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MODULE(S²)

Mathematics Of Doing, Understanding, Learning and Educating for Secondary Schools

Examining Education Stereotypes and Promoting Community-Related Projects in Mathematics Teacher Education

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APLU MTE-Partnership Mathematics Teacher Education Partnership

TODOS 2021
Monday June 21, 12:30 – 1:30 p.m. PST

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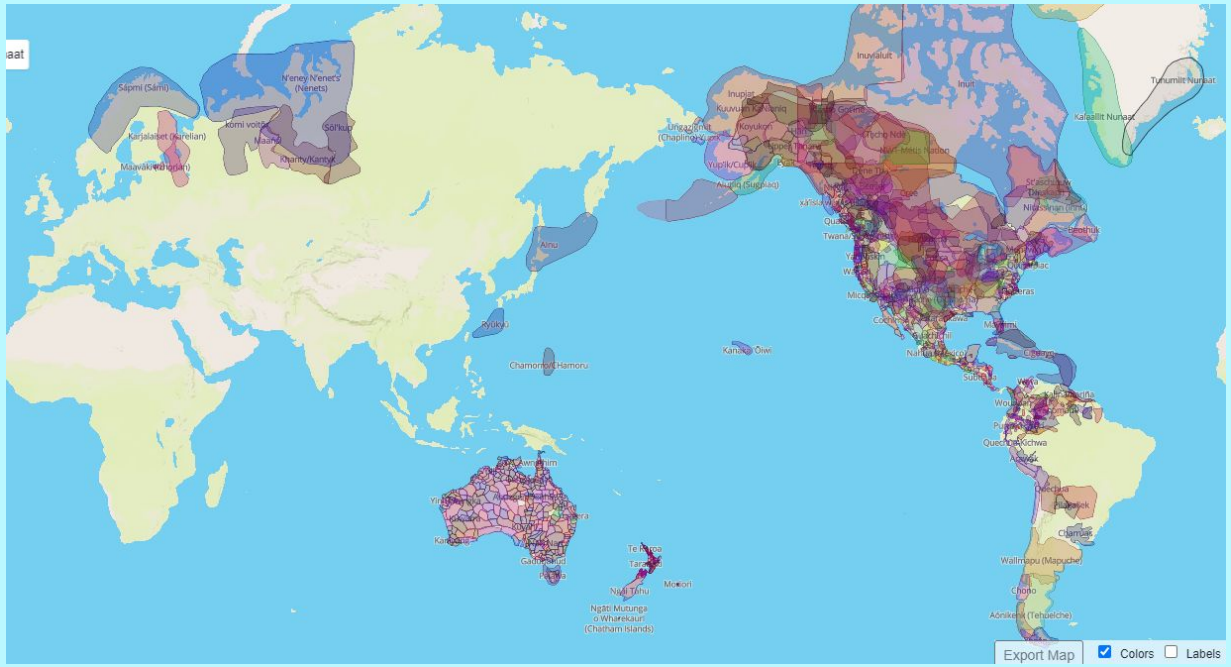
Land Acknowledgement

The campus of Eastern Michigan University is located on the traditional territory (ceded in the 1807 Treaty of Detroit) of the Anishinaabeg, which refers collectively to the Ojibwe, Odawa, and Potawatomi (also known as the People of the Three Fires), and was also home to the Wendat/Wyandot people. This acknowledgement is included here to honor the elders and stewards of these heritages.



https://native-land.ca/

Outline

- MODULE(S^2) Curriculum Development Project

- In-depth look at two activities:
  - Example 1: Americans' opinions about the importance of education, by race and income
  - Example 2: Community-based statistics projects

- Reflection/Discussion

Association of Public & Land-grant Universities

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Mathematics Of Doing, Understanding, Learning and Educating for Secondary Schools

The University of Arizona | Eastern Michigan University | Middle Tennessee State University | University of Nebraska Lincoln | Utah State University

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University Mathematics Curriculum Materials with an MKT focus

- Geometry
- Algebra
- Statistics
- Modeling

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Statistics Writing Team

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To facilitate connecting content with the practice of teaching, writing teams consist of…

