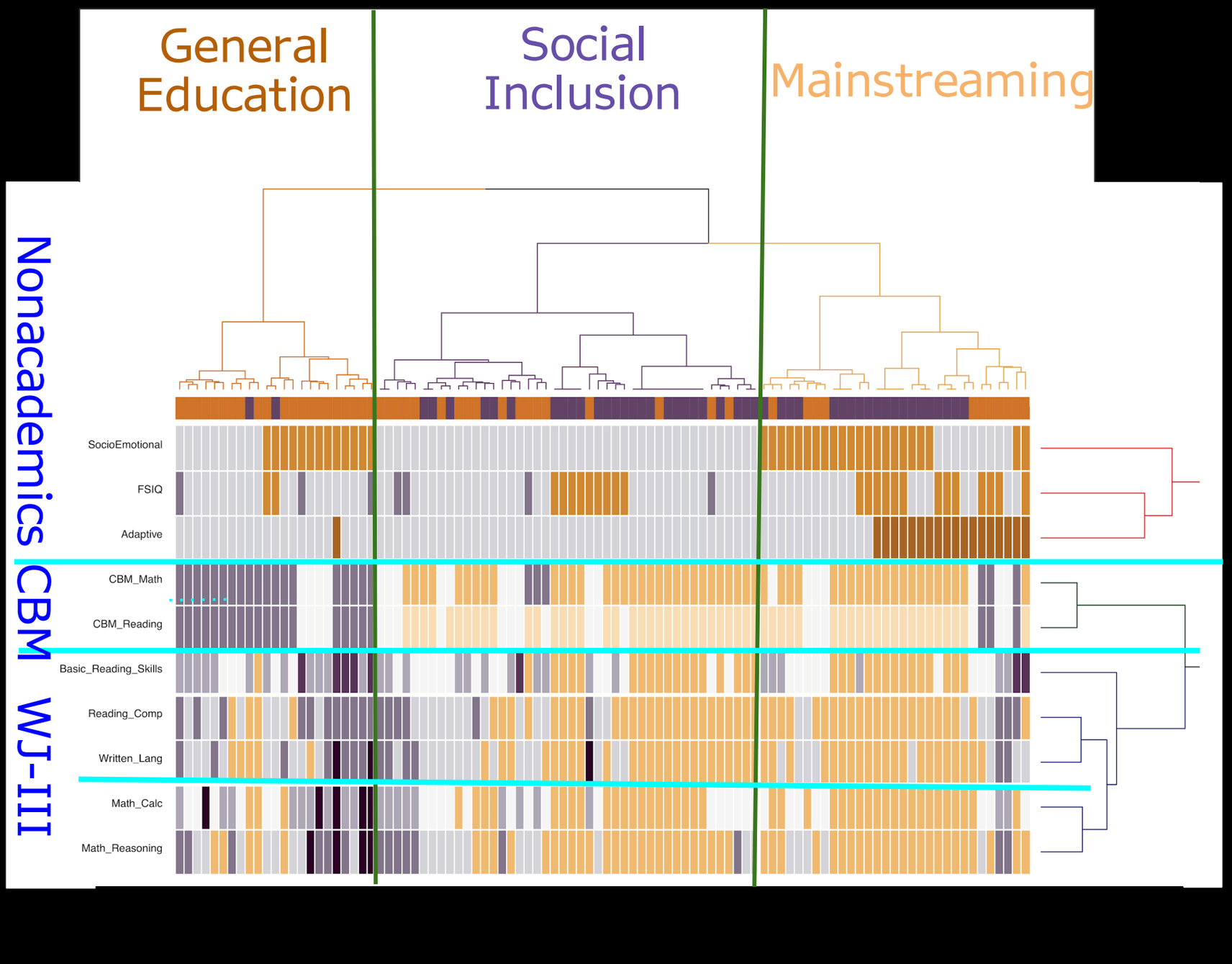
