



Investigating Influences in Idaho STEM Education

Co-PIs

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Background

- * STEM fields stand at the center of virtually all global conditions in the 21st century.
- * At the same time, however, national- and state-level student interest and performance in STEM education is insufficient.
- * Little research to date has investigated the complex factors that shape STEM attitudes, interest, and performance in Idaho.

Project Goals

To investigate the complexity of cultural dimensions that shape STEM educational outcomes with a focus on local contexts, as well as state-level patterns, in Idaho.

To collect data which can inform policy makers, educators, and other stakeholders when STEM education interventions and legislation are considered, developed and implemented.

The Twelve Communities



Bancroft (Caribou Co.)

Boise (Ada Co.)

Fairfield (Camas Co.)

Idaho Falls (Bonneville Co.)

Jerome (Jerome Co.)

Kamiah (Lewis Co.)

Lewiston (Nez Perce, Co.)

Melba (Canyon Co.)

Mud Lake/Terretton
(Jefferson Co.)

Pocatello (Bannock Co.)

Post Falls (Kootenai Co.)

Priest River (Bonner Co.)

Five-year Project Design

Year 1

- Thirty-nine focus groups of teachers, parents, and community members conducted in 12 counties

Year 2

- Statewide phone survey with 12 counties oversampled

Year 3

- Surveys of: students in grades 4, 7 and 10; their parents; random sample of teachers statewide; UI retreat/workshop; pilot innovations

Year 4

- Further implementation of innovations, assessment of interventions, statewide STEM conference, dissemination of results, development of key partnerships

Year 5

- Continued progress with innovations, final surveys to assess progress

Year 1

- Highlights from Focus Groups

Year 2

- Important Statewide findings

High levels of support for investment in education

So much of legislation in politics, and even education decisions that are being made, go back to assuming that you understand what [the science is] they're even talking about. So, while we can't all be experts in everything, I think there's a certain level of literacy in these areas that we all need to be good citizens to be able to make responsible decisions.

-- 2011 Focus Group Response

Statewide Survey Response

- 77.1% support state budget increases in K-12 education.
- 77.4% support state budget increases in STEM education.
- 66.6% support state budget increases in higher education.

- For comparison, 41.7% support state budget increases in law enforcement/public safety.

**Parents appear
uncomfortable
with their
abilities**

- 41.1% of parents were unsure about what courses a child should take to be successful in college
- 37.7% of parents were unsure about how to help someone apply to college
- 41.3% of parents were unsure how financial aid works in college

Statewide Survey Response

- 42.5% of parents in the statewide survey felt their math and science abilities make it difficult to help their children with their homework.
- 48.3% of parents in the statewide survey felt they do not have as much time as they would like to be involved in their children's education.

Science is supported, but support is tempered by uncertainty.

- 58.5% of respondents felt that scientists have a political agenda with their research

“It's alright if they give the facts, but leave it to that. [They] don't need to get on a high horse and press their agenda on others.”

Statewide Survey Response

- 45.5% said that science can be in conflict with their religious beliefs
- 49.1% reported that scientific knowledge changes so rapidly that it is hard to know what to trust
- 60.2% think scientists have had a positive influence in their communities



Year 3

- Student Survey
- Parent Survey
- Teacher Survey

Student Survey

- * Only 28% of Idaho eighth graders are proficient in math and 36% are proficient in science (NCES 2011). In addition, Idaho has a significantly lower percentage (29.5%) of 18-24 year olds in college compared to 36.5% enrolled in the nation as a whole (NCHEMS 2009).

Student Survey Sample

- * Randomly selected 10th, 7th, and 4th grade classes in 12 communities/districts
- * Total of 2,600 student surveys collected
 - * 426 4th graders
 - * 995 7th graders
 - * 1179 10th graders

Student Sample Demographics

Demographic Groups	4 th Graders (n=426)	7 th Graders (n=995)	10 th Graders (n=1179)
Gender			
Girl	49% (207)	49% (455)	52% (600)
Boy	51% (217)	51% (483)	48% (554)
Ethnicity*			
White	--	71% (662)	80% (932)
Hispanic	--	17% (161)	17% (195)
American Indian or Alaskan Native	--	7% (66)	4% (47)
Black or African American, Asian American, or Other	--	15% (138)	9% (90)
Geographic Residence			
Rural	32% (135)	14% (143)	12% (141)
Urban	68% (291)	86% (852)	88% (1038)
Parents' Educational Level			
One or more parents with college degree	--	50% (454)	52% (601)
Neither parent has a college degree	--	19% (170)	35% (400)
Don't know	--	31% (279)	13% (146)

The proportion of boys and girls in our sample is similar to the state population. According to National Center for Educational Statistics, boys comprised 51.5% and girls 48.5% of Idaho's K-12 school population (2010-11).

The ethnic distribution of the sample is similar to the state population. National Center for Educational Statistics reports white students comprise 78.5% of Idaho's K-12 school population. Hispanic students represent 15.9% while other minority populations (including American Indians, African-Americans, and Asian-Americans) are 5.6% of the student population (2010-11).

Students in our survey reported having more highly educated parents than is typical among adults in Idaho (34% of Idahoans 25 years or older had an associate's degree or higher in 2011).

A large number of students in our sample did not know if their parents had college degrees.

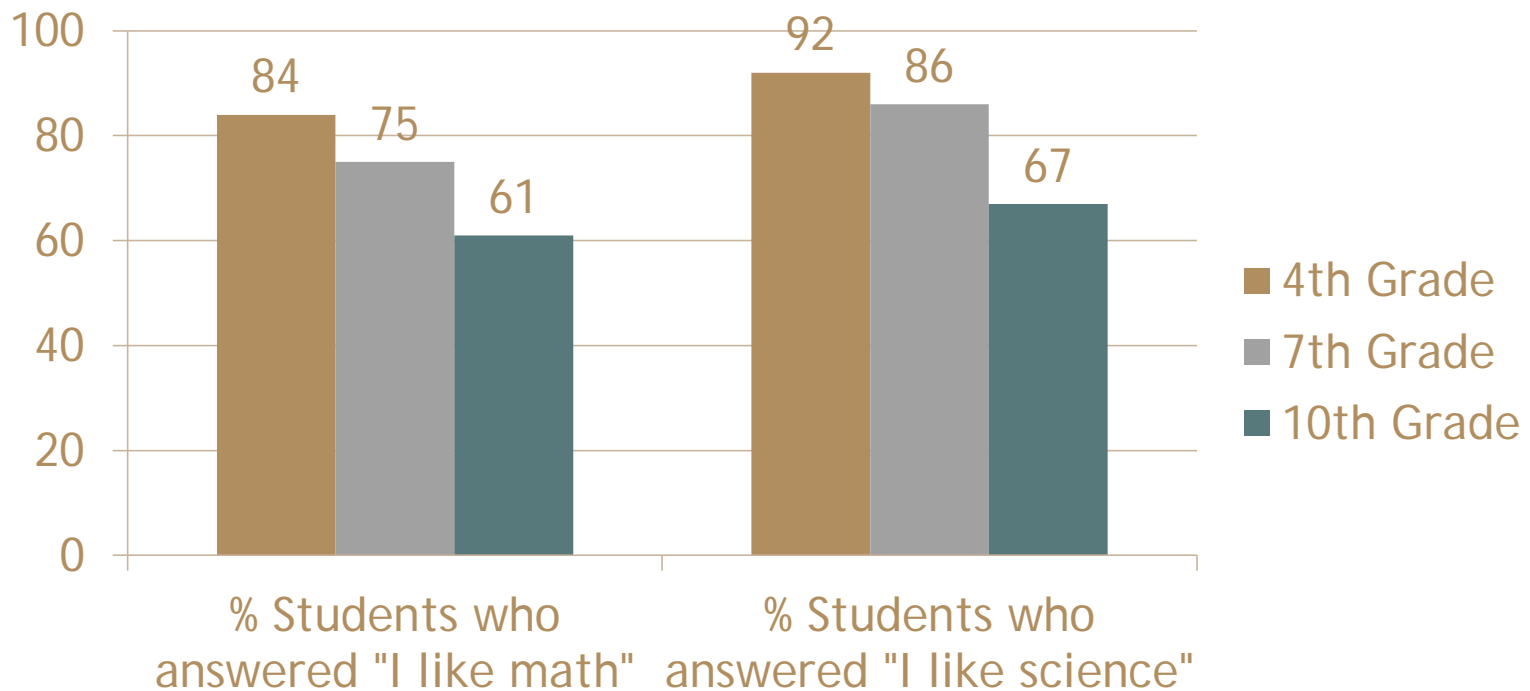
*Students could identify with more than one ethnicity, thus percentages do not total 100. Fourth graders were not asked this question.

