INTEGRATION OF PUBLIC HEALTH AND PROPORTIONAL REASONING-A DEMAND OF TIME
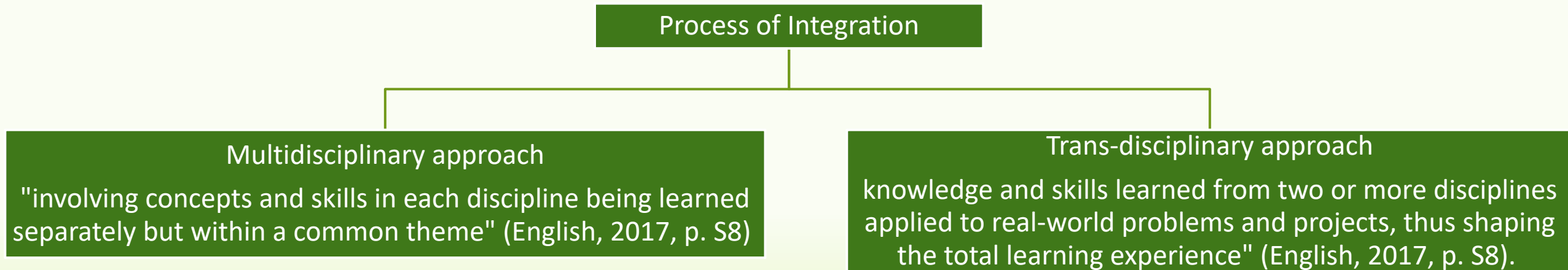
Debasmita Basu, she/her/hers

Eugene Lang College of Liberal Arts, The New School, New York, USA

basud1@newschool.edu

INTRODUCTION

- Educators and policymakers worldwide have worked towards improving STEM education and retaining a higher number of students in STEM fields (Madden, Beyers, & O'Brien, 2016).

- Improved STEM education prepares a generation of students to become well-equipped to tackle complex economic, social, and environmental issues through scientific, mathematical, and technological interventions.

Process of Integration

Multidisciplinary approach	Trans-disciplinary approach
"involving concepts and skills in each discipline being learned separately but within a common theme" (English, 2017, p. S8)	knowledge and skills learned from two or more disciplines applied to real-world problems and projects, thus shaping the total learning experience" (English, 2017, p. S8).

- This study identifies closely with the form of STEM integration that proposes that in a well-integrated STEM module, one subject matter serves as a context to learn another subject and thus makes learning meaningful to students.

RESEARCH QUESTIONS

How an integrated module, developed at the cross-section of added sugar and proportional reasoning,
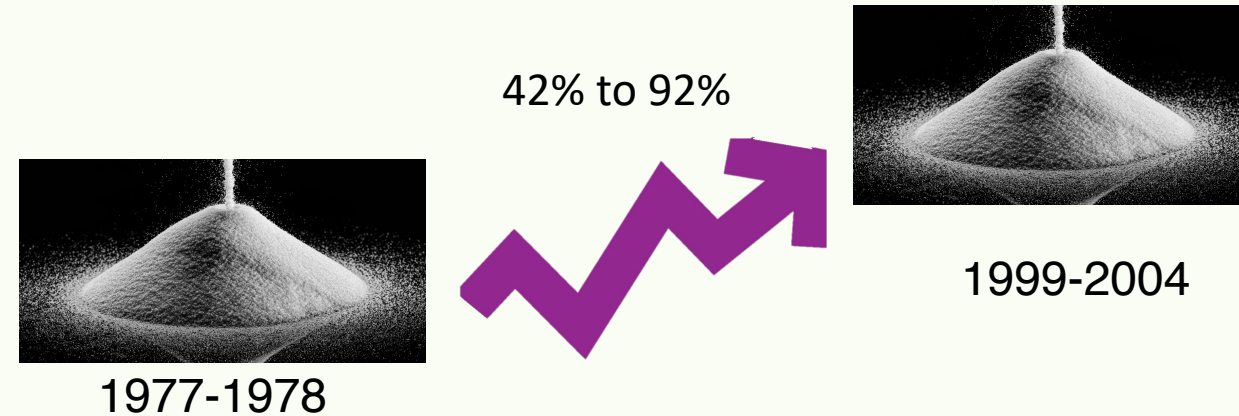i)   provide students with a natural meaningful context to reason proportionally, and
ii)   ii) prompt students to use proportional reasoning to calculate the quantity of added sugar present in different food products and evaluate quality of food.