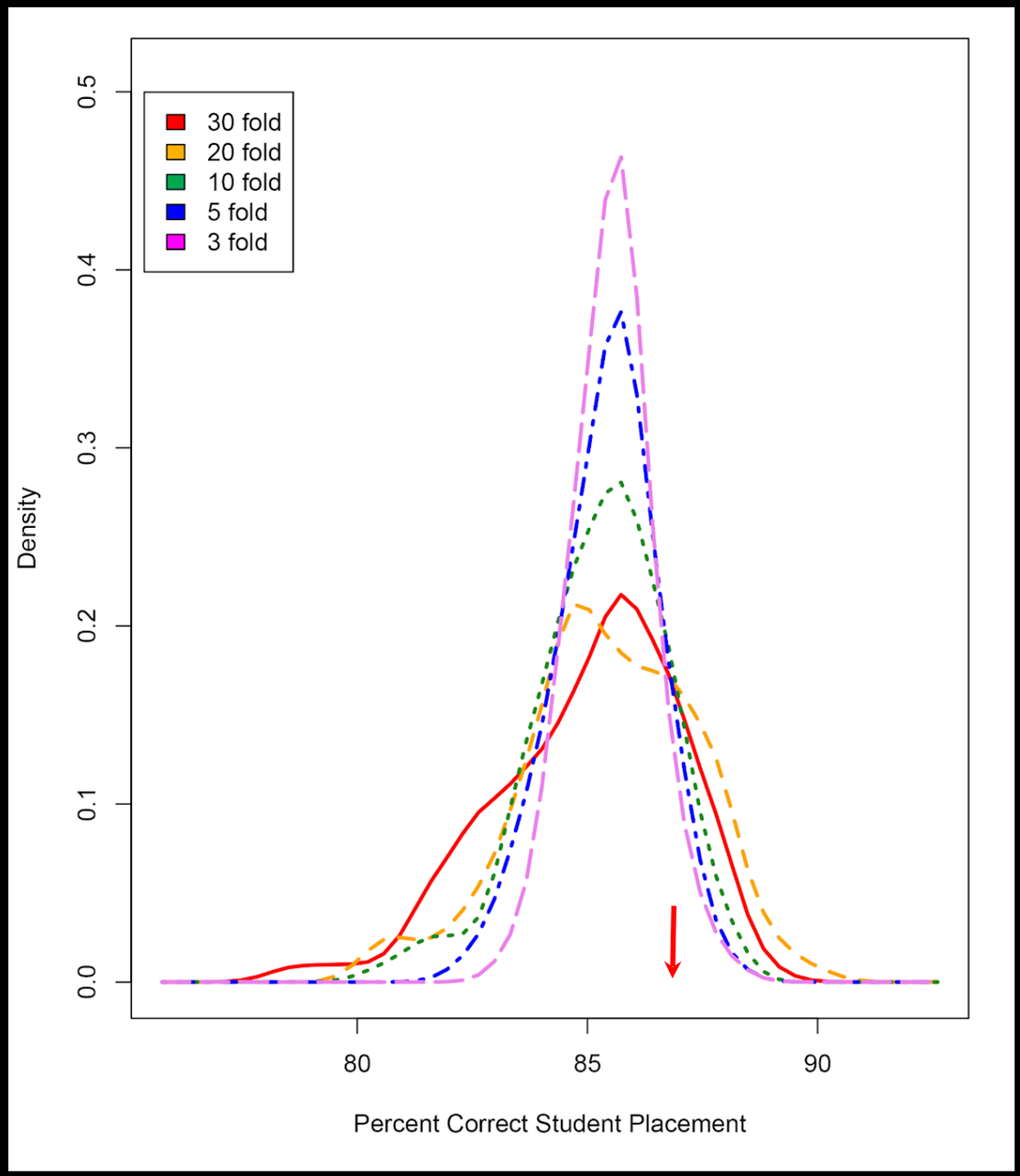