Note: Frequencies are listed in parentheses.

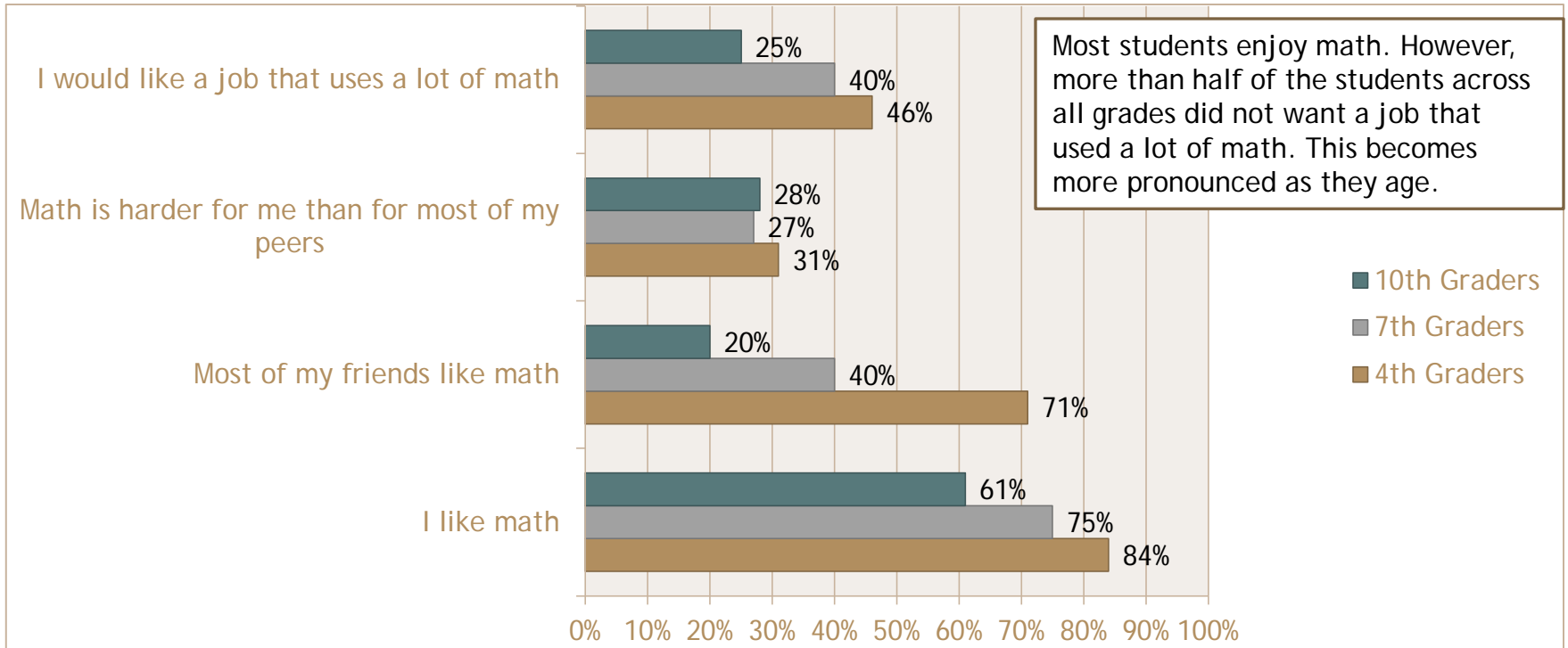
How do 4th grade students perceive STEM careers?

- * The majority of 4th graders like math (84%) and science (92%) yet....
 - * over half (54%) do not want to have a job that uses a lot of math when an adult
 - * over half (60%) would not like to be a scientist