STATISTICIAN: *Dr. Andrew Ross*, math/statistics/data science professor at Eastern Michigan University, background in operations research

MATHEMATICS TEACHER EDUCATOR: *Dr. Stephanie Casey,* mathematics teacher educator at Eastern Michigan University, former AP Statistics teacher, researcher in statistics education

GRADES 6-12 MATHEMATICS TEACHER: *Samantha Maddox*, math teacher at Jefferson High School in Georgia, former AP Statistics teacher

OTHER CONTRIBUTORS

Melody Wilson: graduate research assistant, former high school mathematics teacher

Statistics MODULE(S^2)

- **Statistics & Data literacy in K-12 education**: Higher need and expectations
- **Preservice Teachers**: Feel least prepared to teach statistics and demonstrate weak content understanding (Lovett & Lee, 2017; 2018)
- **Teacher Education**: Greater emphasis on learning based on practices of teaching & equity literacy (AMTE *SPTM*, 2017); very limited resources for statistics teacher education

Equity and Social Justice Strand

An animated graphic from the NY Times shows income inequality by race even after accounting for socio-economic status in childhood.

Major highlights of the equity and social justice strand:

- Module 1: Study Design and Exploratory Data Analysis
  - School district funding inequalities in Pennsylvania with possible explanatory variables, including income and race
  - Air pollution in a low-income neighborhood, working to change the laws
  - Tracking: Racial demographics of U.S. high school mathematics and science courses

- Module 2: Statistical Inference (hypothesis tests & confidence intervals)
  - Study of effects of class size on student learning (we see later that class sizes often differ according to race)
  - Teachers' perceptions of families' beliefs in and support of education

- Module 3: Statistical Association (Regression & 2-way tables)
  - Association of car insurance prices and racial composition by zip code
  - Americans' opinions about the importance of education, by race and income

In-Depth Look at Two Activities

- Example 1: Americans' opinions about the importance of education, by race and income
- Example 2: Community-based statistics projects

Example 1: Activity Launch

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- We describe the 2016 US General Social Survey (GSS), and give our pre-service teachers a data extract (n=1134) with demographic variables:
  - Sex, Degree, SpouseDegree, Race, Personal Income, Family Income
- And respondents' opinions on, among other things,
  - How interested are you in local school issues? (very, moderately, or not at all)
  - Is the nation's spending on improving the education system too much, too little, or just right?
  - How much confidence do you have in the leaders of our education institutions? (a great deal, only some, hardly any)
- We ask our pre-service teachers "What interesting statistical questions could you use this data to investigate?", then small groups agree on a question and investigate it using CODAP to explore the data.

