Universität Münster

IASE Satellite Conference

Statistics and Data Science Education in STEAM

30.09. - 02.10.2025

Fürstenberghaus
Münster, Germany

International Association for Statistical Eduction

Impressum

Organizer:
University of Münster
Institute of Fundamental and Inclusive Mathematics Education ("GIMB")
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INTERNATIONAL ASSOCIATION
FOR STATISTICAL EDUCTION

Dear colleagues,

A very warm welcome to the University of Münster and to the 14th IASE Satellite Conference on Statistics and Data Science Education in STEAM.

Here at the University of Münster, a long tradition meets an equally strong commitment to innovation and international exchange. In this spirit, we come together to explore perspectives on statistics and data science education in STEAM.

Data are everywhere—they shape the challenges and opportunities we face today. Helping learners navigate uncertainty, interpret data and visualizations, and work responsibly with digital tools is no longer optional—it is essential in all STEAM disciplines.

This conference offers a unique forum to share approaches to how statistics and data science can enrich teaching and learning, from primary classrooms to higher education and professional development—with a particular focus on STEAM contexts.

We are delighted that colleagues from many countries and disciplines have joined us. We hope the program offers both inspiration and space for exchange, encourages new collaborations, and strengthens our shared commitment to preparing learners for a world increasingly shaped by data.

On behalf of the Local Organizing Committee, I wish you stimulating sessions, fruitful conversations, and a wonderful stay in Münster.

INTERNATIONAL ASSOCIATION
FOR STATISTICAL EDUCTION

TABLE OF CONTENT

Local Organizing Committee

- Daniel Frischemeier (Münster, Germany) – Chair
- Lisa Birk (Münster, Germany) – Co-Chair
- Gerrit Loth (Münster, Germany) – Co-Chair
- Simeon Schwob (Münster, Germany) – Information Manager
- Verena Witte (Münster, Germany)
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- Ayse Bilgin (past IASE president) (Australia)
- Alejandra Sorto (past IASE president) (USA)
- Bruno de Sousa (IASE president) (Portugal)

General Conference Information

Information and Updates

At the reception desk in the foyer of the Fürstenberghaus, you can obtain up-to-date information about the program and in case of cancelled talks. In addition, current information will also be displayed in the foyer on a projection screen.

WiFi

The eduroam network is available in the Fürstenberghaus (conference venue). If you also have access to eduroam at your home institution, you should be able to use this network without any problems. However, you may need to check your eduroam configuration again.
Otherwise, the University of Münster offers a free network, "GuestOnCampus" (1GB), that you can connect to from all university buildings.

Certificate of Attendance

You will receive your certificate of attendance as part of your registration.

Conference Proceedings

As in previous years, there will also be conference proceedings for the IASE 2025 Satellite Conference. All participants will be informed when the proceedings are available digitally after the conference. However, through this brochure, you can already view all contributions and their abstracts, and access the papers via a provided link.

First Aid and Emergency Information

On each floor of the conference building, you will find a first aid kit. In case of emergencies, please contact the Local Organizing Committee in the foyer.
To safely exit the buildings, please follow the emergency exit signs.

Local Information

Climate

The conference will take place in Münster, Germany. In late September/October, the average high temperature ranges from about 14 to 19°C (approximately 57 to 66°F) with overnight lows ranging from about 8 to 11°C (approximately 46 to 52°F).
It is recommended that you check the weather before you pack, and bring some layers for cold and chilly weather. Also, be aware of rainy days as there tend to be rainy days during that season.

Electricity

Supply runs at 220–240V, 50Hz AC; sockets generally require a two-pin plug with rounded prongs. Please, check whether you will need adaptors and transformers.

Currency

1 Euro (EUR; symbol €) = 100 cents. Notes are in denominations of €500, 200, 100, 50, 20, 10 and 5. Coins are in denominations of €2 and 1, and 50, 20, 10, 5, 2 and 1 cents. Credit cards are widely accepted in most shops, petrol stations, mid- to upmarket restaurants and hotels. All major credit cards are accepted, but it is advisable to carry cash as well. Cheques are very rarely used.
In common with most other Western European languages, the meanings of points and commas are exactly inverse to the English custom; in German, a comma is used to indicate a decimal. For example, 2,99€ is two euros and 99 cents. The "€" symbol is not always used and may be placed both in front or after the price. A dot is used to "group" numbers (one dot for three digits), so "1.000.000" would be one million. So "123.456.789,01" in German is the same number as "123,456,789.01" in English speaking countries.