Students' Interest In Science And Math Declines As They Progress Through School

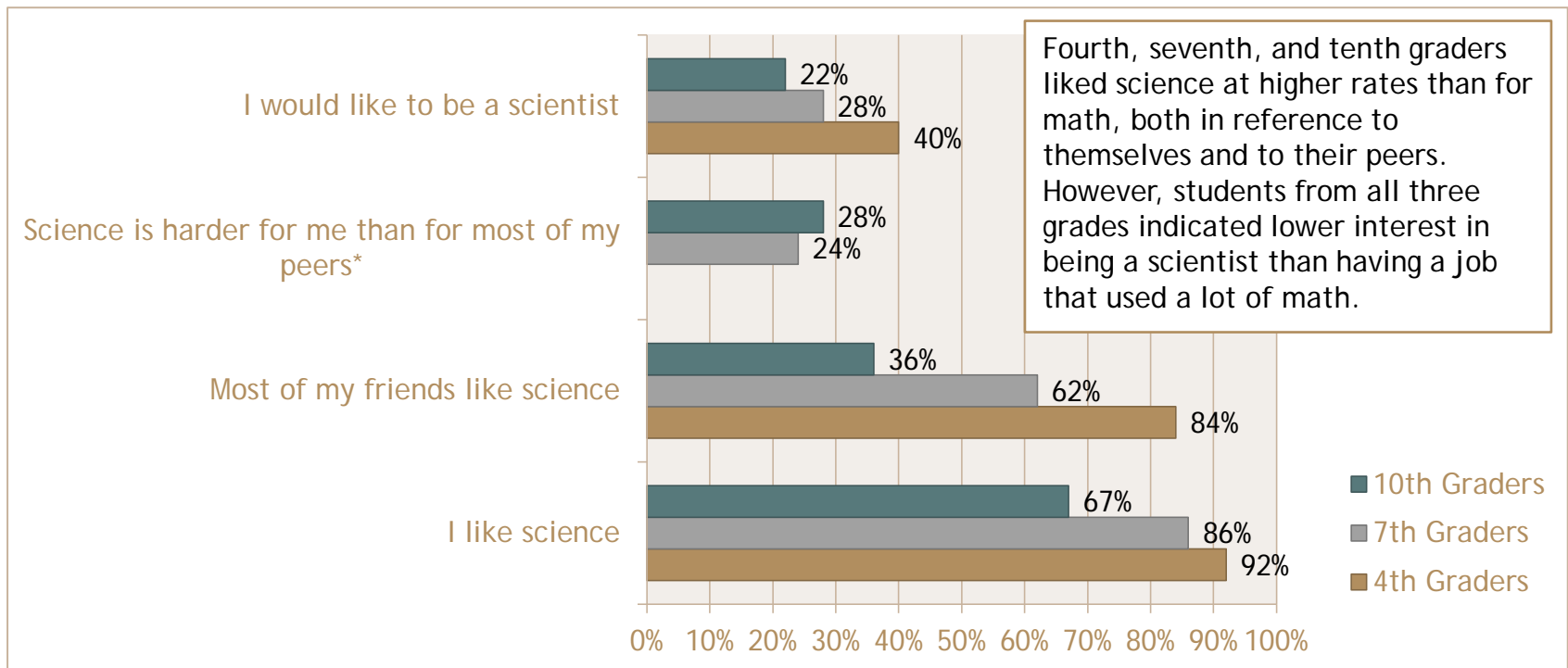


Math Attitudes



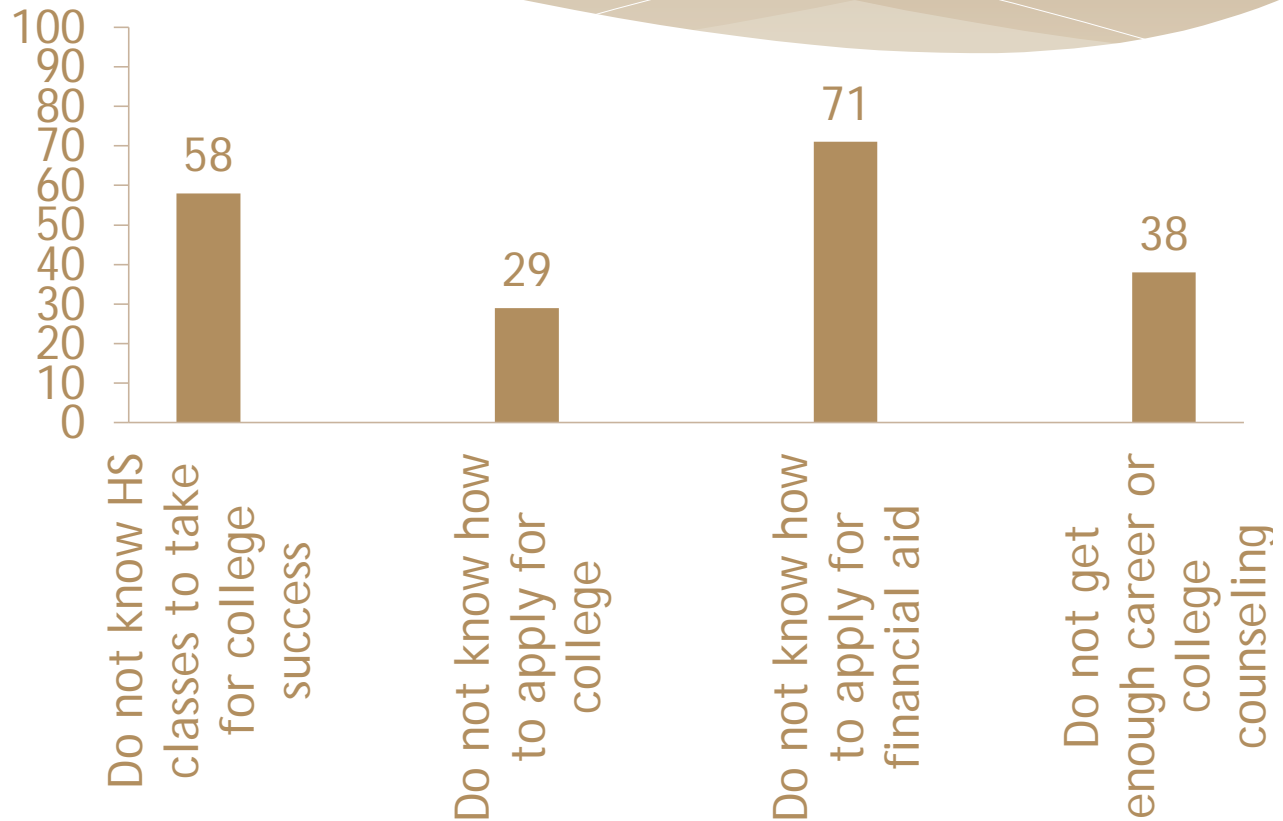
Numbers in the figure reflect the percent of students who agreed or strongly agreed with each listed statement.

Science Attitudes



10th Grade Student Confidence in College Readiness

Idaho High school students are unsure how to prepare for college and by high school their interest in STEM has declined significantly.



Student Attitudes and Aspirations Vary by Race and Gender

- * Nearly half of Hispanic tenth graders wanted jobs that didn't require math or science beyond high school.
- * Hispanic students were more likely than white students to say they want a job that meets their parents' wishes and is really physical.
- * Boys said they like math more often than girls did, but boys were less interested in jobs requiring math beyond high school level. Over a fifth of boys would like a job that doesn't require a college degree.
- * Tenth grade boys were more likely than girls to indicate they would like a job that meets their parents' wishes and allows them to stay in their hometowns.



The Career Disconnect

accountant actress aeronautical FBI agent agriculture analyst anesthesiologist animal science animator anthropology
architecture art artist arts astronomer athlete athletic trainer beautician biologist
business chef chemical engineer chiropractor coaching computer programmer symphony conductor
cosmetologist counselor dental hygienist dermatologist interior designer diesel doctor
electrical engineer electronics law enforcement engineer entertainment animal trainer
family fashion firefighter fish and wildlife forest ranger fun game programmer geologist graphic designer gynecologist
hair dresser helicopter pilot inventor journalist kindergarten teacher lawyer leader manager marketing
math mechanic mechanical engineering medicine midwife
military musician nurse oncologist ophthalmology orthopedics pediatrician
pharmacist
physical therapist president ultrasound technician veterinarian welding writer zoologist

When asked about careers, students didn't want jobs that require a lot of science and math, but then listed STEM jobs as ideal???

Parent Survey

- * Research surrounding parental involvement in their child's education consistently finds that higher academic achievement is linked to parents' expectations and presence in student learning (Jeynes, 2005).

Parent Sample Demographics: Gender, Ethnicity, and Geographic Residence

Demographic Groups	4 th Grade Parents (n=258)	7 th Grade Parents (n=634)	10 th Grade Parents (n=701)
Gender			
Women	80%	82%	76%
Men	20%	18%	24%
Ethnicity*			
White	85%	81%	83%
Hispanic	10%	13%	10%
American Indian or Alaskan Native	3%	3%	2%
Black or African American, Asian American, or Other	2%	2%	3%
Geographic Residence			
Rural	30%	15%	14%
Urban	70%	85%	86%

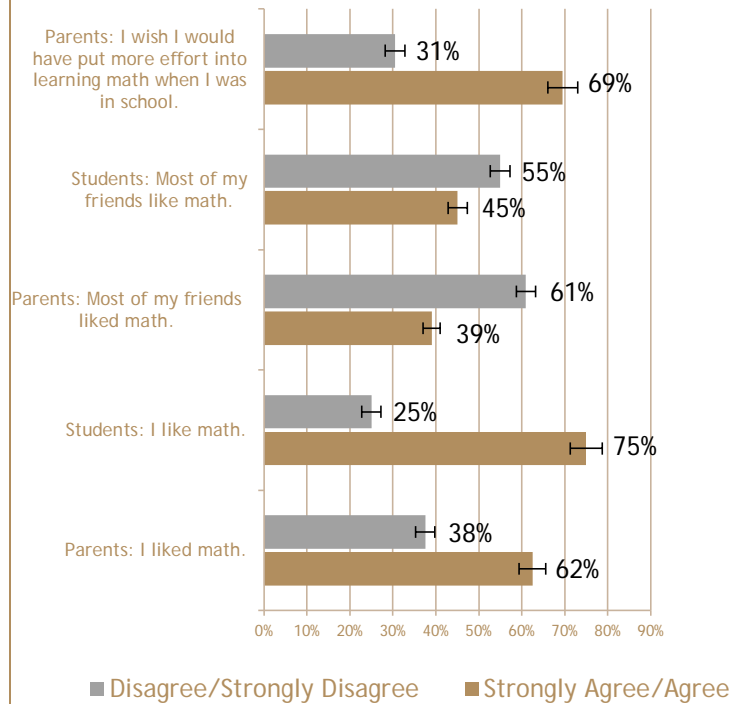
Of the 4th-grade students who participated in the survey fall 2012, 61% of their parents participated. Of 7th-grade students, 64% of their parents participated and 60% of 10th-grade students' parents participated.

The ethnic distribution of the parent sample is not as diverse as the student sample. Although 17% of the student sample reported being Hispanic, only 10% of the parents identified as Hispanic.