General Education
Social Inclusion
Mainstreaming
Nonacademics CBM WJ-III
SocioEmotional
FSIQ
Adaptive
CBM_Math
CBM_Reading
Basic_Reading_Skills
Reading_Comp
Written_Lang
Math_Calc
Math_Reasoning

Computer vs. Reality

Support Vector Machines performed to test algorithm with K fold cross validation

85-87% accuracy for all replications

Larger set results in more reliable model



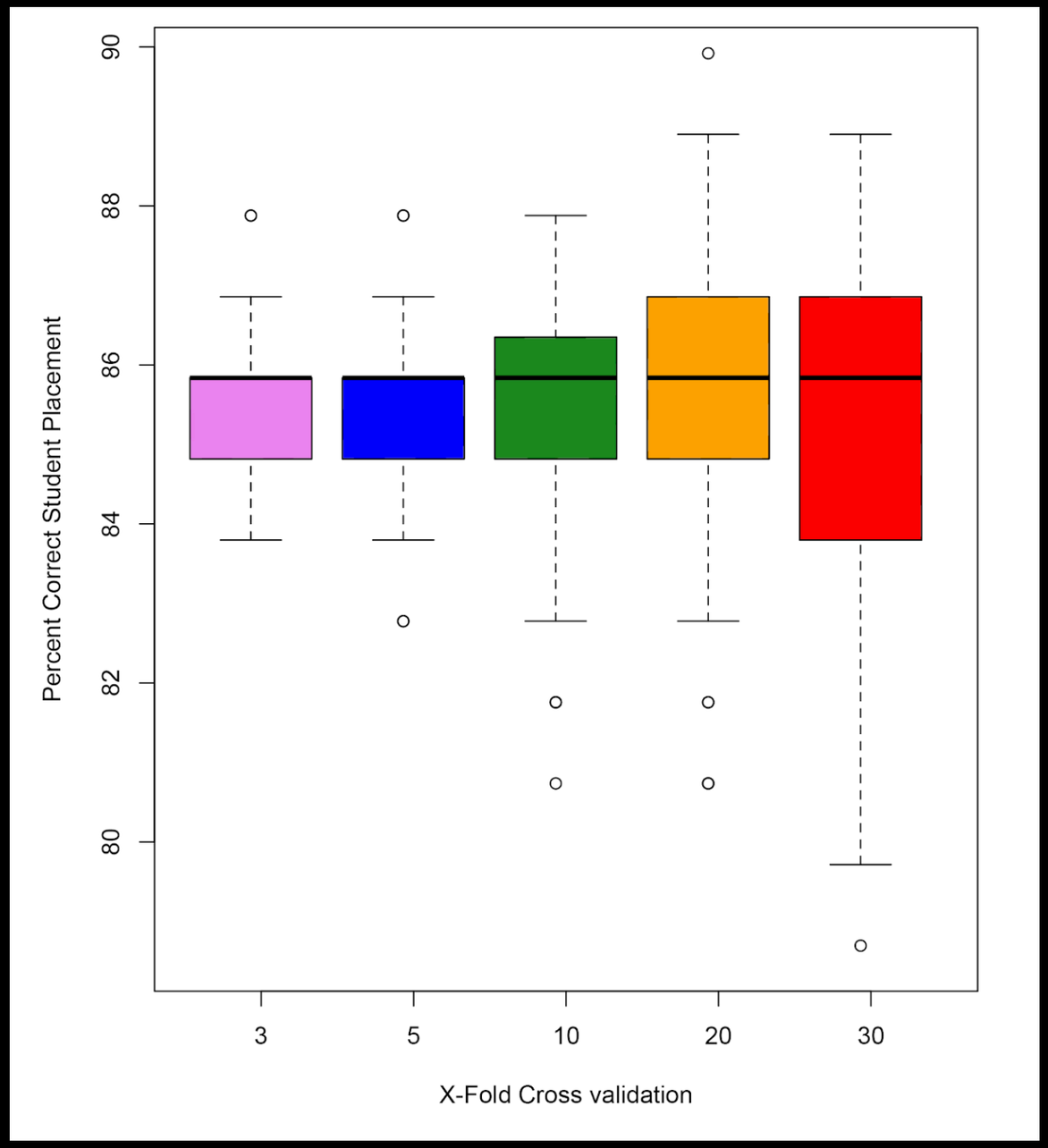
Computer vs. Reality

Support Vector Machines performed to test algorithm with K fold cross validation

1000 training sessions for the k-fold cross validation

Mean and median accuracy were similar

Spread among the data points increased with the number of k-folds used



Computer vs. Reality

Actual Placement

Predicted Placement	General Education	Inclusion	Mainstreaming	Accuracy
General Education	**21**	0	2	**21/23 91%**
Inclusion	0	**38**	3	**38/41 87%**
Mainstreaming	4	3	**24**	**24/31 80%**

Statistical Validity

Sensitivity (True Positive Rate: Correct Predictions of CHANGE in LRE placement)	0.98
Specificity (True Negative Rate: Correct Predictions of NO CHANGE in LRE placement)	0.94
Positive Predictive Value [Sensitivity / All Positive Predictions] (Probability of Prediction of change in LRE placement being TRUE)	0.87
Negative Predictive Value [Specificity / ALL negative Predictions] (Probability of Prediction of no change in LRE being TRUE)	0.97

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Negative Predictive Value [Specificity / ALL negative Predictions] (Probability of Prediction of no change in LRE being TRUE)	**0.97**

Student Outcomes - Year 1

Summary

20 students (17 male, 3 female) identified as candidates

10 classified as Autism (AU)

6 classified as Specific Learning Disability (SLD)

2 classified as Speech and Language Impairment (SLI)

both students with PDD-NOS diagnoses

1 classified as Emotional Disturbance (ED)

Student with PDD-NOS dx