Weights & Measures

Germany consistently uses the metric system for all measures, including road signs (kilometers/hour) and gas (price displayed is per liter).

Local Information

Tax and Tipping

Tax is included in prices.
Unlike in some other countries, service staff are always paid by the hour (albeit not always that well). A tip is therefore mainly a matter of politeness and shows your appreciation. If you did not appreciate (e.g. slow, snippy or indifferent service), the staff will accept that you may not want to give a tip. Since the introduction of the Euro, a tip (“Trinkgeld”) of about 5-15% is customary if you were satisfied with the service. Nonetheless, service charge is already included in an item’s unit price so what you see is what you pay. Tipping in Germany is usually done by mentioning the total while paying. Therefore, if for example a waiter tells you the bill amounts to "€13.50", just state "15" and he will include a tip of €1.50.

Time

The time zone in Germany is Central European Time (Mitteleuropäische Zeit, MEZ; UTC+01:00) and Central European Summer Time (Mitteleuropäische Sommerzeit, MESZ; UTC+02:00). Daylight saving time is observed from the last Sunday in March (02:00 CET) to the last Sunday in October (03:00 CEST), so that during the conference, Central European Summer Time (UTC+02:00) applies.

Drinking water

Tap water has a good quality, is very strictly controlled and can be freely used for consumption. Exceptions have to be labelled ("Kein Trinkwasser" = not drinking water), usually found on fountains and in trains.

Information about Münster

Recommendations for leisure activities

- Aasee (lake in the city center) – *you can go for a walk around the lake or rent a pedal boat*
- Botanical garden behind the famous castle
- Visit the Town Hall – *location where the Treaty of Westphalia was signed in 1648 that ended the Thirty Years' War*
- Rent a bike in the bike capital – *there are more than twice as many bikes in Münster than there are inhabitants*

Recommendations for restaurants, coffee shops and bars

- For traditional Westphalian food *(three pricier options)*:
  - Großer Kiepenkerl and Kleiner Kiepenkerl
  - Altes Gasthaus Leve

- Cheaper restaurants and snacks:
  - Extrablatt
  - Gustav Grün
  - Aro
  - Zeit für Brot – *for the experience of a traditional German sandwich*
  - Raphael's – *great ice cream parlor*

- Coffee shops and bars:
  - 1648 – *at the top level of the Stadthaus for an amazing view over Münster*
  - Krimphove – *especially pain et gâteau for a nice slice of cake*
  - Roestbar – *great for a coffee to go*
  - Fyal – *a coffee place and bar popular among the students of Münster*
  - MarktCafé

Conference Schedule

	Monday, September 29	Tuesday, September 30	Wednesday, October 1	Thursday, October 2
8:00–8:30		Registration		
8:30–9:00		Opening Ceremony	Workshops I	Parallel Sessions V
9:00–9:30		Keynote 1 – Andee Rubin	Coffee Break	Coffee Break
9:30–10:00		Coffee Break	Parallel Sessions III	Panel Discussion
10:00–10:30		Parallel Sessions I	Netlunching	Closing Ceremony
10:30–11:00		Netlunching	Workshops II	
11:00–11:30		Parallel Sessions II	Coffee Break	
11:30–12:00		Coffee Break	Parallel Sessions IV	
12:00–12:30		Keynote 2 – Joachim Engel	*Group photo*	
12:30–13:00		Poster Session & Networking		
13:00–13:30				
13:30–14:00				
14:00–14:30				
14:30–15:00				
15:00–15:30				
15:30–16:00				
16:00–16:30				
16:30–17:00				
17:00–17:30				
17:30–18:00	Pre-Registration			
18:00–18:30				
18:30–19:00				
19:00–19:30	Welcome Reception (optional)		Conference Dinner	
19:30–20:00				
20:00–				

Introduction of the session types

Welcome Reception

On Monday, September 29, the optional Welcome Reception will take place. We welcome all participants of the IASE 2025 Satellite who have booked this event. Pre-registration starts at 5:30 PM, and the Welcome Reception begins at 6:00 PM. This relaxed, informal gathering is the perfect opportunity to meet fellow participants, get to know each other, network, and exchange ideas over snacks and drinks.

Opening Ceremony

At the Opening Ceremony, we will officially welcome all participants. There will be a few welcome addresses and brief explanations about the conference program. Afterwards, we will continue together with the first keynote. The Opening Ceremony begins at 9:00 AM. You are welcome to use the time from 8:00 AM onwards for registration.