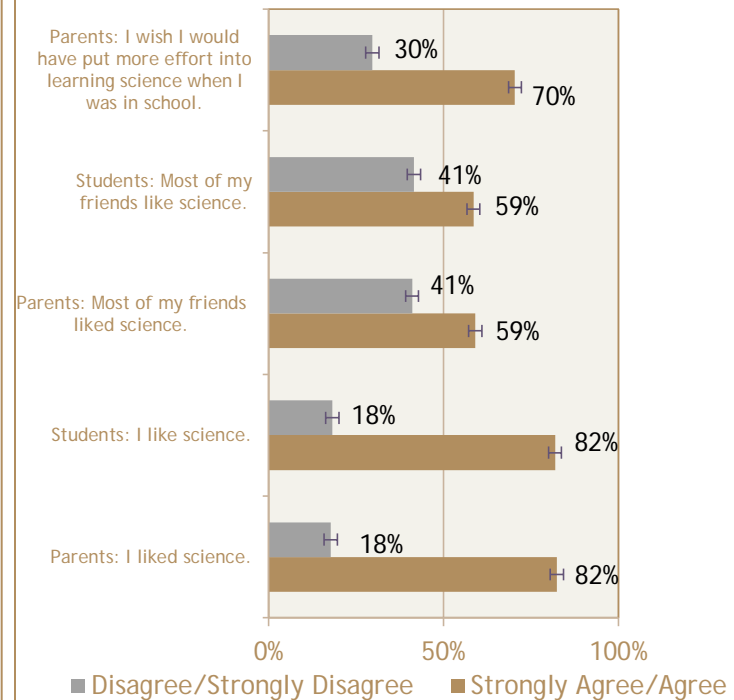
*Respondents could identify with more than one ethnicity, thus percentages do not total 100.

Parent Experiences with Math and Science Compared to Student Responses

Consider your experiences with math in school.



Consider your experiences with science in school.



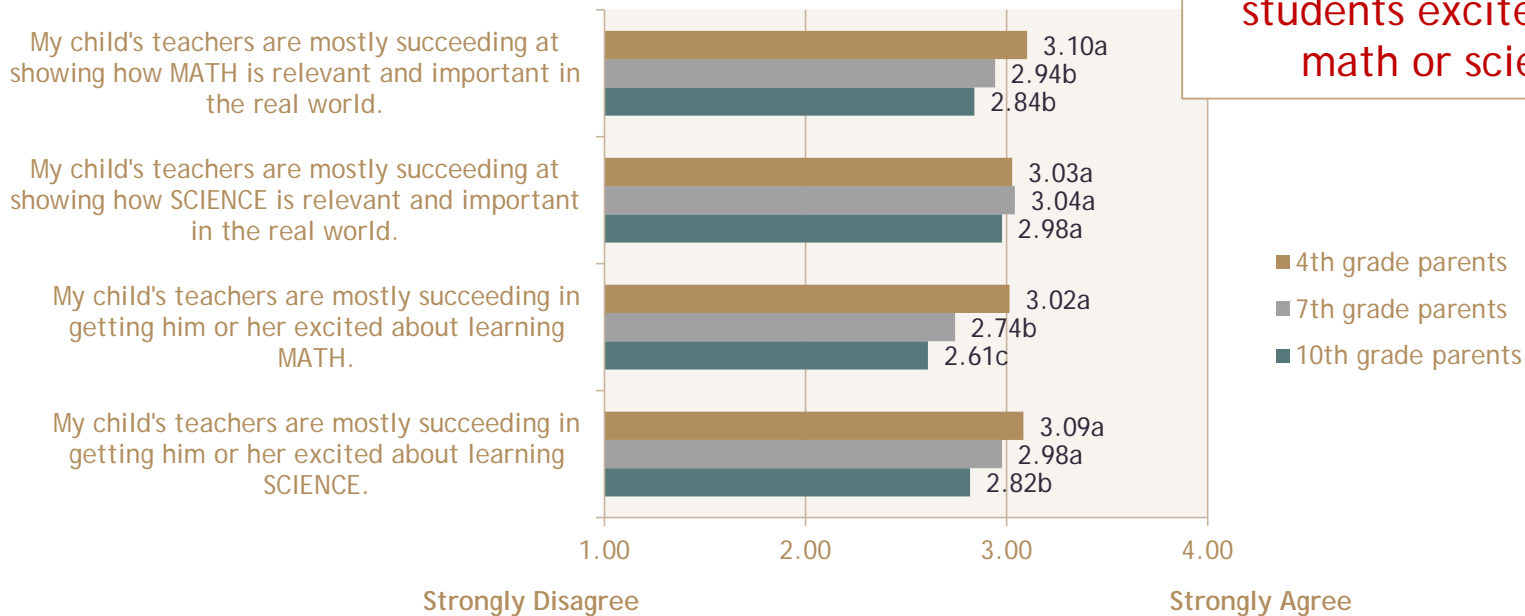
Do Parents' Influence How Their Students Feel About Math And Science?

- * Parents said they wished they had put more effort into learning math and science when they were in school
- * There was a small but significant correlation between how much children reported liking math and how much their parents reported liking math ($r=.11, p<.001$)
- * Perceptions of peers may be more influential than parents with regard to liking math as children who believed their friends liked math were more likely to report that they too liked math ($r=.29, p<.001$).
- * Students showed the same pattern as their parents with regard to their own and perceptions of their friends' liking for science.

How Do Parents Feel About Their Student's Education?

As grade levels advance parents increasingly perceive that teachers are less successful in getting students excited about math or science.

Degree of Parent Agreement with Each Item



Parent Sample Demographics: Income

The number of households living on incomes below Idaho's median income and below poverty was greater for the sample of 4th-grade parents than for the other two parent samples.

Distribution of parents in sample earning above and below Idaho's median income of \$46,890.

	10 th -grade Parents	7 th -grade Parents	4 th -grade Parents
Above Median	58%	54%	44%
Below Median	42%	46%	56%

Poverty distribution of parents in sample.

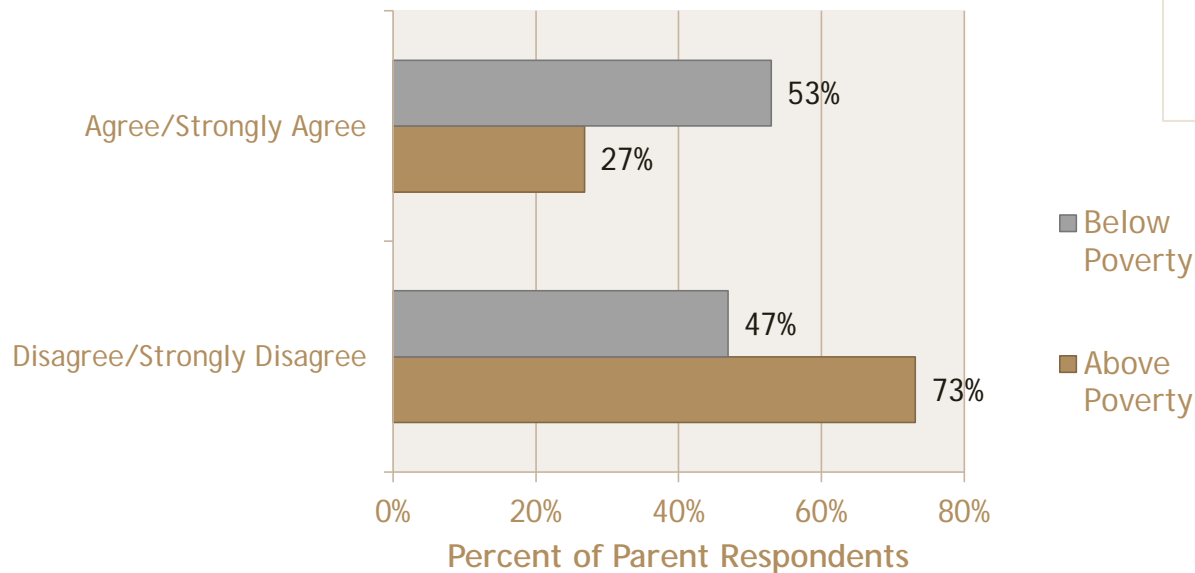
	10 th -grade Parents	7 th -grade Parents	4 th -grade Parents
Above Poverty	75%	71%	60%
Below Poverty	25%	29%	40%

- The largest percentage of families in poverty are Hispanic in this sample.
- Parents with college degrees comprised the smallest percentage of families living below poverty level