Activity Focusing

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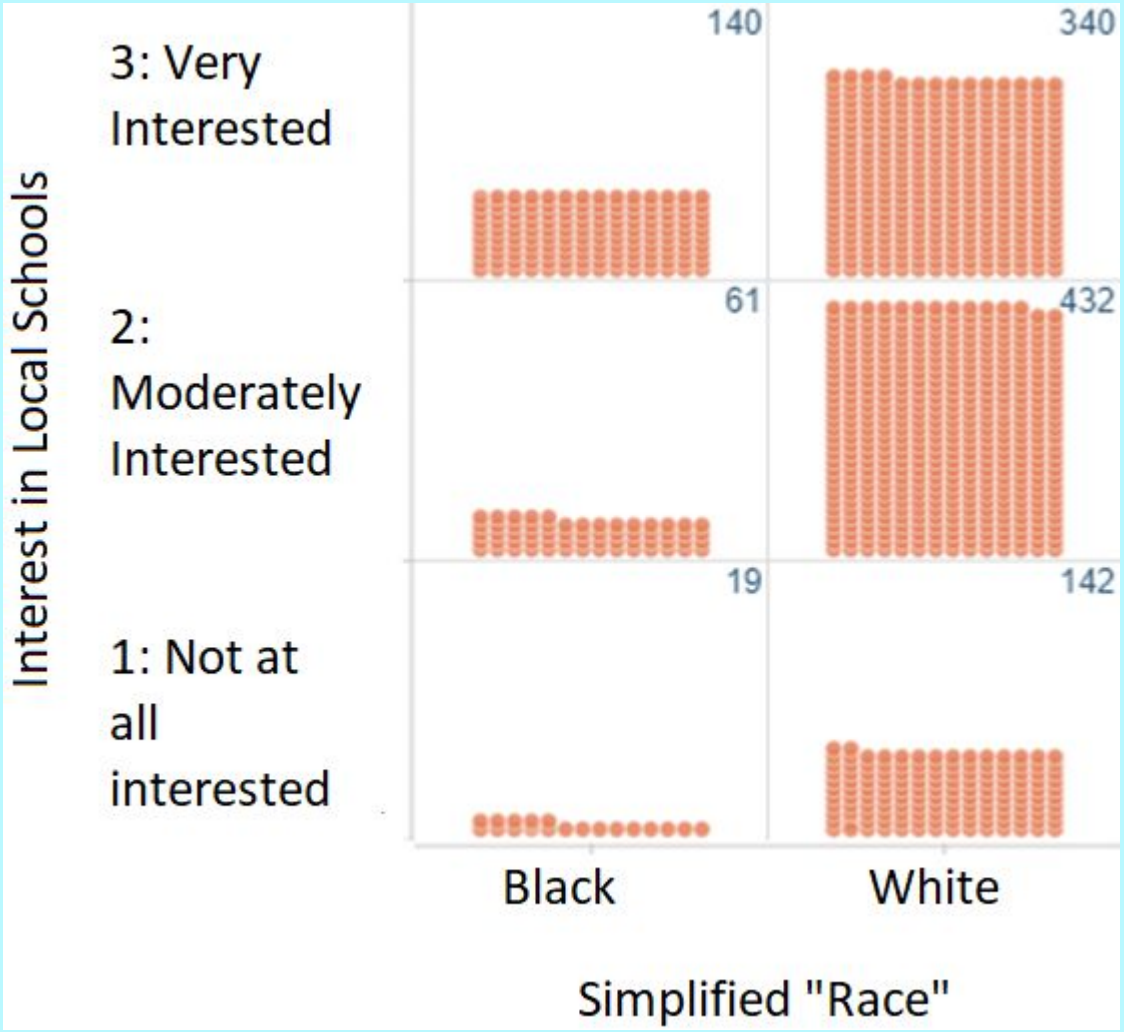
- As a class, let's explore a common stereotype that is related to education in our country: that Black families value their children's education less than White families do.

