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Comment on "Double Your Variance, Dirtify Your Bayes, Devour Your Pufferfish, and Draw your Kidstogram" by Xiao-Li Meng☆

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Having devoted my 40+ career to statistics education, this article is not presenting radical proposals but spot on proposals as to what practices we need to emphasize in developing statistical literacy for all students and for practitioners, as they make sense of data. As teachers of statistical and data science topics, I firmly believe we should focus first not on formulas, procedures, and underlying mathematics but conceptual understanding, the contextual understanding of data telling us a story, the role of variability, and the importance of continual questioning. We must always have the statistical problem-solving process (formulate statistical investigative questions, collect/consider data, analyze data, and interpret results) as the big umbrella and pose statistical questions during the different stages of the process. (Arnold and Franklin, 2021 [1]) Traditionally, our statistics courses have placed emphasis on the third component, analyze data, and the underlying mathematical principles. But as this paper brings out, we should consider finding methods for students not to become blogged down with the mathematics (I love the Car-Talk Bayes Theorem) but instead focus on the other components the statistical problem-solving process, such as interrogating the data used to answer a statistical investigative question; i.e., focusing on quality control issues.

My passion for much of my career has been advocating statistics standards at the school level and researching student learning. As I read section 5, Kidstogram: Let's Plant Some Random Seeds, I felt the introduction could not be written more exquisitely – every state superintendent and department of education should read this section as they revise their state mathematics standards. As the American Statistical Association (ASA) and National Council of Teachers of Mathematics (NCTM) GAISE II document (Bargagliotti et al., 2020 [2], p. 8) states, "It is critical that statisticians – or anyone who uses data – be more than just data crunchers. They should be data problem solvers who interrogate the data and utilize questioning throughout the statistical problem-solving process to make decisions with confidence, understanding that the art of communication with data is essential". The GAISE II document makes recommendations for students to begin reasoning statistically at the elementary school level.

The checklist in section 4 is excellent – a checklist that all consumers and practitioners of statistical studies and analysis should always consider. As I read this checklist and the entire paper, I am reminded of the eight mathematical practices emphasized at the school level that are essential processes as mathematical and statistical content is acquired and used by students. These practices include: making sense of problems and persevere in solving them, reasoning abstractly and quantitatively, constructing viable arguments and critiquing the reasoning of others, modeling with mathematics, using appropriate tools strategically, attending to precision, looking for and making use of structure, looking for and expressing regularity in repeated reasoning. Descriptions of these eight practices through a statistical lens are provided in the ASA Statistical Education of Teachers (SET) document, (Franklin, 2015 [3]). These practices can be thought of as "habits of mind."

Statistical literacy for all should be our ultimate goal. (Tarran, 2021 [4]) For this to happen, as supported in this paper, we must start at the elementary level of education and allow students to evolve in their statistical thinking throughout life. However, there are challenges we must overcome. The following questions are a few this article leads us to reflect upon. How do we make this happen? How do we change the culture in K-12 education where statistics and data science content is a priority, instead of content that is considered the last 2 weeks of the school? How can post secondary schools become advocates for statistics and data science literacy as necessary for college admission? And then what are structures that can support our school level teachers to teach in the spirit of the statistical problem-solving process using probabilistic thinking, not deterministic thinking?

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