

Race, Learning Attitudes and Achievement: An Inequitable Triad



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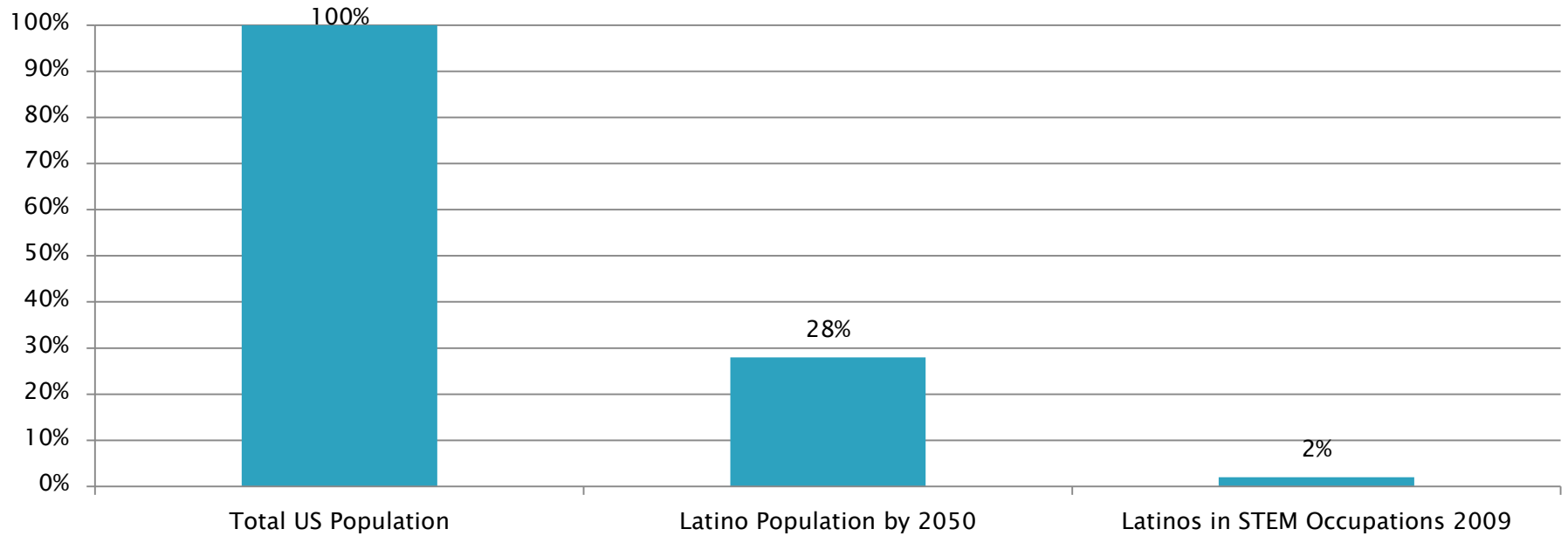
2016 NCTM Regional Conference

Latino Struggles Dramatization



Courtesy of Novelas Educativas and the National Council for
Community and Education Partnerships (2011)
https://www.youtube.com/v/N9IC7aczAaE?version=3&start=169&end=280&autoplay=1&hl=en_US&rel=0

The Problem



Percentages and Benefits

As of June of 2012 . . .

- ▶ 19% of Latinos 26 or older have college degrees, compared to 40% of all adult US citizens
- ▶ The U.S. is ranked 12th in the world in percent of adults with college degrees
- ▶ If 60% of U.S. Latinos obtain college degrees, the net tax revenue increase is estimated to increase \$3,000,000,000/year

Reference: Frank Alvarez, CEO of HSF,
<http://www.youtube.com/watch?v=moH5knfxPI8>

Research Questions

- ▶ 1) To what degree do psychosocial variables that affect mathematics achievement differ between Hispanic and non-Hispanic high school students?
- ▶ 2) How well do psychosocial attitudes related to mathematics and race predict academic achievement for high school sophomores?



Literature Review I

External Factors – *Out of Student Control*

- English language acquisition (Gasbarra & Johnson, 2008)
- Inadequate academic instruction (Kawell, 2008)
- Inequitable/rigid course assignment policies (Allen, 2002)
- Limited parent involvement (Greer, 2009)
- Low family socioeconomic income (Gándara, 2009)
- Contrasting sociocultural identity (Crisp, 2012)



Internal Factors – *In Student Control*

- Epistemology** (Crotty, 1998; Baxter–Magolda, 2007; Pizzolato et al, 2009; Torres, 2004; Buehl & Alexander, 2005, Hidalgo, 2005)