The Relationship Between Poverty and Family Involvement with Education

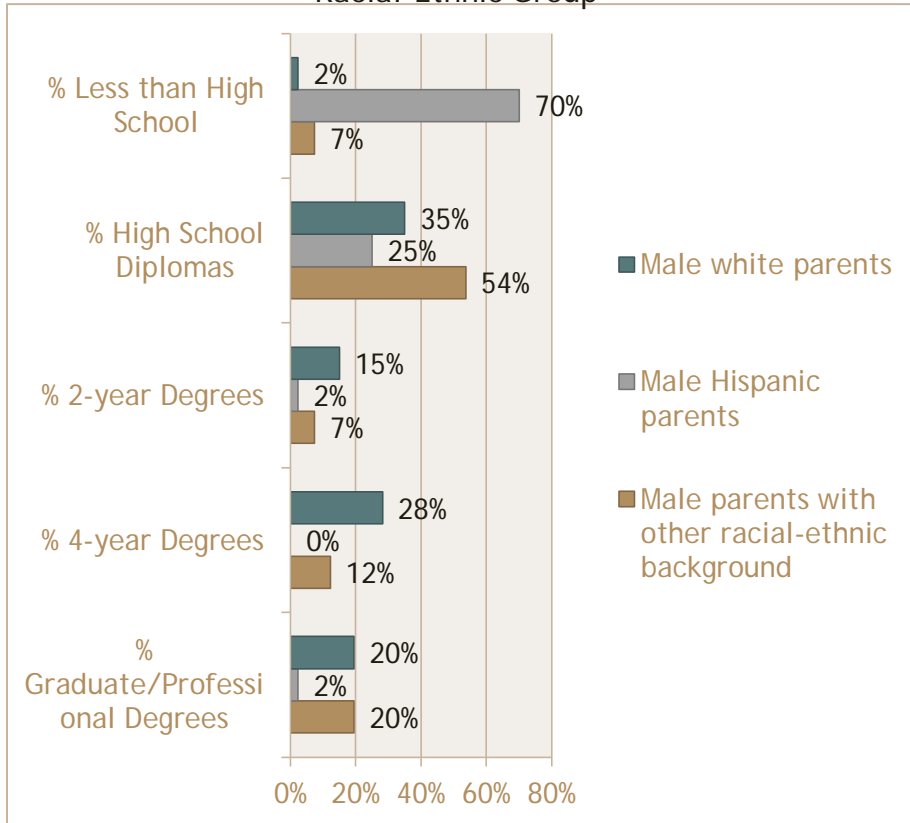
- 60% of parents felt they knew how to support their child's efforts in college preparation.
- Parents experiencing poverty were less likely to report understanding different aspects of college preparation.
- 40% of parents living below poverty level reported they did not know how to help their child apply for financial aid.

My family's financial situation makes it difficult to be involved in my child's education.

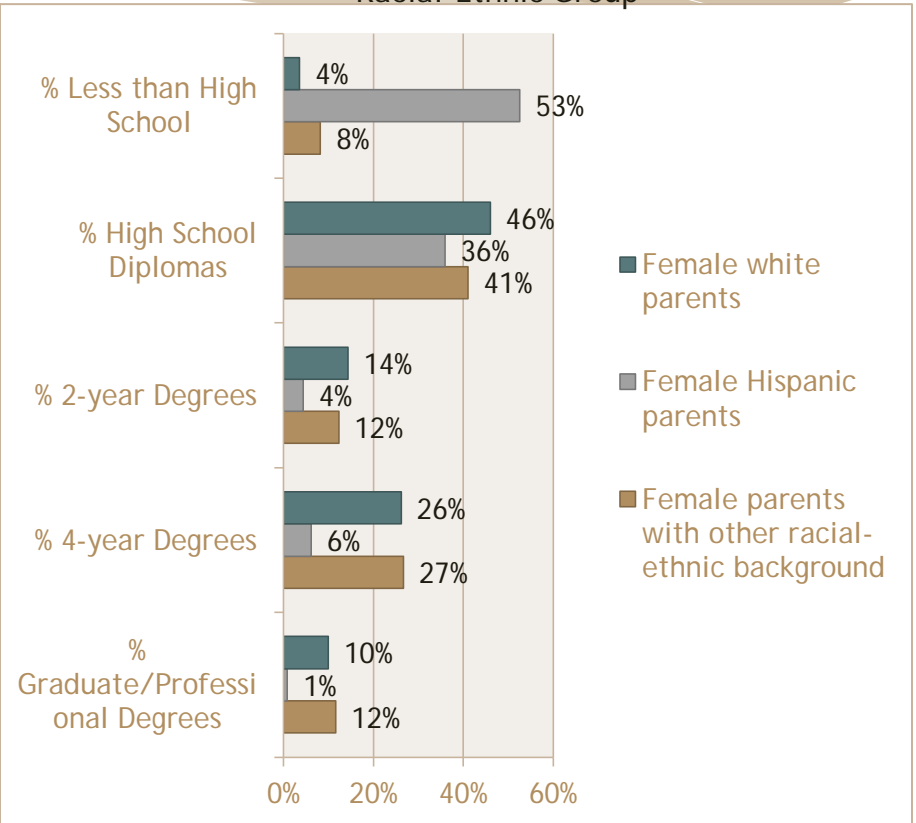


Relationship Between Parents' Educational Attainment and Racial-Ethnic Composition

Male Parents' Educational Attainment by Racial-Ethnic Group



Female Parents' Educational Attainment by Racial-Ethnic Group



- For both male and female parents, the level of educational attainment among Hispanic parents was significantly lower than the other two racial-ethnic groups considered in this report.

Why Does Parent Educational Attainment Matter?

Over 50% of parents, both male and female, reported having a high school education or less, YET

91% of parents said they would like their child to earn at least a four-year degree.

- * Parents with less than a high school education wish they had more time to be involved in their child's education compared to other parents
- * The largest portion of students who indicate they do not want to be scientists come from homes where the parent has less than a high school diploma
- * Parents' educational attainment significantly correlates with students' career aspirations, with the desire to use a lot of math increasing as parents' education level increases ($r=.07$, $p=.01$).
- * Regression analysis indicates that a female parent's educational attainment and grade in school are significant predictors of a child's agreement with the statement, "I want to be a Scientist."

Teacher Survey



“Tell me and I forget,
teach me and I may
remember, involve me
and I learn.”

— Benjamin Franklin



Teacher Sample Demographics

Demographic Groups	Teacher Sample	Idaho Population (Census Bureau)	US Population (Census Bureau)	US Teachers (Nat'l Ctr for Ed Stats)
Gender				
Women	56%	50%	51%	476%
Men	44%	50%	49%	24%
Ethnicity*				
White	96%	94%	78%	383%
Hispanic	2%	12%	17%	7%
American Indian or Alaskan Native	1%	2%	1%	Less than 1%
Black or African American, Asian American, or Other	2%	1%	18%	8%

The sample of Idaho teachers is dominated by females at 56%, yet not as drastically as the national 76%; however, the Idaho State Department of Education reported that 71% of public k-12 teachers were female in 2012-13.

Both the sample and the State reported 2% of Idaho teachers are Hispanic, while the general population of Idaho has 12% Hispanic.

*Respondents could identify with more than one ethnicity.

