How New Hires in STEM Careers Perceive & Value Mathematics

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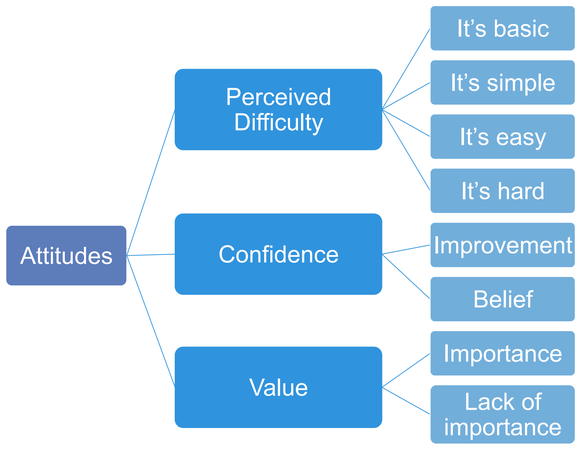
Abstract

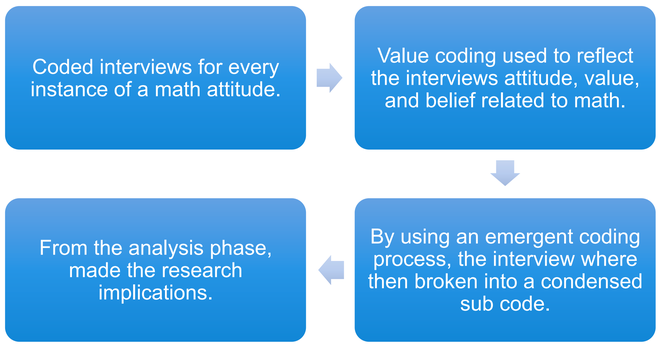
Students' perceptions and attitudes toward math are linked to careers they feel confident in pursuing. Although student attitudes have been heavily researched, attitudes of employees in STEM careers are less understood. We interviewed 27 new hires and managers to understand the attitudes and perceptions of mathematics done in the workplace. Using an emergent qualitative coding process and value coding we explored how employees valued math on the job, perceived the difficulty of math they used, and their confidence in their math abilities. Knowing this information can help bridge the gap between what math students learned in school and what math is used outside of school.

Research Questions

1. What attitudes and feelings towards mathematics are present in the optics?
2. What perceived level of difficulty do employees have when doing math in the workplace?
3. Do employees value the math they used as important to complete tasked on the job?



Methods

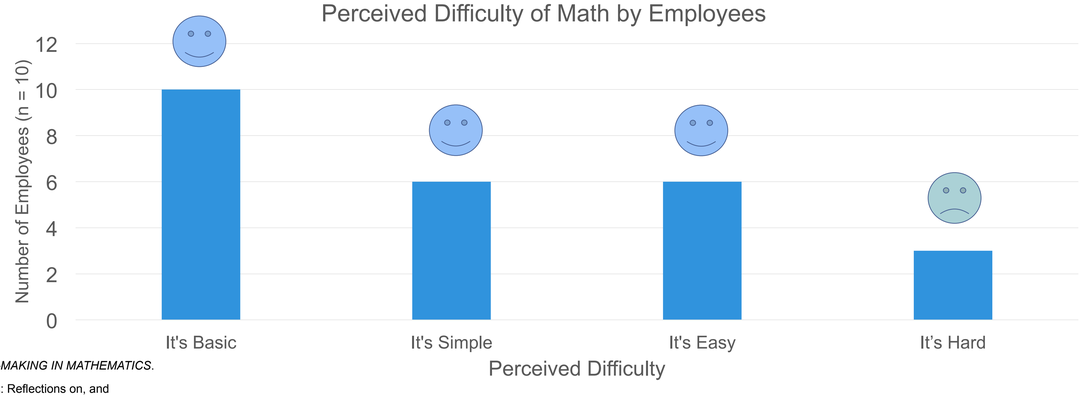


Code Book (Number of Interviews, n = 27)