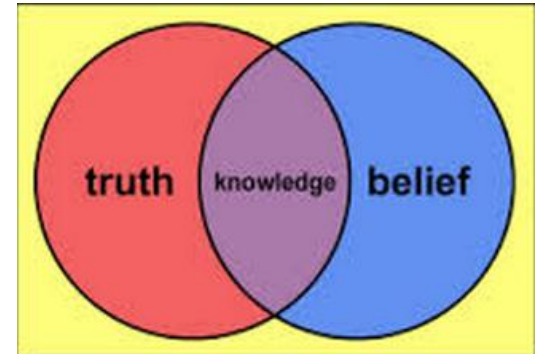
Literature Review II

Epistemology – General

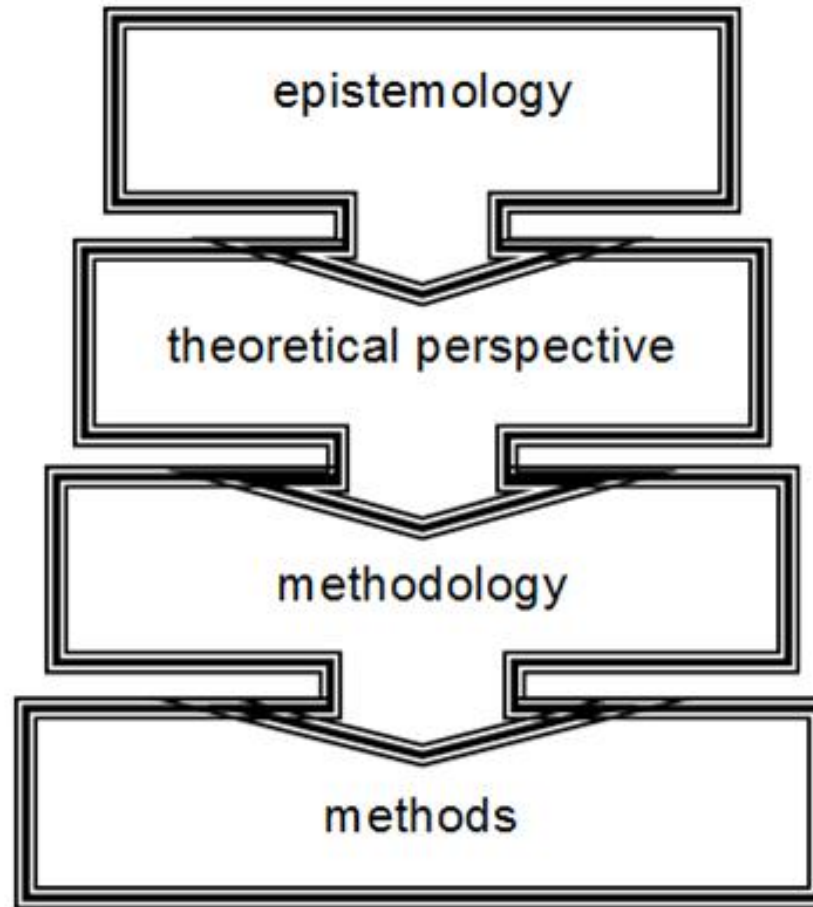
“the endeavor to determine the indubitable foundations of our claims to knowledge” (Cooper, D.E., 1999)

Marcia Baxter–Magolda (Miami University)

- Model of Epistemological Reflection (1992)
 - Ways of knowing are “socially constructed”
- Theory of Self–Authorship (2008)
 - Epistemological development was intertwined with (subject’s) development of their sense of self and relationships with others



Epistemological Framework



(Crotty, 1998)

Research Design

- ▶ “A **quantitative** measure of (epistemological data) has the potential to address a number of theoretical questions emerging from the research about self-authorship”

(Creamer, Baxter Magolda and Yu, 2008)

- ▶ **Instrument:** Education Longitudinal Study of 2002 (NCES)
 - 45-minute, self-administered survey
 - demographic characteristics
 - high school experiences
 - work experiences
 - future plans
- ▶ **Participants:** Stratified, national probability sample
 - 16,197 students from 1,015 public and private high schools
- ▶ **Timeframe**
 - 2002: sophomores
 - 2004: seniors
 - 2005: transcripts obtained
 - 2006: 2 years out
 - 2012: 8 years out



Statistical Analyses

- ▶ Correlation
- ▶ T-Tests
- ▶ Chi-Square
- ▶ ANOVA
- ▶ Hierarchical Linear Modeling
- ▶ Regression



Results of Data Analysis (Correlation) –all participants

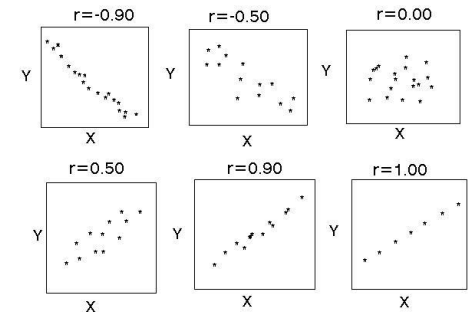


Table 1.6

Correlation Summary Table Comparing Math Attitude Variables (N = 11294)

Variable	1	2	3	4	5	<i>M</i>	<i>SD</i>
1. Gets totally absorbed in math	--	--	--	--	--	2.49	.808
2. Thinks math is fun	.501**	--	--	--	--	2.79	.840
3. Mathematics is important	.456**	.682**	--	--	--	2.51	.890
4. People can be good at math	.236**	.275**	.308**	--	--	2.04	.690
5. Have to be born with math	-.013	-.027**	-.062**	-.305**	--	2.78	.826

* $p < .05$ ** $p < .01$

<i>Correlation Coefficient Value/Range</i>	<i>Relative Strength</i>
1	Perfect
0.7-0.9	Strong
0.4-0.6	Moderate
0.1-0.3	Weak
0	Zero

Results of Data Analysis (t-tests)

Table 1.1a

Comparison of Survey Responses of Hispanic and non-Hispanic Students Regarding Attitudes about Mathematics and Personal Mathematics Efficacy (n = 1540 Hispanic participants and n = 10,134 non-Hispanic participants)