Keynotes

There will be a total of two keynotes held. We look forward to the talks by Andee Rubin and Joachim Engel. Unfortunately, the previously announced keynote by Katie Makar cannot take place. After each keynote, there will be some time for questions. More detailed information about the keynotes can be found in the detailed schedule.

Parallel Sessions

Throughout the conference, there will be five Parallel Sessions timeslots. In each timeslot, three to four sessions will run in parallel, and each session will feature two to three presentations. The sessions are thematically clustered; however, there will be time to switch rooms within a session. Please, make sure to move quickly when changing sessions so as not to disrupt the talks. More detailed information about the Parallel Sessions can be found in the detailed schedule. Session chairs were selected from among those who also have their own contribution in the respective session. We chose this approach because these individuals will be present in the session anyway and therefore will not miss other sessions of interest to them.

INTRODUCTION OF THE SESSION TYPES

Netlunching

On Tuesday and Wednesday, 'Netlunching' sessions will be offered during lunchtime. These provide an opportunity to discuss a specific topic and network while enjoying your meal. The topics of the Netlunches can be found in the detailed schedule.

Poster Session & Networking

The Poster Session will take place on Tuesday from 5:00 PM. Various posters will be on display and can be viewed during a gallery walk. The authors will be available for questions and discussions about their posters. The Poster Session also provides an opportunity for informal exchanges and networking.

Workshops

On Wednesday, there will be two workshop slots featuring up to seven different workshops to choose from. Each workshop will run for the full 90 minutes of the slot. More information are provided in the detailed schedule.

Conference Dinner

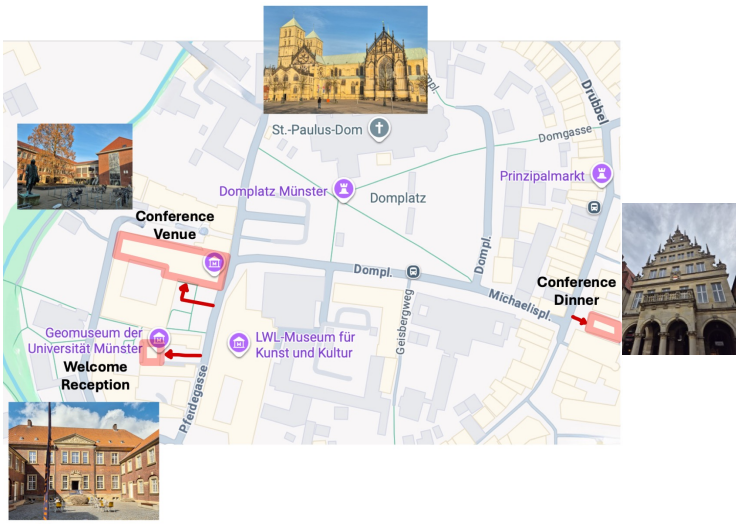
The Conference Dinner will take place on Wednesday evening at 7:30 PM at the Ratskeller Münster. In a relaxed atmosphere with good food, all participants who have booked this event can unwind and conclude the conference day.

Panel Discussion and Closing Ceremony

On Thursday, a panel discussion will take place. Experts will discuss the topic „Looking Forward: Reflecting on the Present, Envisioning the Future of Statistics and Data Science Education“, and there will be an opportunity to ask questions and contribute to the discussion. Following the panel discussion, we will conclude the conference together in the Closing Ceremony.

Conference Venue

Campus Map



An overview of the different rooms for the scientific programme of the conference will be available at the conference venue.

Technical equipment

All rooms offer an HDMI port that is connected to a projector. Please, make sure to bring adapters for your presentation.

Registration

There will be several opportunities to register: if you take part in the Welcome Reception on Monday, please register before the reception at the Geomuseum. Otherwise please register at the Fürstenberghaus (conference venue) before the start of the conference. If you arrive later, you can still register at any time in the foyer on the ground floor.

Certain rooms

The conference catering will be served on the first floor of the Fürstenberghaus, next to the room of the opening ceremony and the keynotes.
In case you need to store luggage or if you are looking for a quiet room as a family, please contact the LOC at the registration desk on the ground floor of the Fürstenberghaus (conference venue).