PROPORTIONAL REASONING

- Multiplicative relationship between two quantities, where the ratio between the two quantities remains the same irrespective of their actual measures (Lamon, 1993)

- Pivotal role in students' mathematical development and paves the path to understanding advanced concepts in mathematics, architecture, and nursing (Cabero-Fayos et al., 2020)

- Experience difficulties distinguishing between proportional and non-proportional situations (Hilton, Hilton, Dole, & Goos, 2016) and employ additive thinking to reason between proportional quantities (Cramer, Post, & Graeber, 1993).

- Authentic contexts help students reason proportionally and contribute towards developing their own repertoire of sense-making tools, and produce creative solutions and explanations (Ben-Chaim, Fey, Fitzgerald, Benedetto, and Miller, 1998)

ADDED SUGAR

- Children and adolescents frequently eat out and drink an overwhelming number of soft drinks, thus exceeding the recommended target energy level derived from fat and added sugar (Story and French, 2004).

42% to 92%

1977-1978

1999-2004

- Obesity, type-2 diabetes, elevated blood pressure, heart, and other chronic diseases (Bray & Popkin, 2014)

- Partnership between mathematics education and public health (James and Adams, 1998; Hyman, 2008).

THEORETICAL FRAMEWORK

Realistic Mathematics Education (RME): Domain-specific instruction theory for mathematics" (Van den Heuvel-Panhuizen, & Drijvers, 2014); advocates connecting learners' mathematical learning with their daily life experiences and knowledge.
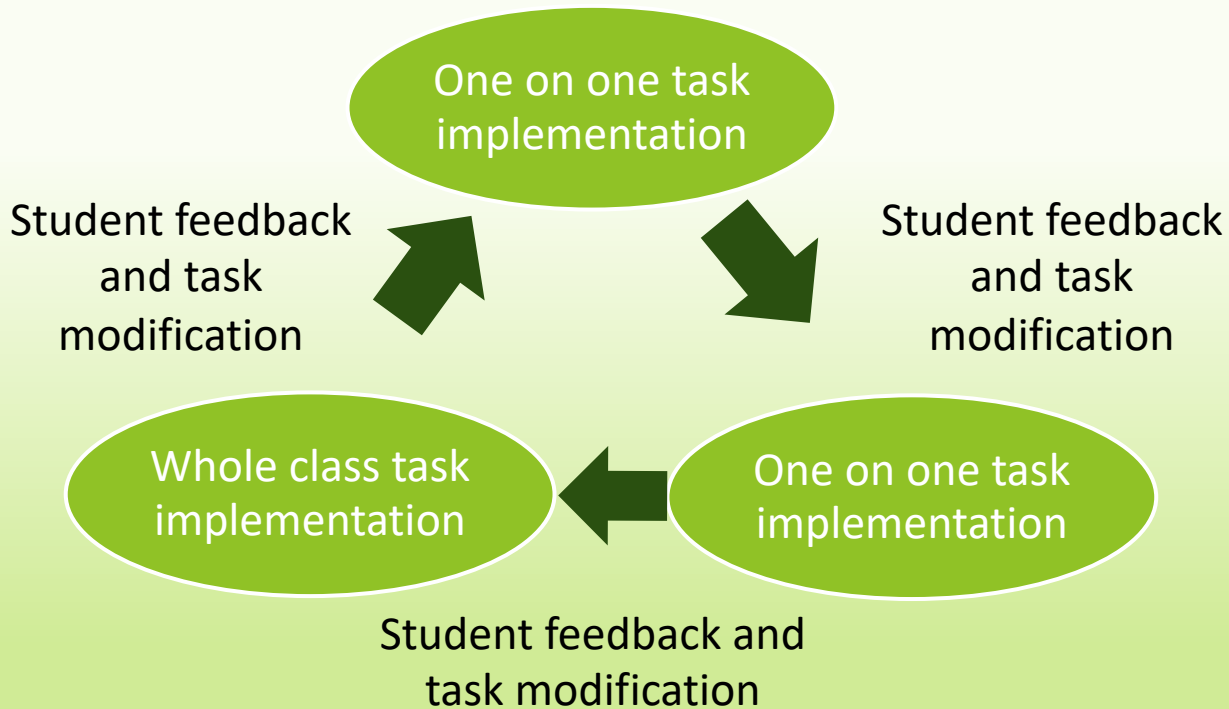
Students construct their mathematical knowledge through active exploration of authentic problem situations, then that would prepare them to communicate mathematically and make connections with each other and the real world (Freudenthal, 1991).