Variable	M	SD	t	df	p	d
Most people can learn to be good at math			-2.787	11672	.005	-0.1
Hispanics	1.76	1.521				
non-Hispanics	1.88	1.539				
Have to be born with ability to be good at math			1.055	11672	.303	.04
Hispanics	2.61	1.837				
non-Hispanics	2.55	1.780				
Thinks math is fun			-4.472	11672	.000	-0.1
Hispanics	2.70	.824				
non-Hispanics	2.80	.842				
Mathematics is important			-3.945	11672	.000	-0.1
Hispanics	2.29	1.512				
non-Hispanics	2.44	1.357				

ATTITUDES

Results of Data Analysis (t-tests)

Table 1.1b

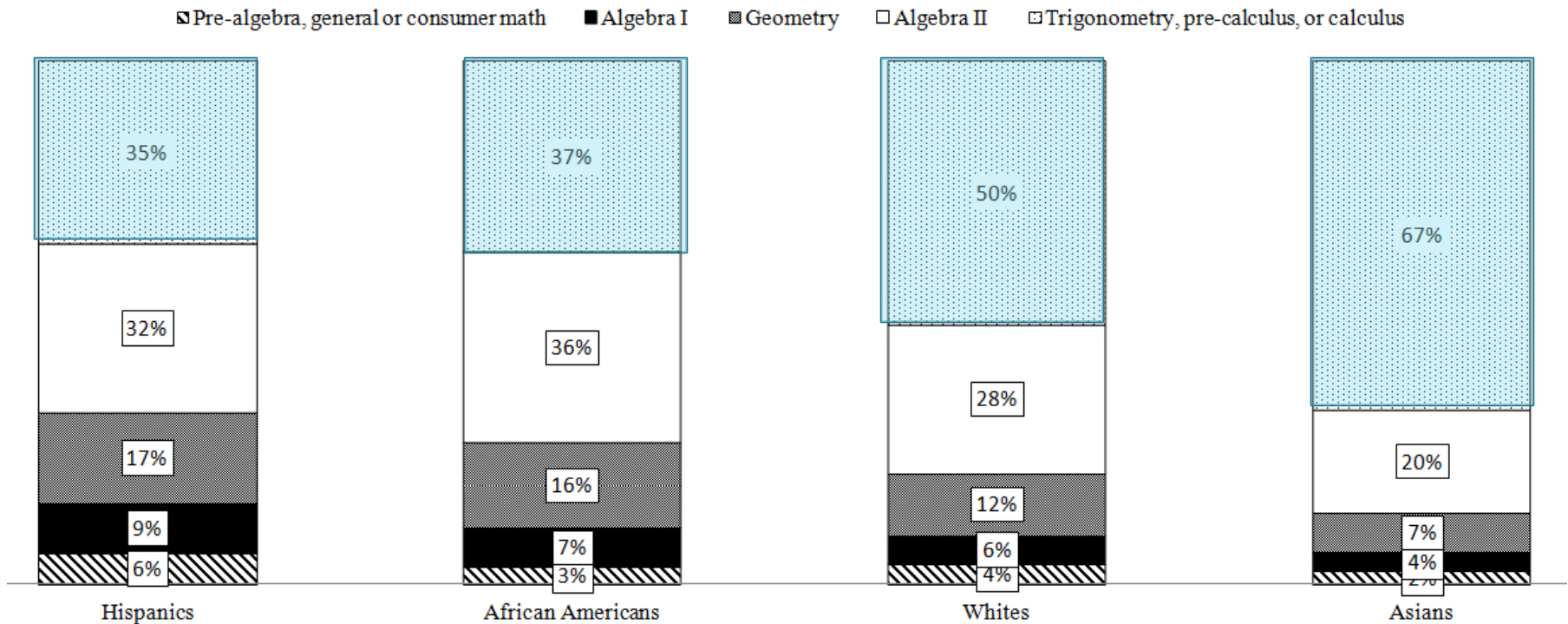
Comparison of Survey Responses of Hispanic and non-Hispanic Students Regarding Attitudes about Mathematics and Personal Mathematics Self-Efficacy (n = 1540 Hispanic participants and n = 10,134 non-Hispanic participants)

Variable	M	SD	t	df	p	d
Can do excellent job on math tests			-3.606	11672	.001	-0.1
Hispanics	1.96	2.479				
non-Hispanics	2.18	2.250				
Can understand difficult math texts			-3.392	11672	.001	-0.1
Hispanics	1.74	2.592				
non-Hispanics	1.96	2.322				
Can understand difficult math class			-2.709	11672	.007	-0.1
Hispanics	1.48	3.290				
non-Hispanics	1.71	3.026				
Can do excellent job on math assignments			-2.950	11672	.003	-0.2
Hispanics	1.37	3.661				
non-Hispanics	1.65	3.375				

E
F
F
I
C
A
C
Y

Results of Data Analysis (Chi-Square Analyses)

Student Highest Math Course Taken versus Race

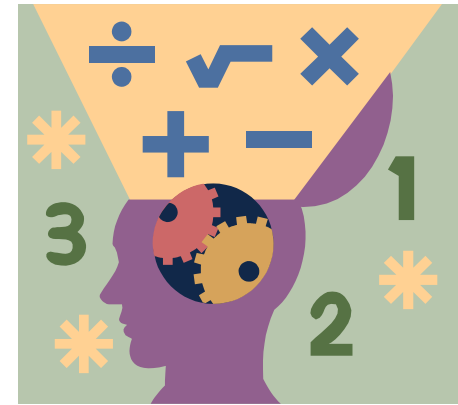


$$\chi^2 = 463.43, df = 12, N = 12,964, p = .000$$

Interpretation: Students of different races are being differentially prepared in mathematics

Results of Data Analysis (ANOVA)