Detailed Schedule – Pre-conference events

Monday, September 29		
17:30 – 18:00	Pre-Registration	Geomuseum
18:00	Welcome Reception	Geomuseum

Location of the Geomuseum
Pferdegasse 3,
48143 Münster

Detailed Schedule, day 1

Tuesday, September 30		
08:00 – 09:00	Registration	Foyer ground floor
09:00 – 09:30	Opening Ceremony	F2
09:30 – 10:30	Keynote 1 – Andee Rubin	F2
10:30 – 11:00	Coffee Break	Foyer 1st floor
11:00 – 12:30	Parallel Sessions I	F029; F030; F043
12:30 – 14:00	Lunch Break & Netlunching	F4; F5
14:00 – 15:30	Parallel Sessions II	F029; F030; F042; F043
15:30 – 16:00	Coffee Break	Foyer 1st floor
16:00 – 17:00	Keynote 2 – Joachim Engel	F2
17:00 – 19:00	Poster Session & Networking	Foyer 1st floor

KEYNOTE 1

Tuesday, September 30 09:30 – 10:30

Data Are Everywhere - in Every Class and Even Outside of School

ANDEE RUBIN
(Room F2 – Soledad Estrella)

After several decades of being a statistics/data science education researcher and curriculum developer, I've developed a "data lens" on the world. I see possibilities for exploring data everywhere I look. In this talk, I will explore several contexts for engaging students with data, including high school science, middle school social studies, early childhood classrooms, and zoos. In each case, I'll describe how data and the disciplinary content or context were generally mutually supportive - but also how pedagogical dilemmas sometimes result from the attempt to merge two sets of educational goals. The descriptions will include video and transcripts of classroom interactions, demos of the technologies used and examples of student work in order to provide the kind of rich detail that reflects the complexity of learning contexts.

PARALLEL SESSIONS I

Tuesday, September 30

Time	Title	Author(s)	Session Chair	Room
11:00-11:30	Videos as formative and summative Assessment of Students' Learning in Civic Statistics	Joachim Engel	James Nicholson	F029
11:30-12:00	The Use of Digital Components in an Undergraduate Statistics Course	Florian Ertz & Ralf Münnich	James Nicholson	F029
12:00-12:30	Playful Experiential Approach to Reasoning with Evidence	Sean McCusker & James Nicholson	James Nicholson	F029
11:00-11:30	Data Collection as a Catalyst for Data Literacy: A Concept for Building Smart City Gadgets at School	Verena Witte, Angela Schwering & Daniel Frischemeier	Verena Witte	F030
11:30-12:00	Design of statistical projects at the school level, advances and challenges when engaging in the statistical problem-solving process	Francisco Javier Trejo Moreno & Eleazar Silvestre Castro	Verena Witte	F030
12:00-12:30	From supervised to unsupervised learning - structuring the core components of understanding	Katharina Bata	Verena Witte	F030
11:00-11:30	Economics versus the environment: promoting systems thinking, sustainability, and collaboration in a "commons" game	Tim Erickson & Laura Martignon	Dionysia Bakogianni	F043
11:30-12:00	Developing Statistical and Data Science Skills in Interdisciplinary Scientists	Chris Brignell	Dionysia Bakogianni	F043
12:00-12:30	DataScEd4CiEn: Integrating Data Science into STEAM Education for Civic Engagement and Social Justice – A Case from Greece	Dionysia Bakogianni & Ioannis Malafekas	Dionysia Bakogianni	F043

PARALLEL SESSIONS I

SESSION I – SESSION CHAIR JAMES NICHOLSON – ROOM F029

Videos as formative and summative Assessment of Students' Learning in Civic Statistics
Joachim Engel

Formative and summative assessments provide essential feedback to both teachers and learners, highlighting what is valued in the learning process and measuring the extent of student progress. In this study, we analyze 37 short videos created by teams of two or three students in a Civic Statistics course. Each video follows a structured script that includes: introducing a hot sociopolitical topic, describing the structure and origin of a rich dataset, presenting data visualizations and analyses leading to well-founded conclusions, and offering a critical review. The video analysis provides insights into students' abilities to analyze data using suitable graphical presentations and data moves, as well as their capacity to connect statistical findings with sociopolitical contexts.

Link to paper: https://uni-muenster.sciebo.de/s/FCCgq3tC2894DXX

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The Use of Digital Components in an Undergraduate Statistics Course
Florian Ertz & Ralf Münnich

In a research project, the Economic and Social Statistics Department of Trier University was able to get an insight into the use of screencasts and e-tutorials in an undergraduate statistics course. The empirical data show that students make ample use of the flexibility those tools offer. We also see that active exercises are very important in terms of exam preparation. The participation rates and the tenacity in working exercise problems can be improved. A natural next step would be the implementation of adaptive e-learning scenarios.