1 classified as Other Health Impairment (OHI)

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Student with PDD-NOS dx

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65% had a diagnosis on the autism spectrum

Student Characteristics

Mean GAC ……..73.20 +/- 10.37 SD

Mean FSIQ ……93.30 +/- 10.34 SD

Mean WJ-III NU achievement:

Basic Reading Skills……86.72 +/- 16.10 SD

Reading Comprehension……80.21 +/- 15.00 SD

Broad Writing……...74.89 +/- 12.92 SD

Math Calculation……79.10 +/- 24.30 SD

Math Reasoning……..78.10 +/- 21.00 SD

These 20 students, based on these values, did not qualify for special education services under an SLD classification however, they were in academic focus self-contained classrooms

Success

Of the 20 student candidates

10 achieved a general education placement (50%)

3 scheduled transition for next school year (15%)

Total of 65% transition success based on the first year limited implementation of the Mainstreaming Process.

Implications

3 classrooms participated in a limited pilot

One class had 4 of their 15 students (27%) in the mainstream classroom

Second class had 6 of 20 students (30%) in the mainstream classroom

Third class had 3 of 12 students (25%) in the mainstream classroom

Reduced teaching load provided opportunities to work more directly with the remaining students in the classroom

Student Outcomes - Year 2

Summary

53 students (37 male, 16 female) were identified as candidates

24 classified as Autism (AU)

15 classified as Specific Learning Disability (SLD)

4 classified as Speech and Language Impairment (SLI)

2 with autism dx

2 classified as Other Health Impairment (OHI)

1 with autism dx

2 classified as Emotional Disturbance (ED)

1 has autism diagnosis, 1 has PDD-NOS diagnosis

2 classified as Intellectual Disability (ID)

2 classified as Developmental Delay (DD)

At end of year both qualified for autism classifications

1 classified as Traumatic Brain Injury (TBI)