- ▶ The mean value for highest level of mathematics course taken for at least one semester
- ▶ Based on:
 - 1 = Pre-algebra, general or consumer math
 - 2 = Algebra I
 - 3 = Geometry
 - 4 = Algebra II
 - 5 = Trigonometry, pre-calculus, or calculus
- ▶ 5.44 for Asians
- ▶ 5.16 for Whites
- ▶ 4.95 for African Americans
- ▶ 4.81 for Hispanics
 - $F(3, 12960) = 109.23, p = .000$
 - **Statistically significant!**



Results of Data Analysis (ANOVA)

- ▶ The mean value for transcript grades for sophomore participants taking Geometry is:
 - 6.91 for Hispanics
 - 6.62 for African Americans
 - 6.54 for Whites
 - 6.32 for Asians
- ▶ $F(3, 4588) = 5.588, p = .001$
- ▶ Interpretation: when Hispanic students are “on track”, they achieve at higher levels than their non-Hispanic classmates.

F1C Grade Value	Student Transcript Grade
13	A+
12	A
11	A-
10	B+
9	B
8	B-
7	C+
6	C
5	C-
4	D+
3	D
2	D-
1	F

Results of Data Analysis (Hierarchical Linear Modeling)

Factors That Contribute to Highest Mathematics Course Completed (N=8972)

Example

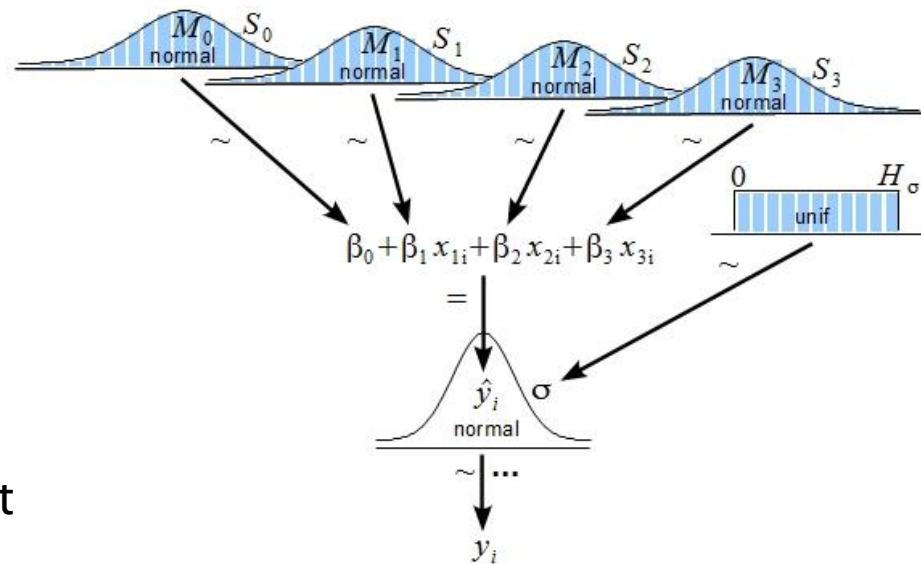
Identifying as an Latino (Hispanic) became less and less a contributing factor when also considering math attitudes, but became more a factor when including work habits and forecasting ones educational attainment were considered. As these additive factors compiled, they became less statistically significant.

		Beta at Step*			
Step	Variable entering	1	2	3	4
Block 1 – Demographic Characteristics					
1	Asian	.067	.057	.044*	.040*
2	African Amer.	.021*	.015*	.022	.016
3	Hispanic	.023*	.019*	.022	.025
4	White	.070	.071	.069*	.073*
5	Gender	.008*	.014*	-.021	-.042**
6	Parent educ.	.015*	.025*	.003	-.004
7	SES	.146	.148*	.120**	.079**
Block 2 – Math Attitudes					
8	Gets absorbed	--	.003*	.007	.003
9	Math is fun	--	-.043*	-.031*	-.021
10	Math is import.	--	-.058	-.052**	-.028*
11	People learn math	--	.014*	.013	.013
12	Born with math	--	.014*	.005	.003
Block 3 – Work Habits					
13	<u>Screen time</u>	--	--	-.043**	-.030*
14	Homework time	--	--	.049**	.028*
15	Employment hrs.	--	--	-.068**	-.058**
16	School activities	--	--	.079**	.053**
Block 4 – Education Forecast					
17	Est. educ. Attain.	--	--	--	.187**

Results of Data Analysis (Regression)

▶ Highest mathematics course taken = 2.428 (Constant)

- ▶ +.397 Asian
- ▶ +.147 Black
- ▶ +.219 Hispanic
- ▶ +.427 White
- ▶ -.238 Gender
- ▶ -.006 ParentEdu
- ▶ +.310 SES
- ▶ +.012 Absorbed
- ▶ -.072 MathFun
- ▶ -.091 MathImportant
- ▶ +.053 PeopleLearn
- ▶ +.010 BornWMath
- ▶ -.030 Screentime
- ▶ +.011 Homework
- ▶ -.084 Employment
- ▶ +.112 Activities
- ▶ +.388 EducAttain



For example, as **SES** is increased by one unit, a sophomore's **highest mathematics course completed** for at least one semester increases by 0.310, holding everything else constant.

$F(17, 8972) = 46.761, p < .000$, adjusted $R^2 = .08$.
Statistically significant!