Link to paper: https://uni-muenster.sciebo.de/s/Y9gAkH2WYewEo6a

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Playful Experiential Approach to Reasoning with Evidence
Sean McCusker & James Nicholson

There has been a resurgence of interest in experiential learning in Higher Education Institutions (HEIs), driven by the employability agenda and the move to build closer links between HEIs and the outside world. Within this context, the concept of 'play' in education emerges as a form of open learning that encourages learners to define their own goals and outcomes. Whilst it is acknowledged that within statistics and data science education, learners will still need guidance and frameworks within which to engage with and interpret data, incorporating elements of play creates opportunities for deeper engagement and understanding. Here, insights from research in playful methodologies, e.g. LEGO® Serious Play® and Clowning are applied to the domain of Reasoning with Evidence. Current, mainstream materials are viewed through the lens of playfulness, and playful design principles are presented through their application to the development of a novel interface for displaying complex multivariate data.

Link to paper: https://uni-muenster.sciebo.de/s/YS42ESdwTA7gZrz

PARALLEL SESSIONS I

SESSION II – SESSION CHAIR VERENA WITTE – ROOM F030

Data Collection as a Catalyst for Data Literacy: A Concept for Building Smart City Gadgets at School

Verena Witte, Angela Schwering & Daniel Frischemeier

In a data-driven world, fostering data literacy among students is essential - yet the sub-skill of data collection remains underrepresented in educational practice. This study explores how personal data collection using environmental sensors within a 'Smart City' project influences students' ability to critically evaluate corrupted datasets. In a quasi-experimental design, 79 high school students participated in an intervention, during which they developed sensor-based Smart City projects and collected their own data. A pre- and posttest measured their ability to identify outliers in a corrupted dataset. The results indicate an improvement in the experimental group compared to a control group that worked with externally sourced data. Findings suggest that engaging with personally collected data enhances students' understanding of data quality and supports the development of critical data reasoning skills. The study underscores the educational value of authentic data practices and calls for further research into their long-term curricular integration.

Link to paper: https://uni-muenster.sciebo.de/s/TFeXTmMZNFiZ93c

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Design of statistical projects at the school level, advances and challenges when engaging in the statistical problem-solving process

Francisco Javier Trejo Moreno & Eleazar Silvestre Castro

This paper presents the results of a design-based research study aimed at fostering 8th-grade students' Statistical Thinking through contextualized investigations. Drawing on GAISE II recommendations for novice levels (A and B) and the Statistical Working Spaces framework, two statistical projects were designed using local orange production as context. Findings indicate that students made significant progress in anticipating variability, organizing data, and applying measures of central tendency and variability. Nevertheless, difficulties were observed when formulating comparative questions, understanding concepts such as sample and variable, and interpreting graphical representations like dot plots and histograms.

Link to paper: https://uni-muenster.sciebo.de/s/ygkQF26r3wY8CAR

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From supervised to unsupervised learning - structuring the core components of understanding

Katharina Bata

With the increasing public relevance of machine learning, the need for corresponding educational opportunities is also growing. While theoretical concepts for structuring learning content already exist for supervised learning, there is no comparable basis for unsupervised learning. This paper examines the extent to which the so-called model concept, a theoretical model to structure the core components of understanding of supervised learning, can be transferred to unsupervised learning. Using the example of k-means cluster analysis, it is shown that the basic structure of the model concept, the so-called facets, is largely transferable, even if individual core components of understanding need to be re-differentiated in terms of content. The results provide a theoretical basis for the development of learning objectives and teaching materials for unsupervised learning and open up further questions regarding the implementation and empirical validation of the proposed structure.

Link to paper: https://uni-muenster.sciebo.de/s/dmZW5zi3SwHfMge

Parallel Sessions I

Session III – Session Chair Dionysia Bakogianni – Room F043

Economics versus the environment: promoting systems thinking, sustainability, and collaboration in a "commons" game

Tim Erickson & Laura Martignon

We want students to grow up to be good citizens. Part of that is to care for the environment and collaborate with one another in allocating shared resources. At the same time, society often identifies success with short-term financial gain—and that often entails setting aside the common good. How can we help students navigate the balance between the ubiquitous drive for money and the need to save the planet? One strategy for this kind of education is to use simulation games in which students experience the phenomena we're concerned about rather than simply endure explanations in class. In the games we present, students use data to see how to make a profit and preserve the environment simultaneously. These games were developed as a small part of the EduS4EL project, described in Martignon et al (2025), in this volume. This paper focuses on the games themselves and on design and pedagogical considerations.

