

Statistical Literacy CoRD

Abstract: These activities encourage active learning of statistics through exploration of non-routine problems. By actively learning topics such as sampling, bias, sample means, sampling variability, sampling distributions, and confidence intervals, students engage directly with the core concepts of statistical literacy. This hands-on approach brings awareness to various data-driven statistics that students encounter in their everyday lives. Not only will students be prompted to analyze and reflect upon various interpretations of data to determine their validity, but they will also collect and analyze their own data. Afterwards, they will reflect on the meaning of their results, hence enhancing their statistical literacy.

Note: The data for Activities 3, 4, and 5 is collected in Activity 2.

MIP Components of Inquiry

This CoRD contains classroom activities that equip college students with the mathematical skills and understanding required to interpret statistical data effectively, thereby enhancing their statistical literacy. These activities align with the Mathematical Inquiry Project (MIP) criteria, emphasizing active learning, meaningful applications, and the cultivation of academic success skills.

Active Learning: This CoRD's activities actively engage students in learning mathematical statistics through the exploration of non-routine problems. By actively learning about topics such as sampling, sampling error, bias, sample means, sampling variability, sampling distributions, and confidence intervals, students will engage directly with the core concepts of statistical literacy. This hands-on approach will bring awareness to various data-driven statistics that students encounter in their everyday lives. Not only will students be prompted to analyze and reflect upon various interpretations of data to determine its validity, but they will also collect and analyze their own data. Afterwards, they will reflect on their results and determine the appropriate conditions necessary for a conclusion, hence enhancing their statistical literacy. These reflections will encourage students to think critically as they encounter statistical data throughout their lives, which allows them to become more informed citizens.

More specifically, as students proceed through the activities in the CoRD, they will be actively learning in a variety of ways. They begin by exploring real-world scenarios in which they will select pertinent information, use their critical thinking skills to analyze the information given and evaluate the validity of the data and claims that are presented. During this process, students will be introduced to how bias and an inappropriate sample selection can influence the results of research and be used to promote self-serving false claims.

Students will collect their own data early in the CoRD and perform statistical analyses of their data in various ways as they proceed through the activities. For example, they will evaluate the sample mean, sample deviation, as well as confidence intervals. Various

sample sizes will be used, and students will focus on technology for computations such as the sample mean, sample standard deviation, and confidence intervals. In performing the calculations, students will need to select the correct input, perform the calculation by hand or via technology, and evaluate their actions via reflections with leading questions.

Meaningful Applications: Our activities will emphasize meaningful applications of mathematical statistics to enhance statistical literacy.

One such method of achieving this goal is through student exploration of the sampling process. Understanding the basics of sampling and recognizing potential biases are crucial skills for all students, enabling them to approach research with a skeptical and questioning mindset. Students will have the opportunity to conduct this type of exploration as they collect their own data and determine potential biases that occurred.

Interpreting data also plays a pivotal role in statistical literacy. Students must develop the ability to extract meaningful insights from data, a skill essential for navigating today's data-rich environment. In this CoRD, students will be given multiple scenarios of poorly conducted studies where they determine and justify whether the claims in these studies are truly valid.

Throughout the CoRD, students are asked to claim and justify how the sample size impacts variability in statistics such as the sample mean and sample standard deviation. Students will also make observations regarding the impact of the confidence level on the width of the confidence interval, as well as the impact on the width of the confidence interval as the sample size increases.

The following are some additional ways students will be exposed to meaningful applications. As students explore examples of statistics, they will encounter statistics in different contexts (e.g. articles, advertisements, and packaging). Students will also be introduced to the word "variable" in a statistical setting. They will learn that a statistical variable measures a characteristic that changes from one unit to the next, whereas an algebraic variable is a letter or symbol that denotes a quantity that may change within a problem. An important takeaway is that a statistical variable is not necessarily a number. Lastly, students will be able to generalize the concept of "midpoint" when they determine where a sample mean lies within a confidence interval.

Academic Success Skills: Our activities will foster students' construction of their identities as learners by engaging them in "real-world" problems. In fact, the concluding activity (Activity 6), allows students to revisit the concepts they studied throughout the CoRD such as sampling error, margin of error, and bias as they consider a news article.

Technology is used throughout the CoRD to streamline computations and help students visualize concepts such as exactly what a confidence interval calculates. This use of technology allows students to focus on grasping the underlying concepts as opposed to the computations. This approach not only promotes the development of academic

success skills, such as technological proficiency but also facilitates a deeper understanding of statistical analysis.

Critical thinking is an important skill for students to have and such thinking is encouraged throughout the activities by the questions the students are asked to consider. For example, students are asked if they think that a simple random sample is possible in all scenarios. Also, after they collect their data, they are asked if a particular source is “better” than the other and why. Another theme that can be found throughout the CoRD requires students to consider the impact of the sample size on the variability in the statistics.

By engaging students in real-world scenarios and empowering them to construct their identities as confident, capable learners, we aim to foster a more meaningful learning experience that they can reference throughout their lives.