(Socioeconomic status combines mother's education, father's education, mother's occupation, father's occupation, and family income)

Ties to Literature Review

Epistemological *Self-Authorship* – “the capacity to take ownership of (student’s) own internal authority”
(Kegan, 1994; Baxter-Magolda, 2004)



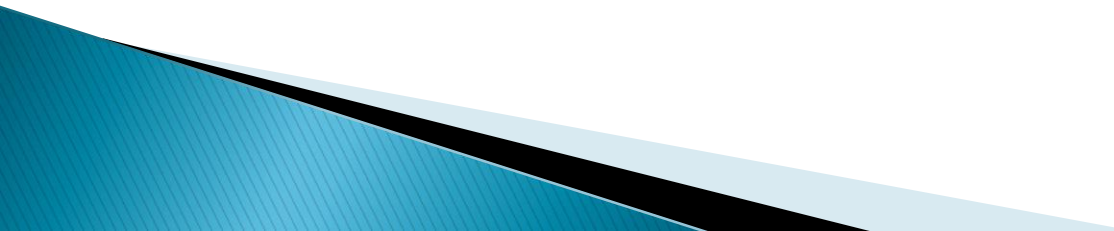
“Theoreticians have defined Latino/a reality using an epistemology created out of the experience of **Whites** . . . as if such an epistemology wasn’t based on living experiences” (Hidalgo, 2005)

Implications



- ▶ Math attitudes are important, but not everything (race, SES, forecasting *as well as* instruction, curriculum, materials, environment, etc.)
- ▶ Ameliorative Considerations
 - Mentor/Mentee Relationships – Forecasting
 - Summer instruction for underrepresented minorities to advance tracks in mathematics
(The Jaime Escalante Math Program, 1990)
- ▶ The Effects of Tracking
 - How do we know if URM students have reached their full potential in math given a reduced set of courses?

Suggestions for Further Studies

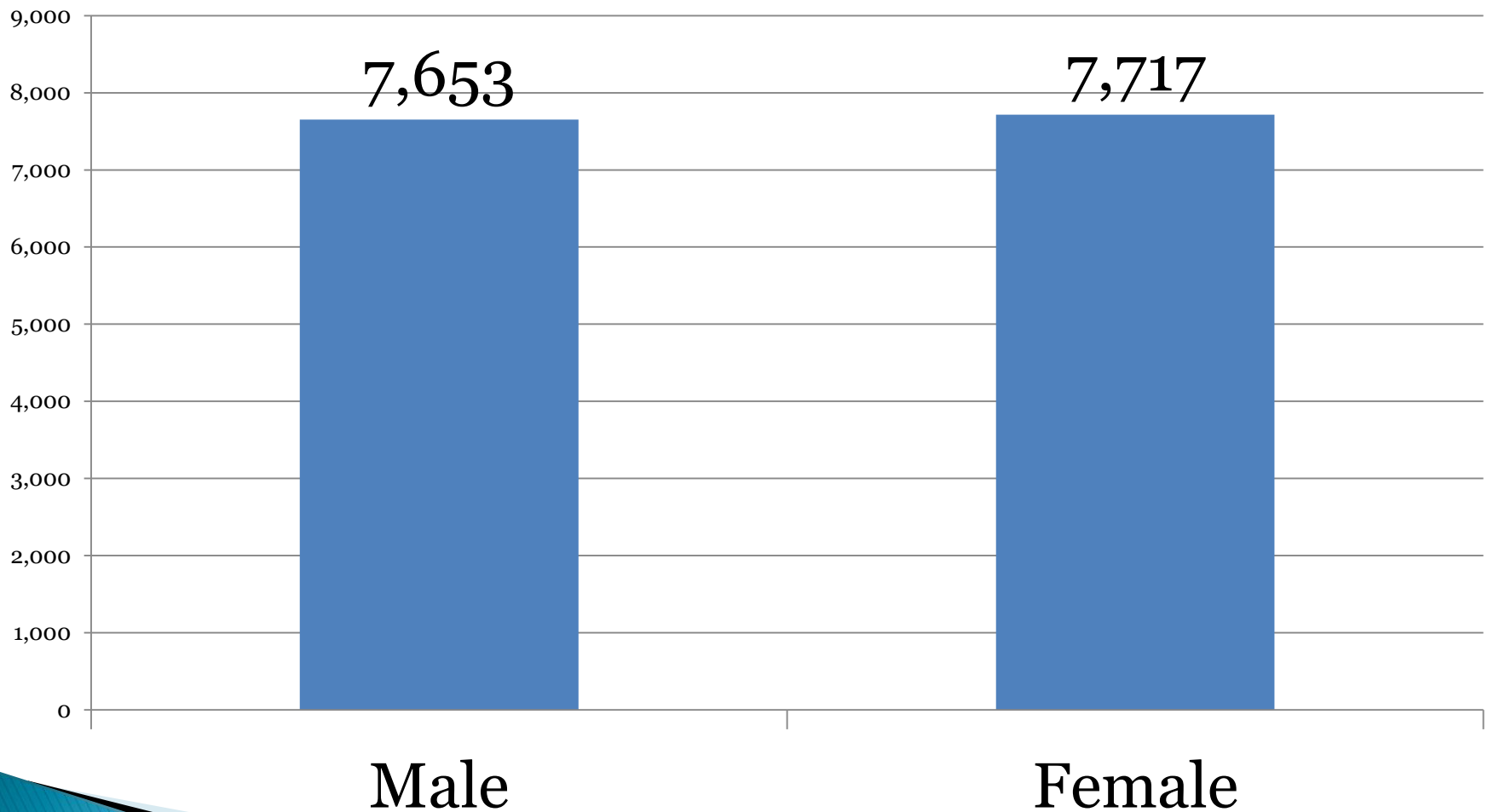
- ▶ Longitudinal comparisons with the same students as they matured in age (e.g. how many students changed their minds about “math being fun”) based on ethnicity/race, SES, family composition, parent educational attainment, etc.
 - ▶ Comparisons of student “math attitudes” to those of their parents, teachers, administrators and counselors
- 

Thank You!