Code	Definition
Attitude	Math attitude is the way employees/managers think and feel about the value of math that is being done within there workplace.
Perceived Difficulty	Level of math that is being done, level of challenge.
It's basic	Just information that is known, used for everyday, like regular courses.
It's simple	Something that comes natural to them.
It's easy	Includes things like not difficult.
It's hard	Difficult too understand, takes extra practice to learn or understand.
Confidence	Ones worth on ability doing task and self evaluation of task being done.
Improvement	Being able to move from one level to another, self awareness of learning.
Belief	Part if a system that includes our values and attitudes, plus our personal knowledge, experiences, opinions, prejudices, morals and other interpretive perceptions.
Value	Is the importance we attribute to oneself, another person, thing, or idea.
Importance	Information that is crucial for on the job.
Lack of Importance	Information that is not needed for the job.

Finding 1 : Math is "Basic" or "Easy" to STEM Employees

- Despite widespread concerns about students' math preparation, employees view math as basic or easy because the math used in the workplace is what is used everyday. For example basic or easy can include using software to evaluate a formula, however its still important to make sense of the math.
  - *"just basic decimals and adding, subtracting, it's pretty basic"*
  - *"Basic math skills that almost everybody will have, in terms of adding and multiplying"*
  - *"I feel like the basic math skills, the understanding, like, "Here's the equation for this, here's the equation for that." I feel like that was all sort of expected, and figuring out what kind of tool you actually want to use to solve the problem."*
  - *"It's very basic sign, co-sign, tangent stuff, but someone who's giving a training class to the sales people about projection and then they're talking about you have to do sign and it's like…"*
  - *"This is easy, this is high school math." …"Well high school was 30 years ago for some of these people. That doesn't help them. That's not a comforting thing to say."*



Finding 2 : Perceived Importance of Math to Employees

- Geometry or trigonometry is viewed as the most important math type because the shape and dimension of optical designs are critical for their function.
  - *"Geometry is everything. They need to know what they're looking at, what they're doing, and where they're going."*
  - *"The trig is probably one of the most important things that we deal with because we're dealing with angles and curves"*
- Math is viewed as unimportant when not related to typical workplace tasks.
  - *"The stuff that you learn in calculus classes you don't use, but I think, obviously, the people that excelled in those classes are going to do well"*

Employees Value Table of Math Type

Types of Math	Importance	Lack of Importance
Algebra	6	4
Arithmetic	5	5
Calculus	7	4
Fourier	1	1
Geometry Trigonometry	11	2
Linear Algebra	1	0
Other Math Type	4	1
Statistics	1	0
Unit Conversions	2	1

Conclusion

- Employees perceived math as easy when they used it everyday on the job. This probably comes from improving their skills daily through practice and using software.
- According to Dweck's research on fixed versus growth mindset for learning math, people who view math as easy or simple have a fixed mindset. Although recent hires viewed math as easy or simple more research is needed to connect growth mindsets to workplace math use.
- Despite widespread concerns about students' math preparation, our study shows that math is viewed as basic, simple, and easy more than being hard. On the job training and practice helps build their confidence in doing math.

Future Work

- How does math use compare across different STEM fields?
- Study workplace training and links to growth and fixed mindset.
- How do math training and practice in the workplace differ from a school environment?

References

1. Dweck, C. S. (2008). *Mindsets and Math/Science Achievement*.
2. Saldana, J. (2013). *The Coding Manual for Qualitative Research* (2nd ed.)
3. Schoenfeld, A. H. (2009). LEARNING TO THINK MATHEMATICALLY. *PROBLEM SOLVING, METACOGNITION, AND SENSE-MAKING IN MATHEMATICS*.
4. Reider, D., Knestis, K., & Malyn-Smith, J. (2016). Erratum to: Workforce Education Models for K-12 STEM Education Programs: Reflections on, and Implications for, the NSF ITEST Program. *Journal of Science Education and Technology, 25*(6), 859-859.

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