1 classified as Orthopedic Impairment (OI)

Summary

53 students (37 male, 16 female) were identified as candidates

24 classified as Autism (AU)

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At end of year both qualified for autism classifications

1 classified as Traumatic Brain Injury (TBI)

1 classified as Orthopedic Impairment (OI)

Overall 57% had a diagnosis on the autism spectrum

Student Characteristics

Mean GAC .....76.12 +/- 15.45 SD

Mean FSIQ .....87.40 +/- 13.04 SD

Mean WJ-III NU achievement:

Basic Reading Skills.....89.88 +/- 17.20 SD

Reading Comprehension.....74.31 +/- 15.21 SD

Broad Writing.....76.98 +/- 14.81 SD

Math Calculation.....88.11 +/- 28.20 SD

Math Reasoning.....72.98 +/- 19.71 SD

These 53 students, based on these values, did not qualify for special education services under an SLD classification in Granite School District, however, they were in academic focus self-contained classrooms

Success

Of the 53 student candidates

16 achieved a general education placement (30%)

5 scheduled transition for next school year (10%)

Total of 40% transition success based on the second year implementation of the Mainstreaming Process.

Implications

Year 2: 8 classrooms participated with 102 total students

53 were identified as potential mainstreaming candidates (51%)

29 students participated in full day mainstreaming (28%)

15 students accessed the mainstream curriculum for either language arts or math (for a total of 42%)

Reduced teaching load provided opportunities to work more directly with the remaining students in the classroom

Success - District Wide

For the SEL/CBTU cluster units

26 students were identified as candidates

9 achieved a general education placement (34%)

17 in mainstreaming 25-50% of the time but lacked SocioEmotional skills

For the Life Skills/severe/ID cluster units

9 students were identified as candidates

9 achieved a general education placement (100%)

For diagnostic kindergarten students

7 candidate students were identified

3 achieved a general education placement (42%)

4 in mainstreaming >25% of the time due to underdeveloped SocioEmotional skills

Year 2: Student Candidate Success

Overall, 94 candidate students across all special education settings were identified as candidates

41 were able to successfully transition into a general education with part time special education services placement for the subsequent year (43%)

10 were able to access a less restrictive unit (11%)

54% of identified candidate students were able to access a less restrictive environment as defined by IDEIA (2004).

Moving Forward

Limitations

Missing Achievement data on three year re-evaluations

Missing Adaptive data on students in SEL/ED/CBTU cluster units

Lack of paraprofessionals to facilitate mainstreaming

If students need more restrictive environments as an initial mainstreaming option, there will be a personnel requirement

With the presently reported implementation, preferential focus was placed on transitioning students that had the lowest need of support

Other students were put into small groups for mainstreaming or social inclusion, and this de-individualized the process somewhat, resulting in less than optimal mainstreaming outcomes

Future Goals

Larger datasets to scale computational methods

Determine if algorithm can be automated and centralized in a cloud based repository

Cloud based systems would facilitate data-based decision making by rural LEA that lack sufficient data to develop computational analyses to predict student success.

Providing access to a broad, diverse data set may help the teams in designing instructional programs for individual students.

Development of such a database would require access to special education data that crosses socioeconomic, gender, and racial divides to guarantee the system is maximally unbiased.

Implementation would require a system capable of protecting identifiable information from any uploaded data to prevent inadvertent FERPA or HIPAA violations.

Such privacy would be possible using a RedCap or Castor EDC with a web-based portal to query the database

User would receive anonymized data

Computations could be performed either online or on the local computer

No Time to Lose

All tools, code, and training data necessary to implement this method are FREELY available

I am willing to write intro scripts and get everything up and running for anyone that wants to implement it

I am currently working on a professional development sequence to help schools with cluster units be able to implement these tools with fidelity and buy-in from administrators and general education teachers

https://github.com/mrhunsaker/MainstreamingAlgorithm

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Questions?