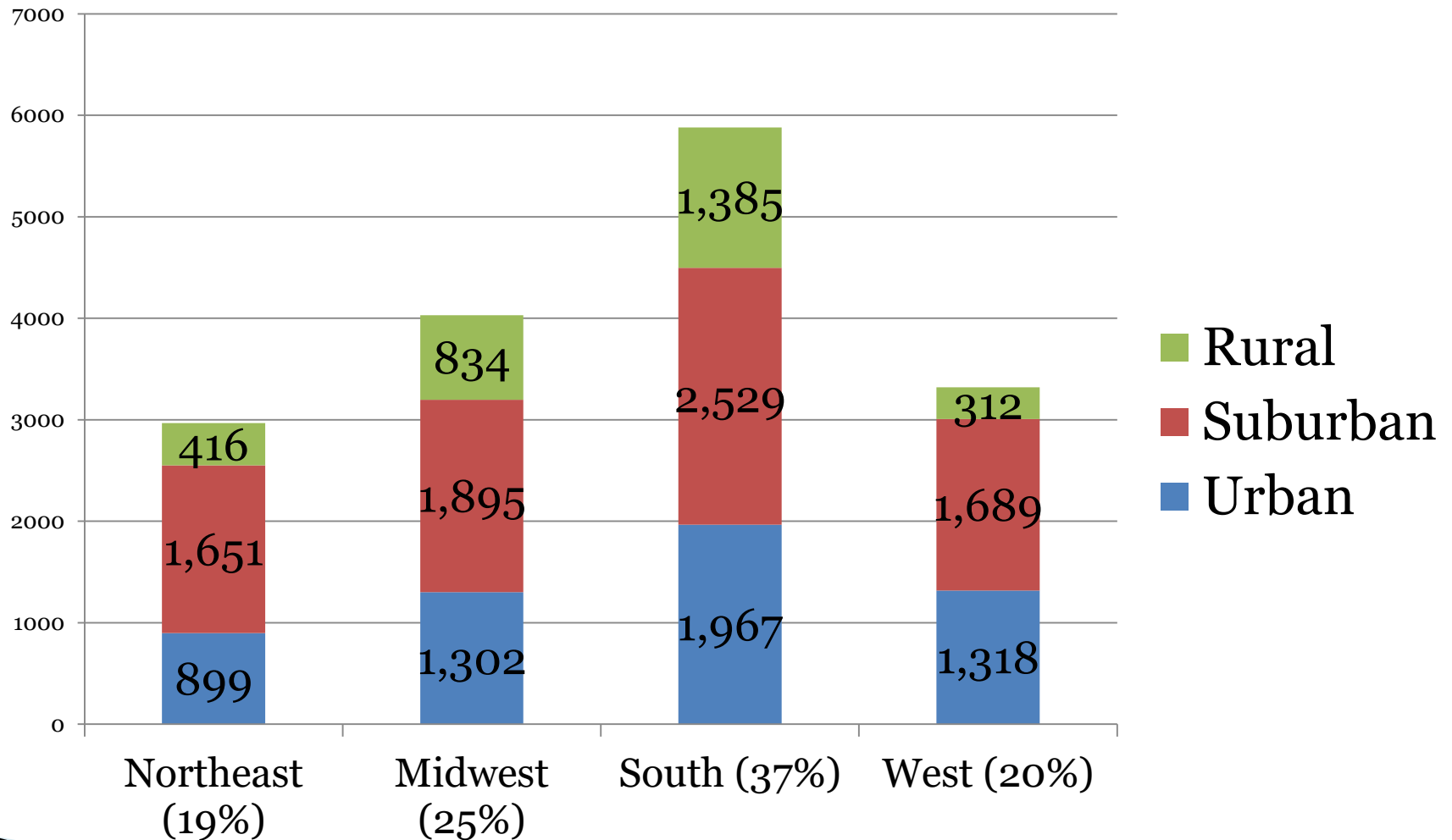
- ▶ Any Questions?



