

# INCLUSIVE STATISTICS EDUCATION WITH DIGITAL RESOURCES

SPECIAL ISSUE OF THE STATISTICS EDUCATION RESEARCH JOURNAL (SERJ)

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The International Conference on Teaching Statistics (ICOTS) provides an opportunity for diverse communities to come together with a common goal of improving the learning and teaching of statistics. Statistics educators, statisticians, teachers, and educators at large contribute to the scientific programme of ICOTS. The most recent ICOTS conference—the 11<sup>th</sup> International Conference on Teaching Statistics (ICOTS-11)—was held in a hybrid format from 11–16 September 2022 in Rosario, Argentina and addressed 14 topics. (See <https://icots.info/11/?topics> for more information.)

During ICOTS-11, several themes were “hot topics” that generated considerable conversation, particularly in light of COVID-19. Having just gone through a pandemic, many of us as educators were familiar with having to go online to teach and conduct research. Discussions were held around how inclusive this experience was, both for students and teachers, and to what extent digital resources were a true facilitator of teaching and learning for all students. The current statistics education landscape, together with the emergence of new areas such as data science, demands that we reflect deeply on changes that might disadvantage particular groups of students.

For this Special Issue we were interested in scholarly articles addressing the aspects of inclusion and digital resources in statistics education. We interpreted the topic of inclusion in a broad sense for this issue. With the expansion of and shift to inclusion in recent years, individually different interests, learning opportunities, attitudes, and cultural backgrounds of learners are gaining increased attention in the design of instruction, particularly since the ratification of the United Nations Convention on the Rights of Persons with Disabilities.<sup>1</sup> Inclusion and inclusive practices in school aim to ensure that all learners, regardless of their individual competencies, are recognized in the classroom and that adequate and individual accommodations and adaptations are made for their personal needs and special characteristics as needed so that they can participate in the classroom both professionally and socially. We believe that digital resources are one way that schools and instructors can address inclusion.

This Special Issue is unique in that it presents a large variety of different fields in the inclusive statistics education landscape using digital resources. The contributions include studies involving broad age ranges for groups of learners and participants (ages 9–65), multiple methods (lesson study, documentary review, Anthropological Theory of the Didactic, cluster analysis, etc.), different digital resources (CODAP, lesson videos, etc.), and different contexts (STEM, non-STEM, etc.) that consider curriculum issues, interrogate new developments, and discuss the state-of-the-art and future trends that could inspire ideas for teaching, learning, and research in the inclusive statistics education landscape involving digital resources. The eight contributions of this *SERJ* Special Issue on inclusive statistics

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<sup>1</sup> [https://treaties.un.org/doc/Publication/CTC/Ch\\_IV\\_15.pdf](https://treaties.un.org/doc/Publication/CTC/Ch_IV_15.pdf)

education with digital resources can be grouped as follows: (a) contributions that attend to students with individual (or multiple individual) differences to consider how those differences might influence student learning or perceptions (Berginski et al.; Leavy et al.; Levy et al.; Thatte et al.) (b) contributions that attend to instruction that addresses students' differences or promote inclusive education (Ferreira et al.; Khalemsky et al.) and (c) contributions that attend to the preparation of teachers for inclusive teaching practices (Ailton et al.; Verbisck et al.). The contributions are briefly summarized in the following paragraphs.

Berginski and colleagues addressed inclusive statistics education with digital resources by adopting a blended learning format for elementary statistics courses, using videos to present lecture content. These barrier-free videos included captions, audio descriptions, German Sign Language (DGS), and transcripts. The authors provided initial empirical evidence on the importance of using German Sign Language (DGS). Qualitative and quantitative data from 10 deaf participants showed improved perception from teaching materials with DGS compared to those with captions. This study highlights the value of including sign language in teaching materials to make them fully accessible for deaf students.

Leavy and colleagues reported on a study with sixth-grade emerging bilingual learners involving a five-lesson STEM unit focused on statistical literacy using data on honeybee studies and innovative technologies for data collection and visualization. Their lesson study targeted concepts like distribution, center, variability, data comparison, and informal inference. Their paper highlighted data comparison lessons, demonstrating digital technologies' role in making statistics relevant to societal issues and enhancing students' statistical agency. This study also showed that statistical understanding was boosted by inclusive pedagogies, universal design principles, and data analysis tools.