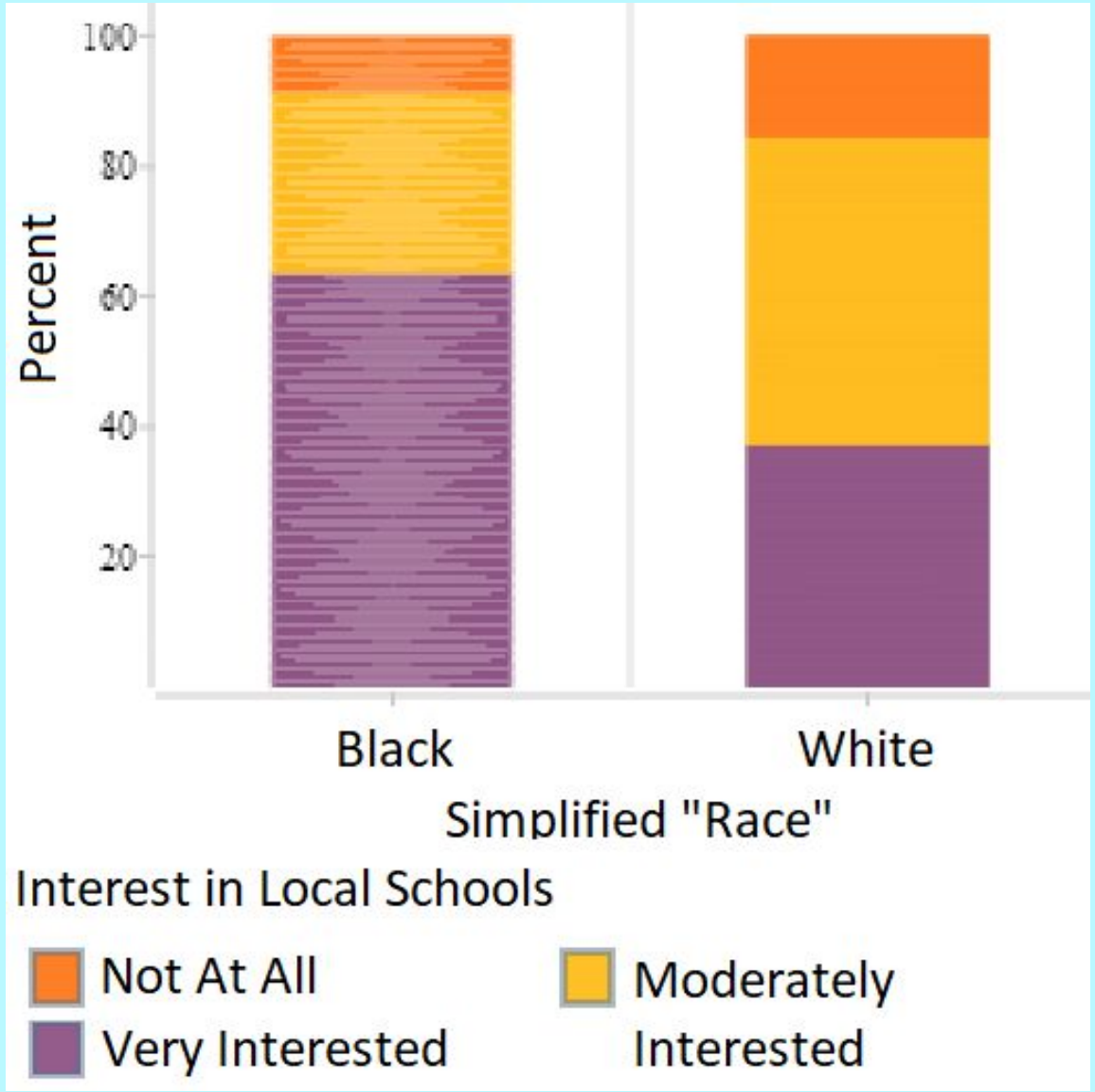
- We ask our PSTs: What does the data set tell you about this idea? Make a graph of the relevant variables. Sketch the graph you made here, and answer: what do you notice?

First likely graph



- ***Big Question 1***: If a student said "In this graph, 340 White people and 140 Black people are 'very interested' in local school issues, and those numbers aren't the same, so how much they care about local school issues is different.", how would you respond, as their teacher?

Segmented Bar Graph



- We tell PSTs: Two variables are <u>associated</u> if knowing one of them gives you information about how the other one behaves.
- We ask our PSTs: “Would you say that there is association between the two variables here? Explain.”
- Later, we say: update your list of what is/isn’t influencing racial gaps in income, etc.

Learning Outcomes

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Module 3 (Statistical Association)
Activity 10: Introduction to Categorical Association

Pre-service teachers will be able to:

- *Summarize categorical case data into a two-way table and a segmented bar chart, using CODAP*
- *Interpret two-way frequency tables*
- *Use conditional relative frequencies to describe whether two categorical variables are possibly associated*

- *Consider a common (US) racial stereotype in light of actual data.*

Example 2: Community-based statistics projects

Gutstein, E. (2007). Connecting community, critical, and classical knowledge in teaching mathematics for social justice. *The Montana Mathematics Enthusiast*, *1*(1), 109–118.