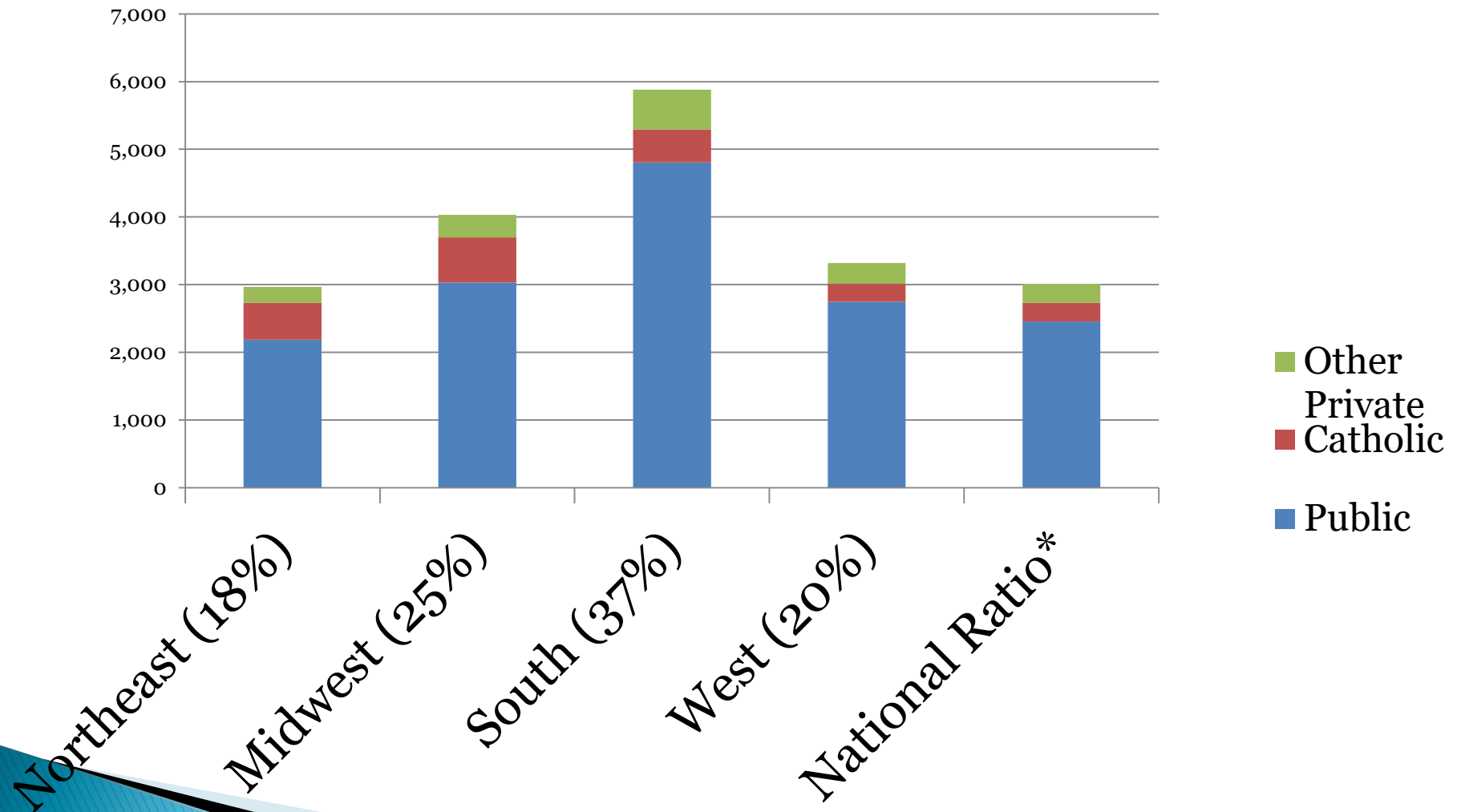
Sample Characteristics: Gender



Sample Characteristics: Regions



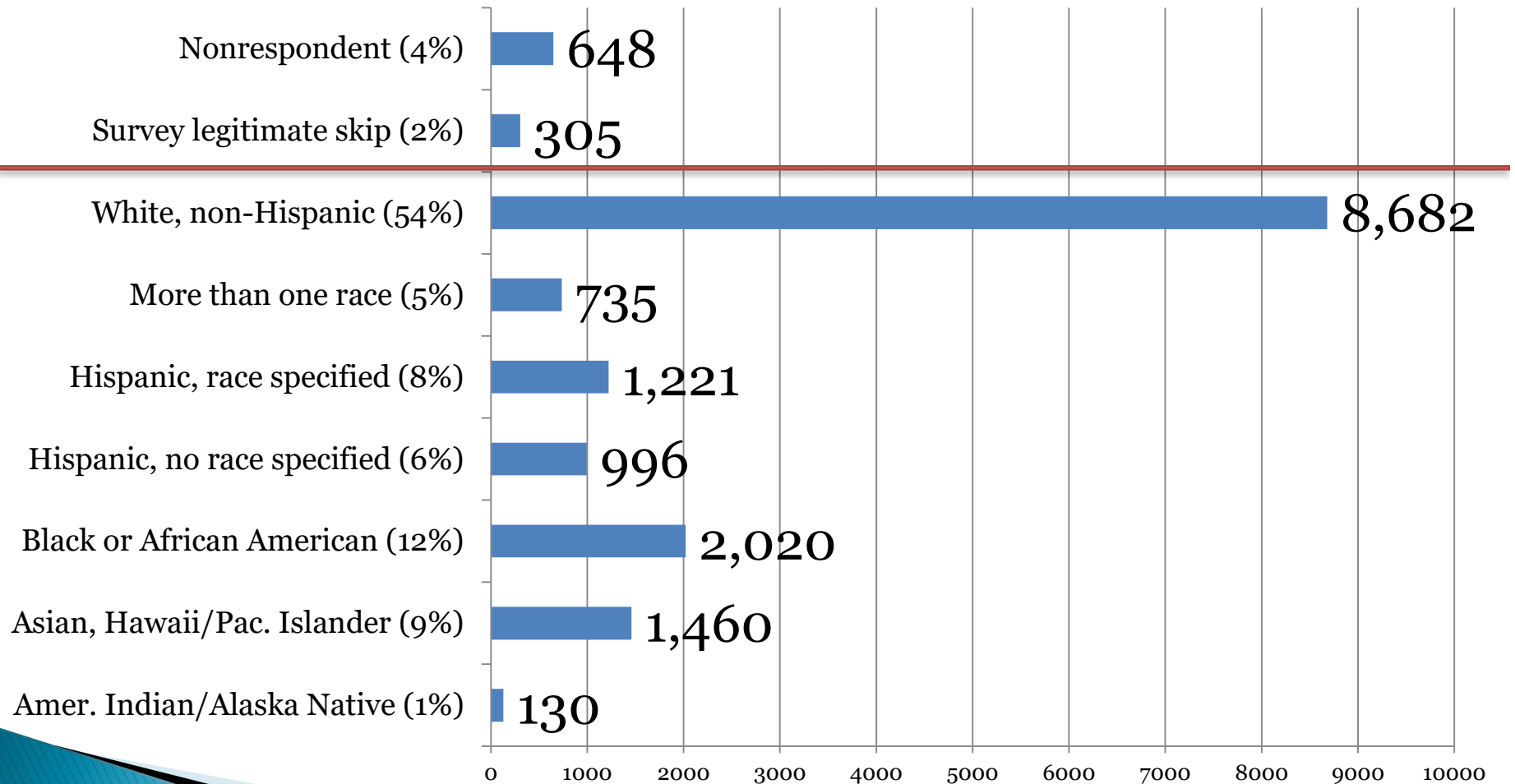
Data Characteristics: School Types



* Source: NCES

(http://nces.ed.gov/programs/digest/d12/tables/dt12_005.asp); Total Numbers/10

Characteristics: Race/Ethnicity

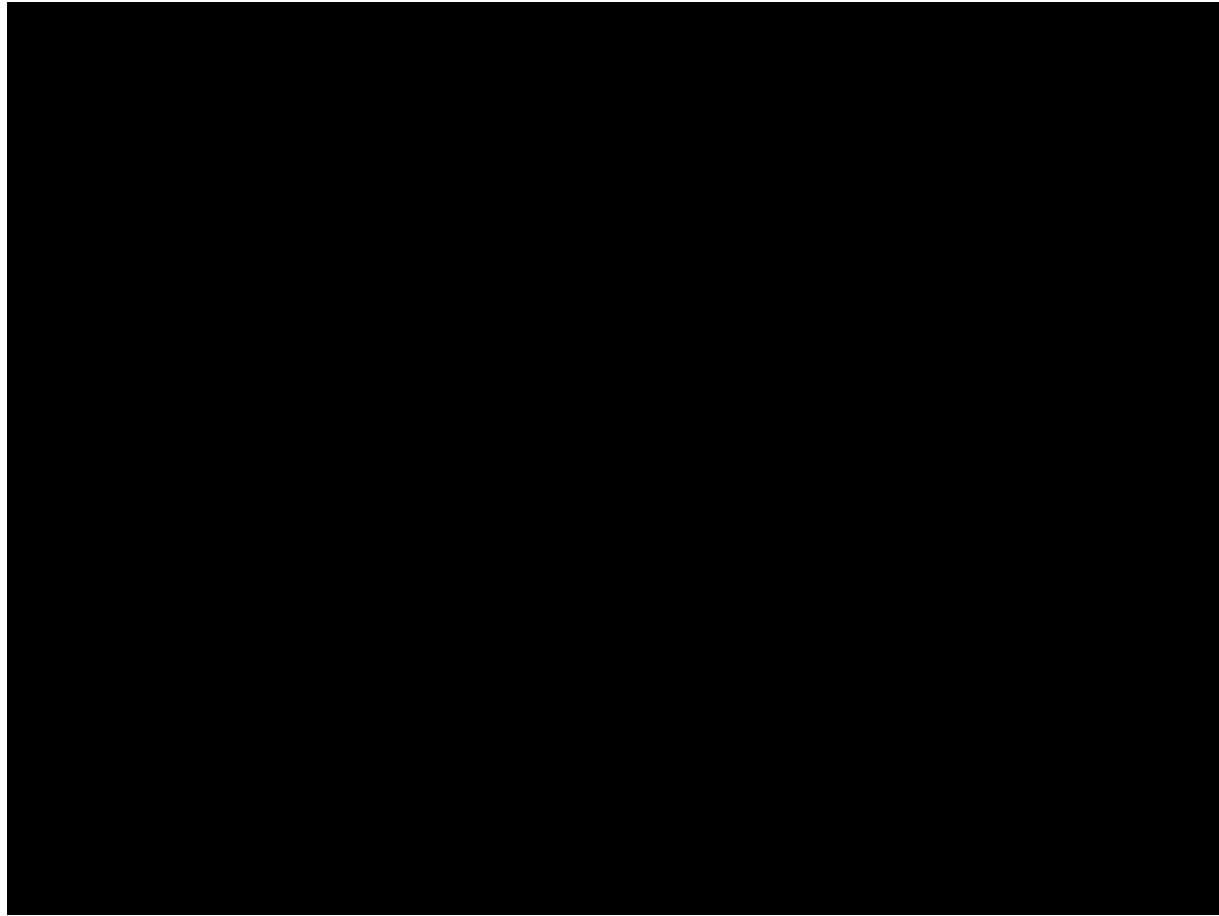


Methodology – Quantitative

- ▶ Previously *qualitative* was used for studies with epistemological (self-authorship) theoretical framework
- ▶ “. . . a quantitative measure of self-authorship will add to the impetus for practitioners to create educational interventions targeted at promoting self-authored ways of reasoning (Creamer, Baxter Magolda and Yu, *Preliminary Evidence of the Reliability and Validity of a Quantitative Measure of Self-Authorship*, 2008, p.551).
- ▶ “relate your approach to your personal understanding and training” (Creswell, 2012, p. 20)



Immersion



<http://www.snagfilms.com/films/title/immersion#>