Sources: US Census Bureau and Idaho Department of Education

Teacher Sample Demographics: Grade Levels and Subject Areas Represented

All grade levels from kindergarten through twelfth grade are represented in the sample

Grade Level	K	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
# Teachers in Sample	24	46	46	35	27	24	25	38	43	28	32	30	31

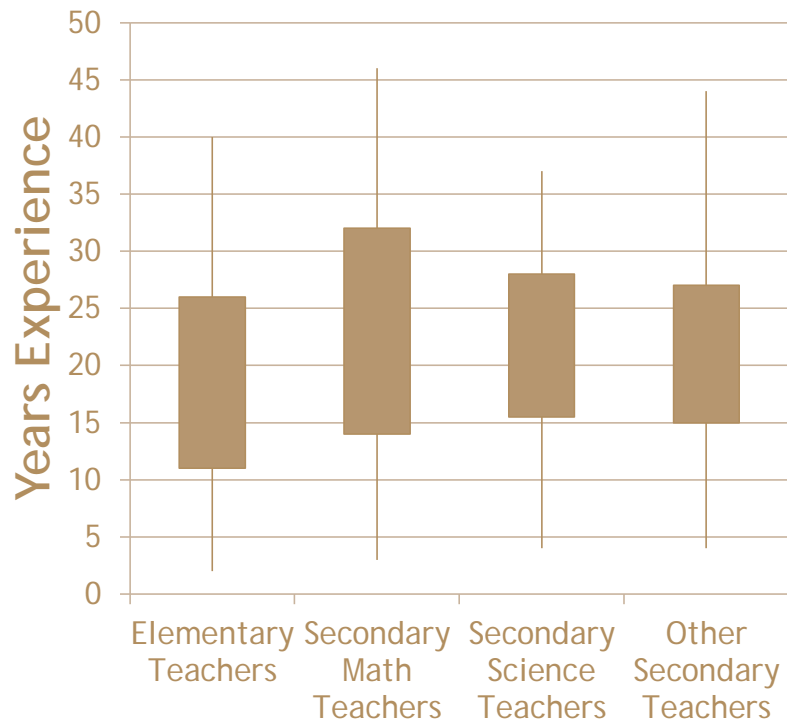
Teachers represented a wide variety of subject areas.

Subject in Jr. High/High School	Social Sciences	Math	English	Science	Vocational /Technical	Health /PE	Arts	Foreign Language /ELL	Speech	Special Ed	Elec tives
#Teachers in Sample	47	39	37	36	13	11	7	6	5	3	9

Teacher Experience

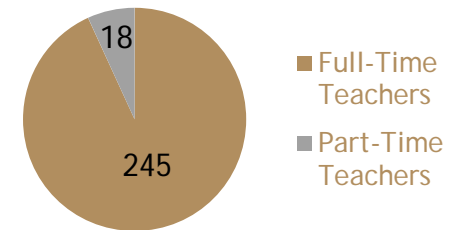
Teachers had between 2 and 46 years of teaching experience including the 2012-2013 school year

Years Teaching Experience

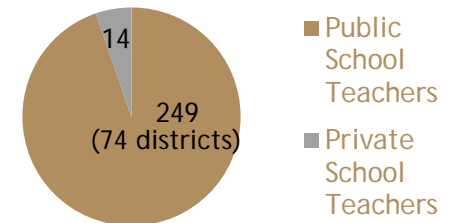


Maximum: Top of upper whisker
75th percentile: Top of box
25th percentile: Bottom of box
Minimum: Bottom of lower whisker

Current Teaching Schedule



Teacher Sample Public/Private Schools

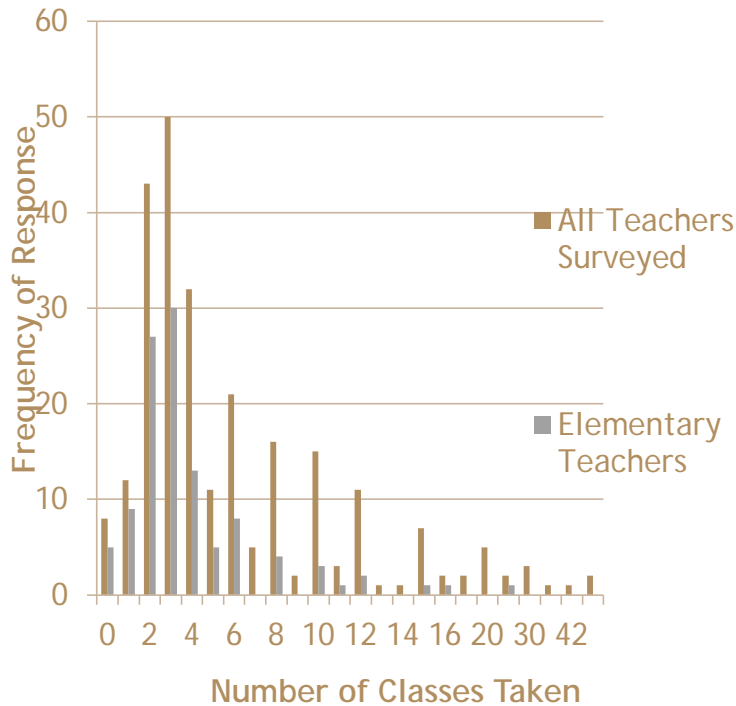


The average number of years taught for the entire sample was 20 years. The median was also 20 years.

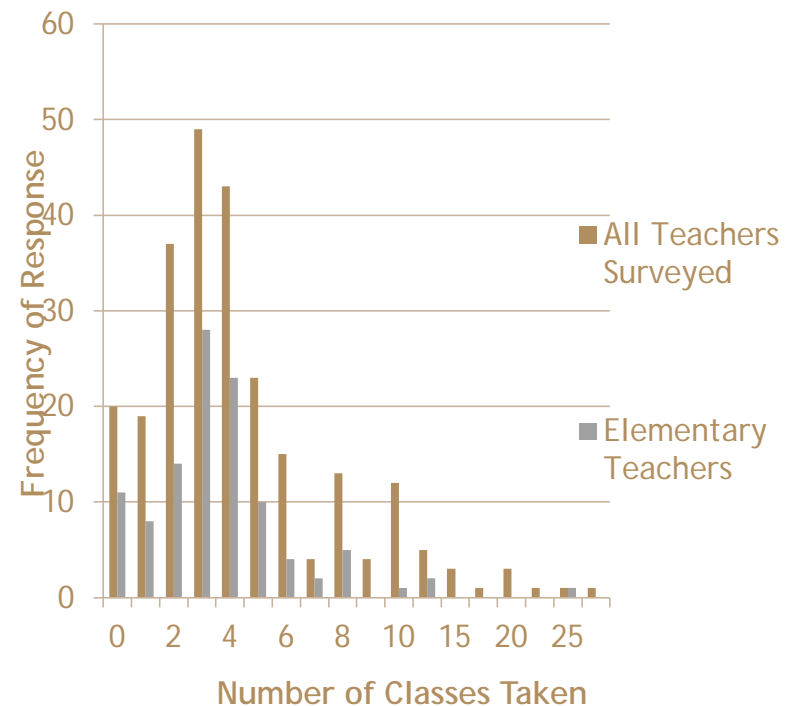
Teacher Preparation in Science and Mathematics

Elementary teachers, who must teach several subjects, tend to take fewer math and science courses in college.

Science Classes Taken



Math Classes Taken



Teacher Professional Development

Please indicate how satisfied or dissatisfied you are currently with each of the following at your school:

The amount of time your district provides for professional development

59%

The quality of professional development opportunities

57%

Science, technology, engineering, and math related professional development opportunities

75%

0 10 20 30 40 50 60 70 80 90 100
Percent Satisfied or Very satisfied

Yet, in another question, only 42% agreed/strongly agreed with *There has been sufficient professional development devoted to supporting the transition to the CCSS at my school.*