“Counting Trucks”

Using Student-Led Projects in the Classroom

Philadelphia
Grocery Stores

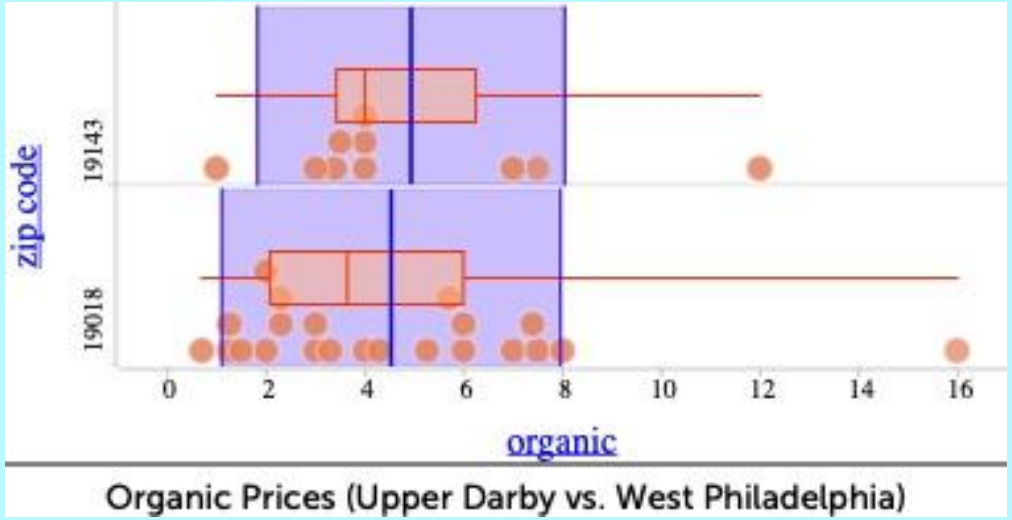
West
Philadelphia

Upper
Darby

Schwartz, Katrina (2015) Relevant Math For Students' Lives: Creating Context With Social Justice Issues.
https://www.kqed.org/mindshift/39169/relevant-math-for-student-lives- creating-context-with-social-justice-issues

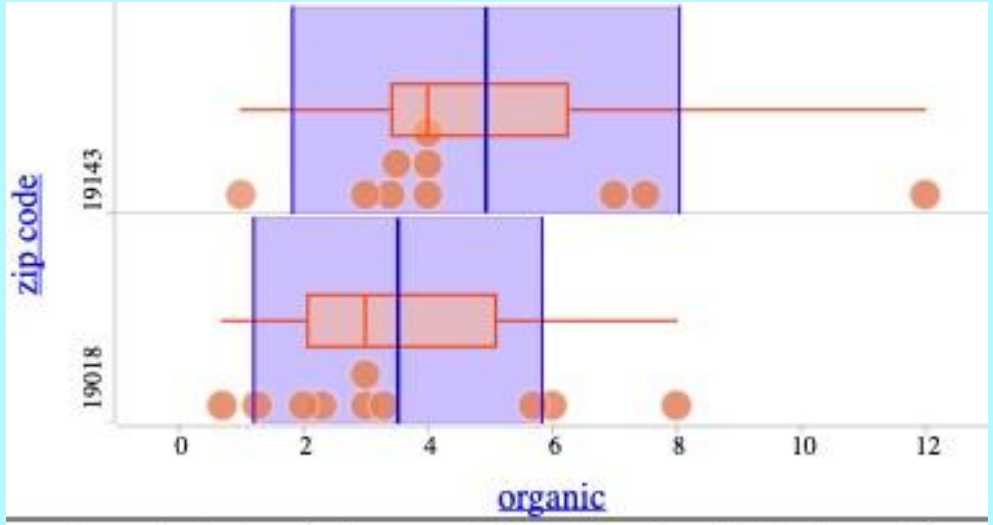
Connecting projects to “classical” knowledge