Link to paper: https://uni-muenster.sciebo.de/s/CYJoWpmsbiNJxZE

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Developing Statistical and Data Science Skills in Interdisciplinary Scientists

Chris Brignell

The University of Nottingham's Natural Sciences course is an interdisciplinary science undergraduate degree. A new module was developed to teach introductory statistics based on the recommendations and goals of the GAISE report (ASA Revision Committee, 2016) with a focus on statistical thinking, conceptual understanding, real contexts, active learning, use of technology, and assessment which drives learning. In the pilot, second year undergraduate Natural Sciences students participated, with qualitative feedback on module design and delivery collected through survey instruments. Student feedback was positive, with them acknowledging that interactive classes and computer classes were engaging ways to learn using real-world contexts and that continuous assessment added depth to their learning. This case study demonstrates the potential to teach statistics to scientists through context-relevant scenarios, ultimately enabling students to apply their knowledge to projects involving their own scientific data.

Link to paper: https://uni-muenster.sciebo.de/s/bAR7aa59LZWCiAk

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DataScEd4CiEn: Integrating Data Science into STEAM Education for Civic Engagement and Social Justice – A Case from Greece

Dionysia Bakogianni & Ioannis Malafekas

This paper explores the implementation of a data science activity within a STEAM scenario on food waste and sustainability, carried out in a Greek lower secondary school as part of the Erasmus+ project DataScEd4CiEn. The Greek case offers a unique lens due to the traditionally formal and discipline-bound structure of the national curriculum, where data literacy and interdisciplinary approaches are still emerging and not yet systematically embedded. Through an iterative design process, students engaged with real-world datasets to explore social issues and propose civic actions. The findings reveal both the emergence of key data science practices as well as the challenges involved in supporting open-ended inquiry and integrating data insights into civic messaging. The paper also highlights broader pedagogical tensions in teaching data science in schools and emphasizes the strong potential of STEAM scenarios to promote social engagement through data-driven inquiry.

Link to paper: https://uni-muenster.sciebo.de/s/gEkr5SZsos7gNLW

NETLUNCHING

Tuesday, September 30

12:35-13:15

YOUNG RESEARCHERS IN STATISTICS AND DATA SCIENCE EDUCATION

THERESA BÜCHTER & LENA JAEGER
(Room F4)

13:20-14:00

DATA SCIENCE EDUCATION RESEARCH IN LATIN AMERICA

FELIPE RUZ
(Room F5)

PARALLEL SESSIONS II

Tuesday, September 30

Time	Title	Author(s)	Session Chair	Room
14:00-14:30	Conciliating statistical and language literacy skills for the development of critical thinking and communication: students stand up for the Brazilian biomes.	Bianca Walsh, Renata Souza Bueno & Larissa de Carvalho Alves	Laura Martignon	F029
14:30-15:00	IT'S IN THE WIND: AN OPPORTUNITY FOR UNDERSTANDING EPIDEMIOLOGICAL EVIDENCE	James Nicholson & Sean McCusker	Laura Martignon	F029
15:00-15:30	Statistical Tools to Assess Environmental Risks	Laura Martignon & Jaime Martinez	Laura Martignon	F029
14:00-14:30	Effects of a simulation-based training on students conceptual understanding of the Binomial test	Karin Binder, Stephan Schnaitmann & Tim Erickson	Karin Binder	F030
14:30-15:00	Project Work for a Large class – Authentic Assessment	Ayse Aysin Bilgin, Jaslene Huan Lin & Nazli Ersahin	Karin Binder	F030
15:00-15:30	Designing and Implementing Data Lessons in Secondary Education	Emily Thrasher, Michelle Pace & Bruce Graham	Karin Binder	F030
14:00-14:30	A Deep Dive into Statistical, Data, and Digital Literacies: A Bibliometric Analysis (2000–2024)	Fernández-Pascual, Pinto, Caballero & Marín Jiménez	Leandro de Oliveira Souza	F042
14:30-15:00	Advancing Critical Data Science and Statistical Literacy for Democratic and Civic Education	Olushina Olawale Awe, Joachim Engel & Florian Weber-Stein	Leandro de Oliveira Souza	F042
15:00-15:30	Statistical Literacy in the age of disinformation	Ana Flávia Ferreira Pinho & Leandro de Oliveira Soza	Leandro de Oliveira Souza	F042
14:00-14:30	Teachers' role in promoting primary school students' integration of mathematical, statistical, and other STEAM reasoning through data-based modelling	Takashi Kawakami, Akihiko Saeki & Shohei Chiba	Lily Clements	F043
14:30-15:00	Teaching Regression Calibration to Correct for Measurement Error to Develop Statistical Thinking	Anarina L. Murillo & Avery Maytin	Lily Clements	F043
15:00-15:30	Data skills for agroecologists	Aboubacari Abdou Amadou, Lily Clements, Lucie Hazelgrove Planel & David Stern	Lily Clements	F043