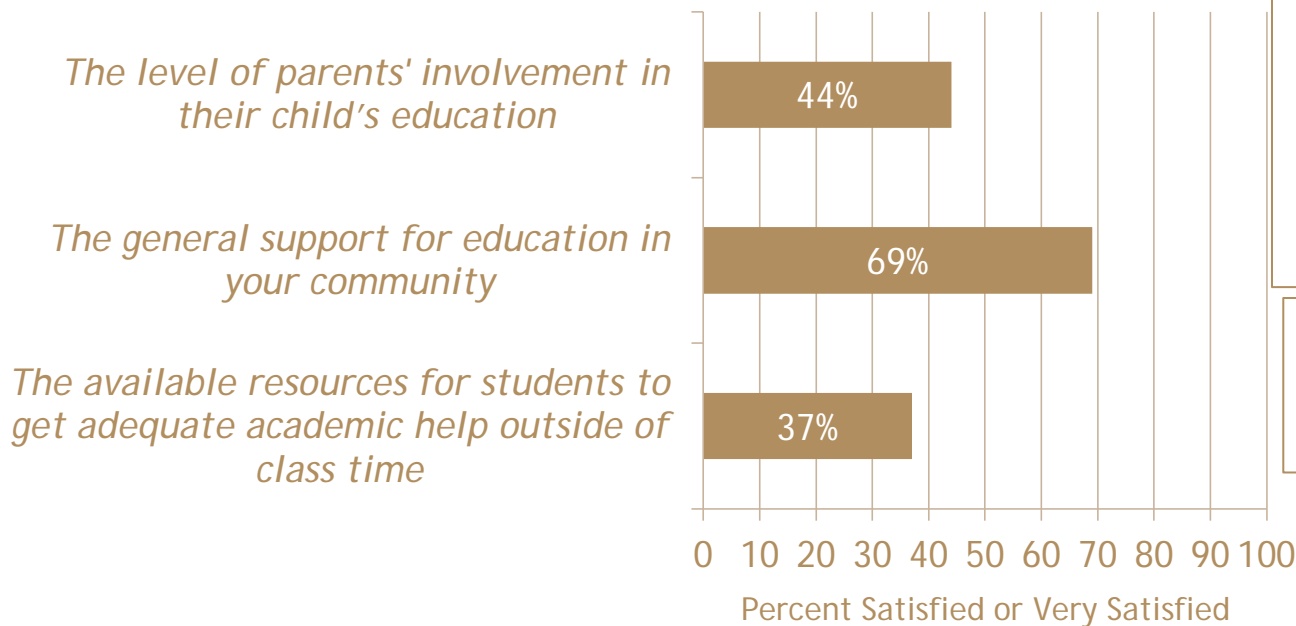
What Do These Teachers Have to Say About:

- Parental Involvement?
- Community Engagement?
- Student Achievement?
- School Culture?
- Student Motivation?
- Student College Preparation?

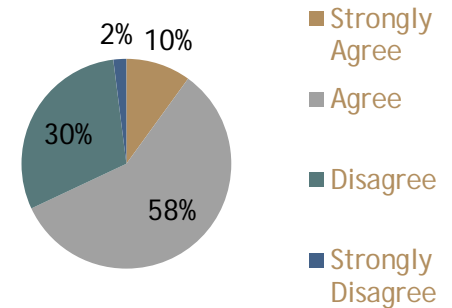
Parental Involvement and Community Engagement

A majority of teachers in the sample were satisfied with the support for education in their communities; yet only 44% indicated they are satisfied with parents' involvement and even fewer feel students have adequate resources.

Please indicate how satisfied or dissatisfied you are currently with each of the following at your school:



"I would like to have more interaction in my classroom with science, engineering, math or technology professionals."



The majority of teachers want more interactions with STEM Professionals

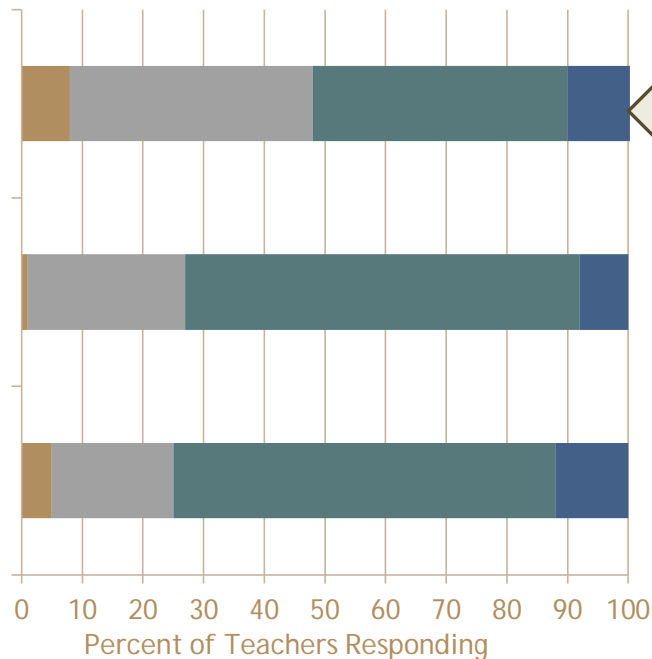
Student Achievement

Influence of Various Factors on Student Achievement

**Many of my students are not motivated to work in school because they feel education has no place in the futures they see for themselves.*

***Student achievement in math is mostly a reflection of their natural abilities.*

There is not much I can do as a teacher to overcome the influence of adverse family conditions on students' learning.



Sub-groups: 34% of elementary teachers agreed with this statement, while 57% of secondary teachers agreed.

Teachers Believe they have an impact.

■ Strongly Agree ■ Agree ■ Disagree ■ Strongly Disagree

School Culture

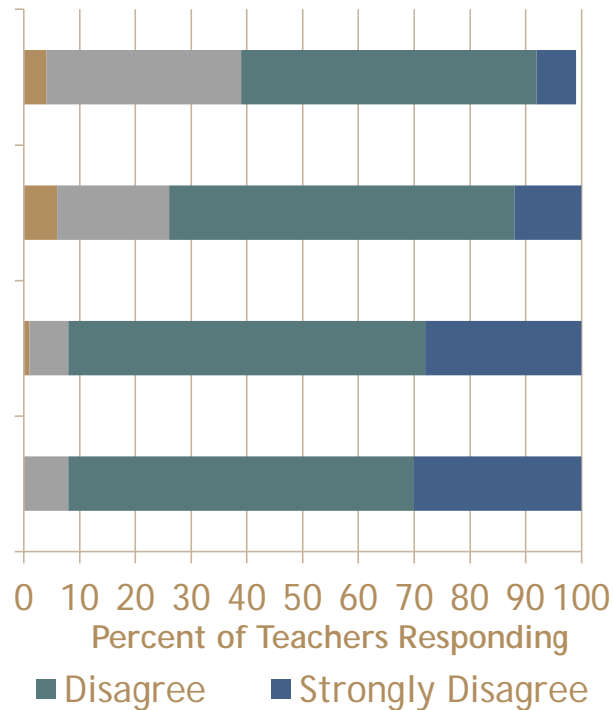
Teachers perceive a positive peer culture but feel there could be more emphasis on Science and Math and how it relates to employment

**Most of my students have a clear idea of how math and science can be used in their future employment and daily lives as adults.*

***My school emphasizes math and/or science at the expense of other subject areas.*

The student peer culture at my school encourages boys more so than girls to succeed at math and/or science.