- mean
- standard deviation
- box plots
- histograms

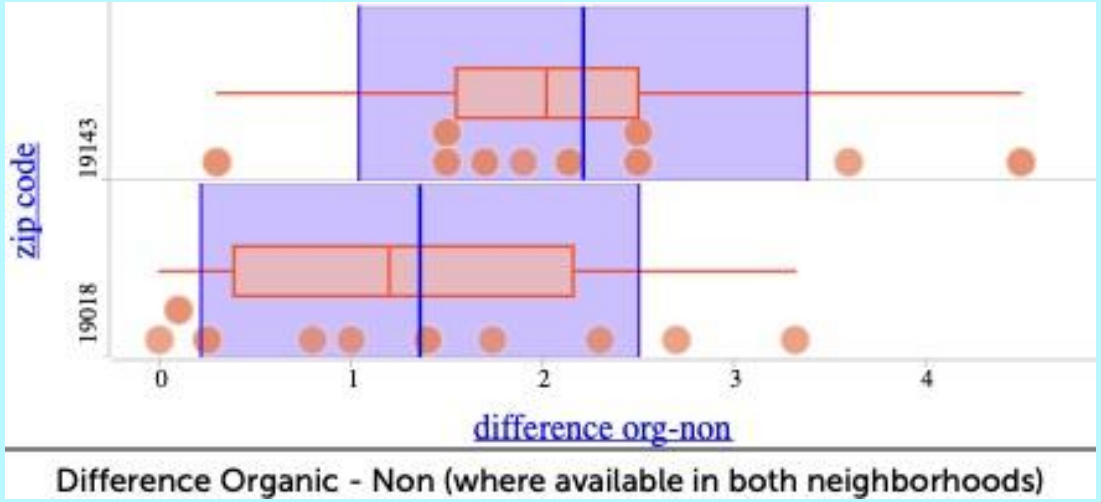


Organic Prices (Upper Darby vs. West Philadelphia)

Organic Food Availability (Upper Darby vs. West Phila.)



Organic Prices (where available in both neighborhoods)



Difference Organic - Non (where available in both neighborhoods)

What do you think?

Question 10-b Referring to the pre-reading for this lesson, “Gutstein’s Three C’s Framework,” imagine what community knowledge might have inspired teachers and/or students to propose this project.

Question 10-c Suppose that students at this school were joking about the unhealthy eating habits in their community. But, instead of asking critical questions about this situation, they were blaming it solely on poor choices of the residents. What question(s) could you ask them in order to push them toward critical knowledge of the situation?

Question 10-d What change-oriented actions could the students take based on this project?

Going further with preservice teachers

Question 10-g What issues do you think your future students would be interested in working on, based on the local community they live in? Try to think both of within-school issues and outside-of-school issues. Feel free to make a guess as to where you'll be teaching if you don't know yet.

[though, we also emphasize to the PSTs that they should have their students come up with ideas!]

Hear from preservice teachers who have used our materials

What did you learn about equity and social justice as a result of this course?

I learned that we live in a society that struggles with equity and social justice on a daily basis and how prevalent it is.

I learned about how people's background and socioeconomic status impact their ability to be successful in the world. There are many inequities in education and learning about them allows citizens and educators alike to work against these injustices.

What was most helpful about this course for learning ways to include equity and social justice topics in teaching?

We looked at race and poverty and how those play into our school system and it was helpful to learn about the misconceptions that people hold and look at the data to find out the truth and think about the real causes and how we can address these things as teachers so all of our students are getting a fair and equal education.

Including topics about equity and social justice can engage and encourage students to look into the topics that interest them and that they do have something to contribute to these ideas.

Reflection/discussion questions:

A) What are barriers to using statistics teacher education materials that focus on equity and social justice (like these) and what are possible ways to overcome them?

B) What actions would you like to take as a result of attending this presentation? Let's share ideas.

C) What other topics could we include in our materials, using data to address issues of equity and social justice, either in education or in society at large? Email us your ideas!

Interested in more information?

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- Project website: www.Modules2.com

  Materials broadly available Spring/Summer 2022

- Interested in adopting the materials? We will have some professional-development supports available!

- Please tell your colleagues!
- Contact us: scasey1@emich.edu andrew.ross@emich.edu melody@umich.edu

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https://bit.ly/3goyzgK

We encourage you to tag others and tweet highlights from the conference using #TODOS2021