PARALLEL SESSIONS II

SESSION I – SESSION CHAIR LAURA MARTIGNON – ROOM F029

Conciliating statistical and language literacy skills for the development of critical thinking and communication: students stand up for the Brazilian biomes

Bianca Walsh, Renata Souza Bueno & Larissa de Carvalho Alves

Brazil's National Curriculum determines that statistics be taught from very early education. Some of the skills expected from 12-year-old students are (i) interpreting data from media, (ii) identifying graph elements, and (iii) writing texts based on statistical data. This paper describes a project from the National School of Statistical Sciences (Ence/IBGE) to this public. Students had to use statistical data to make a public claim. They experienced a simulated Conference of the Parties, focusing on the fires that devastated Brazilian biomes in 2024, and had to fight for aid funds. School teachers and students were deeply engaged, and students had an impressive performance as they experienced criticizing disinformation, curating quality sources, organizing data in bar graphs, and finally stood up for their chosen biomes using arguments and statistical data. Articulating both literacies showed that students experiment engagement and pride in presenting compelling arguments based on contextual knowledge and statistical data.

Link to paper: https://uni-muenster.sciebo.de/s/CnRzf3sX7DyWGsZ

IT'S IN THE WIND: AN OPPORTUNITY FOR UNDERSTANDING EPIDEMIOLOGICAL EVIDENCE

James Nicholson & Sean McCusker

The government in England in 2024 initiated a wide-ranging review of curriculum and assessment across all subjects and ages. There is a broad consensus in the UK that data education should be across multiple subject areas. Ridgway (2022) sets out the rationale for Civic Statistics as an important element of the curriculum. We will review the literature on how epidemiology has been used recently in various innovative curricula. The drive for the introduction of Civic Statistics in curriculum reflects the public need to better understand information about the state of society. Epidemiology is inherently important in this context, as mis-information and dis-information about Covid-19, other diseases and vaccinations in general, has been increasingly problematic in an age where social media is the predominant source of information for many people, especially in the younger generations. Epidemiology offers a context in which the interplay between policy and evidence is immediate and transparent.

Link to paper: https://uni-muenster.sciebo.de/s/Cp62enWWSPiEnkD

Statistical Tools to Assess Environmental Risks

Laura Martignon & Jaime Martinez

Young people are increasingly aware of the climate crisis, witnessing its effects and actively engaging in discussions and actions towards sustainable behavior. The purpose of the project EduS4EL has been to foster basic competencies of youngsters for critically assessing environmental risks based on reliable data. Specific analytical skills to be developed include risk assessment, data analysis, logical reasoning, and a foundational understanding of environmental issues. This paper explores a set of technological tools designed, which may help high school students develop these skills through targeted educational interventions focused on experience based learning.

Link to paper: https://uni-muenster.sciebo.de/s/Hba793gK3MGEySF

PARALLEL SESSIONS II

SESSION II – SESSION CHAIR KARIN BINDER – ROOM F030

Effects of a simulation-based training on students conceptual understanding of the Binomial test

Karin Binder, Stephan Schnaitmann & Tim Erickson

Significance tests are used intensively in quantitative empirical research and are also taught at schools and universities. However, even experts and statistics lecturers are subject to misconceptions when interpreting significance tests. Our empirical study focuses on the binomial test, and examines the extent to which a refresher course that focuses on a simulation-based approach (using CODAP) is more conducive to learning than typical education on the binomial test that focuses on calculations. While the conceptual knowledge in the experimental group with simulations improved slightly more than in the control group, the students in the control group showed more improvement in procedural knowledge. However, the pre-test performance was weak overall and only a slight increase was observed in both groups after the 100 minutes of training in the two different refresher courses. A comprehensive development of understanding hypothesis testing is important in teaching, and the results suggest that this cannot be sufficiently improved by our short training session.