Levy et al.'s study places Attention Deficit Hyperactive Disorder (ADHD) in the spotlight. Apart from demographic information and an indicator of students' academic achievement, two self-reported instruments were used, namely the Self-Efficacy Scale for Academic Performance and the Statistical Anxiety Rating Scale (STARS). ADHD has been shown to affect learning and performance, and the authors examined how ADHD impacted statistics test results. They ultimately found a significant indirect link between ADHD diagnosis and final grades. ADHD was also associated with lower self-efficacy, leading to negative attitudes toward statistics and poorer grades.

Thatte, Nimkar, and Makar investigated how language, culture, and conceptions of uncertainty can influence how students respond to statistical investigations. This exploratory study examined how two groups of children (ages 9–12) with different home dialects used expressions of uncertainty in the standard school dialect, focusing on the Marathi word for “about.” One group of children attended a government school with a different home dialect, while the other attended an elite private school speaking the standard dialect at home. Thatte et al. found that neither group spontaneously used “about” when describing data, even when prompted. However, the private school group adopted the term more readily. These findings highlight the influence of language on learning statistics in a non-Western context.

Ferreira et al. examined how intersectionality appears in statistical education tasks for Brazilian schools. Using intersectionality as an analytical tool, their study specifically explored the complexities of social injustices through power dynamics. Documentary analysis was employed by the authors of this study to focus on tasks chosen based on perceived intersectional categories in pedagogical proposals. The discussion of this submission encourages teachers to use statistical tasks to help students understand concepts of inequity and social injustice.

The paper by Khalemsky and colleagues presents inclusive instruction methods for multi-stage practical projects in non-STEM statistics and data mining courses at an academic college in Israel. The diverse student population included various cultural and ethnic groups and the study explored how diversity influences project topic choices, database selection, methodologies, research questions, and

result interpretation. Their findings may aid educators in developing inclusive teaching approaches in multicultural environments. Using cluster analysis, the authors identified five student groups with unique characteristics and perceptions of the learning process, highlighting the need for tailored instructional methods.

Ailton et al. have evaluated the progress of research in statistics education involving technological resources in teacher training in Brazil. For this purpose, a systematic literature review (SLR) was conducted, which included works from the National Meeting of Mathematics Education and the International Seminar on Research in Mathematics Education. This exploratory study used qualitative and quantitative approaches with descending hierarchical classification (DHC). Their findings highlight ongoing challenges in integrating technology into classrooms, including the need for public policies to ensure infrastructure and proper teacher training are provided.

Based on the Anthropological Theory of the Didactic, Verbisck and colleagues designed and implemented a study and research path for teacher education (SRP-TE) to promote inclusive statistics education. The study began with a newspaper report on water scarcity in Brazil, questioning the supporting data with a focus on a teacher from a disadvantaged rural school in Northeast Brazil. The course enabled the teacher to conduct an inquiry activity with her sixth-grade students, utilizing digital tools for data visualization and graphing. This case study highlights how SRP-TE supports professional development and inclusive statistics teaching.

All eight contributions differ in terms of the perspectives from which they consider both inclusion and the learners' needs when contemplating the implementation of inclusive statistics education practices using digital resources. Of course, this *SERJ* Special Issue is only a small step towards realizing inclusive statistics education with digital resources. Further, deeper, and broader research is required to understand the potential benefits and challenges that may arise as a result of truly realizing inclusive statistics education practices using digital resources. We wish you a pleasant journey when reading this Special Issue.

## **ACKNOWLEDGEMENTS**

During the process of editing this Special Issue, many people have supported us greatly. We are extremely grateful to Tina Marcroft, who supported us tremendously as the temporary *SERJ* Assistant editor by improving the formatting and language of papers from non-native authors with her very helpful, constructive, and intensive feedback. Noleine Fitzallen, the outgoing *SERJ* Assistant Editor, provided initial assistance with the contributions of this Special Issue—thank you, Noleine, for your help and support! We are also very grateful to Anna Fergusson, the incoming *SERJ* Assistant Editor — Technology, who has supported and helped us in the production of this Special Issue. We thank all reviewers for their support in writing constructive and helpful reviews to improve the quality and writing of the papers in this Special Issue. Last, but not least, we are very grateful to all authors who have contributed to this unique Special Issue – without them, this Special Issue would have not been possible.