PARTICIPANTS AND SETTINGS

One middle school student Lenny
Midwest region of the United States
Zoom

Password protected

One on one task implementation

Student feedback and task modification

Student feedback and task modification

Whole class task implementation

One on one task implementation

Student feedback and task modification

TASK DESIGN

A packet of Oreo cookies,
A can of Coke,
A 40 oz container of Chobani Greek yogurt, and
A 15.3 oz box of Kellogg's Honey smacks breakfast cereals

Count of Added Sugar

Name of the student: _____

According to the American Heart Association (AHA), the maximum amount of added sugars we can eat in a day are as follows:

Men: 9 teaspoons
Women: 6 teaspoons, where 1 teaspoon = 4 grams of sugar.

Name of food product	Number of servings	Amount of sugar (in grams)/ serving	Number of teaspoons of sugar/ serving	Total teaspoons of sugar in the packet	Percentage of Daily Limit of sugar.

TASK DESIGN FRAMEWORK

Proportional reasoning frameworks

Lamon (1993) → Stretcher and shrinker activities
Cramer and Post (1993) → Missing value problems

RESULTS (REASONING BETWEEN PROPORTIONAL QUANTITIES)

<u>TASK 1</u>

First, we know that one teaspoon is equal to 4 grams, and we need to figure out, the 17 grams is how many teaspoons... So, basically, what I did was, um, I just said one by x is equal to four over 17 ($\frac{1}{x} = \frac{4}{17}$) and cross multiplied them. So, you get 17 over 4x, you divide four on both sides, and you get x is equal to 17 over 4 (x = $\frac{17}{4}$).

It's a comparison. So, on the top, we got what we were given. Um, so one teaspoon of one to four grams, but in the bottom, as a denominator, we're trying to see, we were trying to solve for it

<u>TASK 2</u>

Oreo: There are 10 servings per container. (One) serving is two cookies. So, 10 times two is 20 (cookies)..., so two over 20 is equal to 4.25 over x ($\frac{2}{20} = \frac{4.25}{x}$). Um, we could multiply it, but we could simplify it here. So, there's one. So, it's two over 20 (2/20). So, there's one in 10 (1/10). And we could say that x is .. the number of teaspoons in the total would be 10 times 4.25.

Chobani Greek yogurt: Because we found a one for one serving, and now we're just trying to find it for four servings because that's how many servings there are in a package. So, it's just one serving plus one serving plus one serving plus one serving is equal to the total cup. So, another way to put that is just, um, the 3.5 times four

TASK 3

The total teaspoons count in one Coke is 9.75. And for men it's, um, nine teaspoons. So, you would have to drink less than one bottle, less than one Coke.

RESULTS (DEVELOPING AWARENESS ABOUT FOOD QUALITY)

I found the honey smacks to be surprising because they have the second most sugar (out of the four food products); I was really surprised about the total teaspoons of sugar in the honey smacks.

CONCLUSION

Integrating mathematical and nutritional science
Partnership between mathematics and science teachers
Making students aware of food quality and healthy life choices.

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