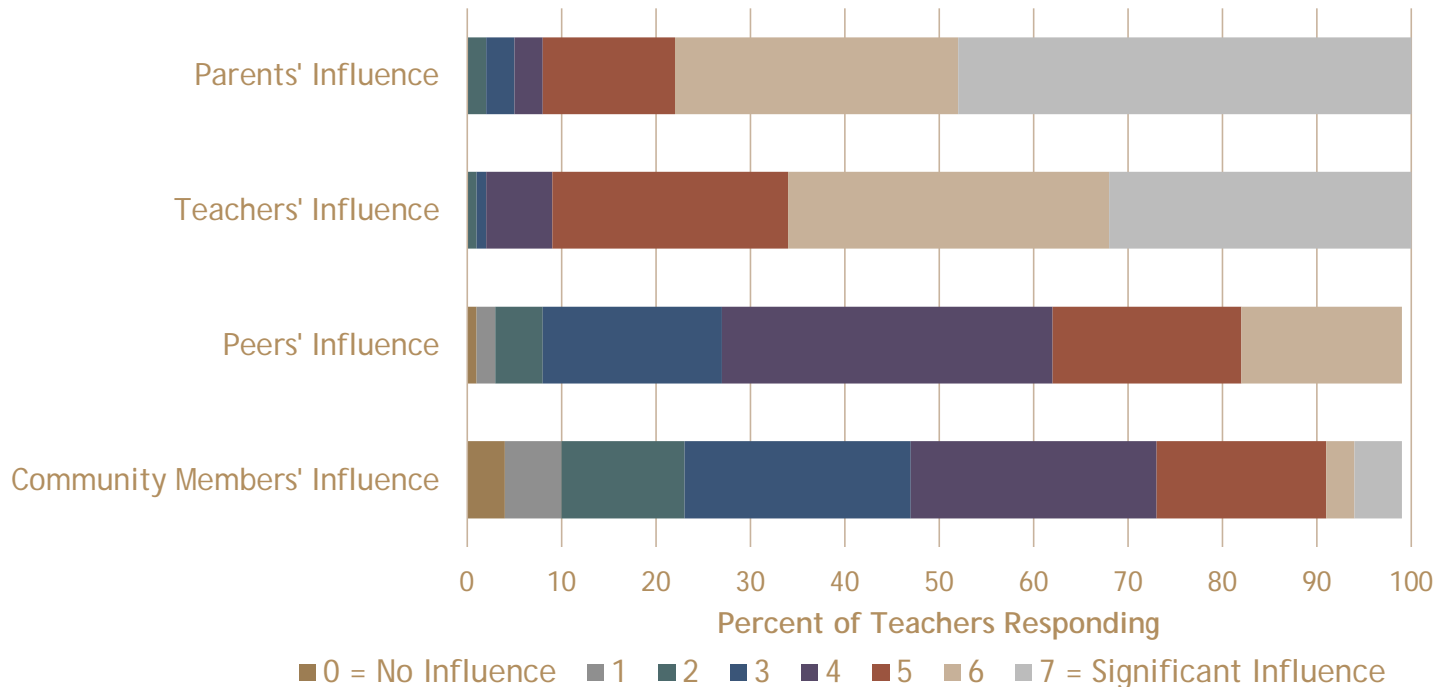
The student peer culture at my school encourages white students more so than ethnic minority students to succeed at math and/or science.



Student Motivation

Teachers indicate themselves and parents as having more significant influence than peers and community members for students' academic motivation. A very similar distribution occurred for a parallel question about influences on a student's decision to attend college or not.

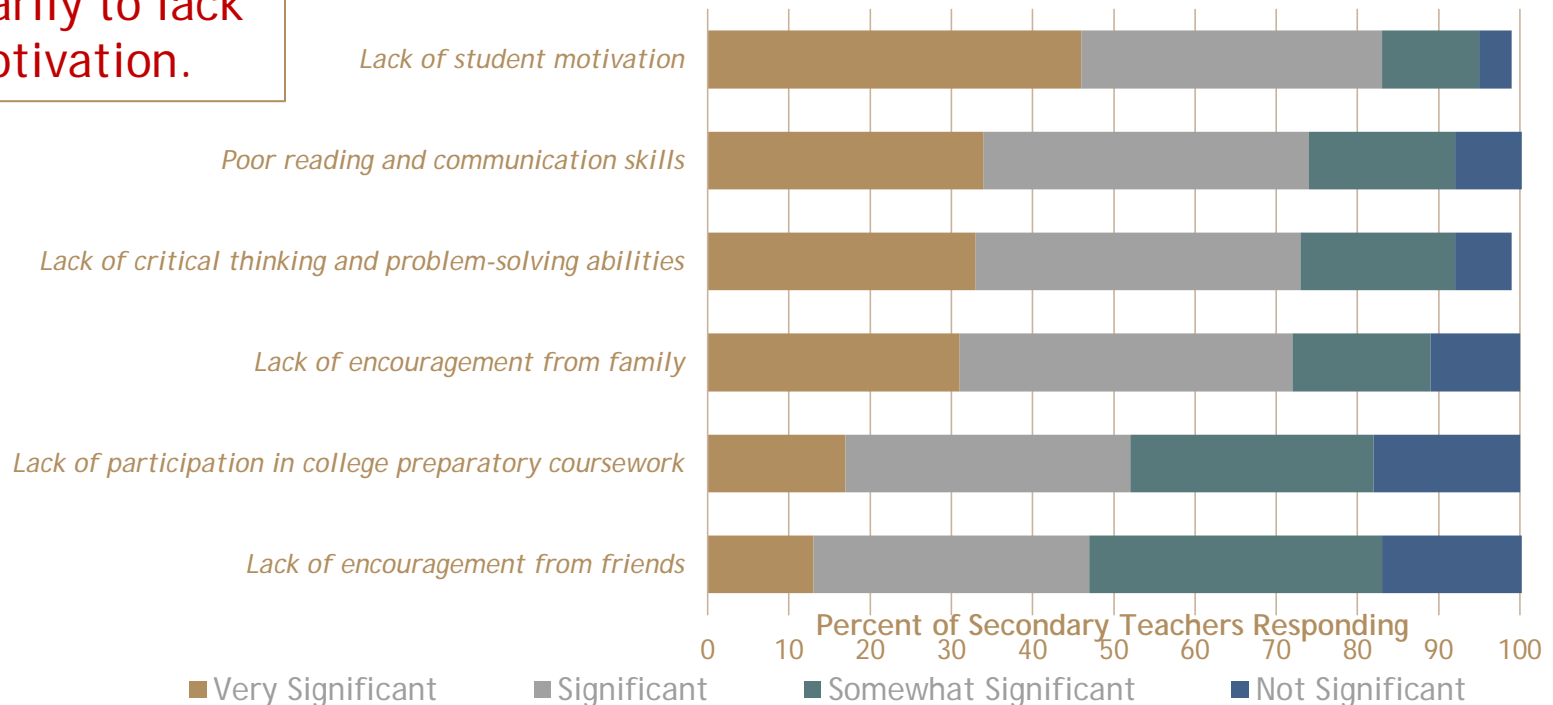
Influence on Student Academic Motivation:



Student College Preparation

Teachers attribute lack of preparation primarily to lack of motivation.

“How significant are each of the following factors in explaining why students in your school may leave high school unprepared or unable to succeed in a 2- or 4-year college?”



Conclusions

- * The statewide survey suggests that **Idaho citizens support education** and specifically STEM education
- * Most students were not interested in jobs that use a lot of math and did not want to be scientists. *Yet, they are interested in STEM-related careers.* **Career awareness may be the key to resolving this disconnect.** *(Poster presents more detail)*
- * Students' positive experiences with, and attitudes toward, math and science significantly decline as they progress in grade level. **High School may be too late for interventions.**
- * **Gender and Ethnicity** are related to student attitudes. *(Posters present more detail)*
- * Parents and students alike have **doubts regarding the necessary steps to proceed to college and parents are concerned about their abilities** to help their children with math and science and this is pronounced with lower income and lower educational attainment. *(Posters present more detail)*
- * Many teachers have only the minimum requirements in math and science education and do not feel prepared to implement the Common Core Standards in math. **Teacher Preparation in math may be key**

Innovation Projects

- * “Introducing STEM Experiences to Head Start Children in Jerome County”
 - * Develop and deliver hands-on bilingual STEM activities
 - * Target children 3-5 years old and their parents and teachers
 - * Jerome County
- * “How I do STEM” Community Awareness Campaign
 - * YouTube video competition highlighting STEM careers
 - * Produced by H.S. students for broad community awareness
 - * Lewiston area
- * “Technology to Teach Mathematical Practices to Parents”
 - * Develop and deliver video tutorials for parents to help them support children with math homework
 - * Target parents of students in grades K-6
 - * Kootenai County

Innovation Projects

- * **“ Dig’ n IT” Digital Innovation Generating New Information Technology**
 - * Summer internship experience focused on technology
 - * Target high school girls
 - * Post Falls, Idaho
- * **“Virtual World Village”**
 - * Development of the web-based Virtual World Village 3D learning environment
 - * Targeting High School Student use
 - * Statewide
- * **“iSTEM from Excellence”**
 - * Informal STEM education using the place-based theme of Watersheds
 - * Elementary Schools
 - * Lakeland School District
- * **“Eastern Idaho Awareness”**
 - * A public awareness and assistance campaign about FAFSA and college applications
 - * High School students and parents
 - * Caribou County, Bannock County, Bonneville County