Link to paper: https://uni-muenster.sciebo.de/s/XTWGySYmaCtzcCK

Project Work for a Large class – Authentic Assessment

Ayse Aysin Bilgin, Jaslene Huan Lin & Nazli Ersahin

Improving graduate employability is increasingly essential due to evolving industry demands. Through experiencing the data investigative workflow comprising framing research questions, implementing data analysis and communicating results, students develop key employability skills such as organisational and time management skills. Large statistics classes pose challenges for fostering engagement and assessing practical skills authentically. This paper presents a scalable approach using authentic data for a project assessment that enables students to make decisions for their data investigative workflow. Examples of student work indicate that project-based assessment deepens understanding and strengthens connections between theory and professional practice. These experiences help build critical thinking and communication skills which are vital for today's job market. The paper concludes with implications for assessment design and acknowledges current limitations, offering a roadmap for educators aiming to bridge classroom learning and employability through authentic experiences.

Link to paper: https://uni-muenster.sciebo.de/s/578pz6w8k9KJE3k

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Designing and Implementing Data Lessons in Secondary Education

Emily Thrasher, Michelle Pace & Bruce Graham

This study examines how secondary teachers incorporated the six-phase Data Investigation Process (Lee et al., 2022) into classroom lessons following a professional learning experience. Analysis of 13 lesson plans, interviews, and survey responses revealed that while most lessons addressed multiple phases, few supported full engagement across all six. Framing the Problem was the most consistently attended-to phase, often grounded in authentic contexts and clear investigative questions. In contrast, Explore and Visualize was less developed, frequently limited by specific learning goals constraints. Lessons that integrated technology, especially CODAP, were more likely to support deeper student exploration and reasoning. Findings underscore the need for thoughtful instructional design.

Link to paper: https://uni-muenster.sciebo.de/s/G4Czt8A6BL4oygf

Parallel Sessions II

Session III – Session Chair Leandro de Oliveira Souza – Room F042

A Deep Dive into Statistical, Data, and Digital Literacies: A Bibliometric Analysis (2000-2024)

R. Fernández-Pascual, M. Pinto, D. Caballero & A.E. Marín Jiménez

This study aims to explore the field of statistical literacy in relation to quantitative, data, and digital literacy, highlighting their interconnected development and significance, to better understand how STEAM educators and researchers contribute to advancing these essential skills. Scientific literature indexed in Web of Science from 2000 to 2024 (n=674 articles and books) is analyzed using co-occurrence analysis in VOSviewer. Five interrelated key trends are discovered: Data Literacy, Statistical Applications for Modeling and Prediction, Statistics Education, Mathematics, and Quantitative skills, Statistical and Quantitative Literacies and Digital Literacy. The findings highlight the growing relevance of statistical, data, and digital literacy, as well as the need of an effective integration of these literacies for education, research, and professional practice in STEAM disciplines.

Link to paper: https://uni-muenster.sciebo.de/s/d2pXFFQ2gs59krL

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Advancing Critical Data Science and Statistical Literacy for Democratic and Civic Education

Olushina Olawale Awe, Joachim Engel & Florian Weber-Stein

In an increasingly data-driven world, the integration of critical data literacy and statistical reasoning into civic education has emerged as a vital component of democratic engagement. The ability to interpret, question, and ethically engage with data empowers individuals to participate meaningfully in civic life, challenge misinformation, and advocate for equitable policies. This paper examines the intersection of data literacy, statistical reasoning, and civic education, emphasizing their role in fostering informed and socially responsible citizens. Drawing from global scholarships, pedagogical innovations, and case studies, we argue that a critical approach to data education enhances democratic resilience by promoting analytical thinking, ethical awareness, and social justice. By reimagining curriculum design and instructional strategies, educators can equip learners with the competencies needed to navigate a data-saturated society, promote equity, and contribute to democratic decision-making.

Link to paper: https://uni-muenster.sciebo.de/s/9kLZrdzHpArCPQQ

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Statistical Literacy in the age of disinformation

Ana Flávia Ferreira Pinho & Leandro de Oliveira Soza

Persuasive speeches are crafted to convince the audience to adopt a particular viewpoint, support a cause, or endorse a political candidate. In the political arena, various rhetorical strategies are disseminated through the media with the aim of generating identification, appealing to emotions, and reinforcing arguments. This article reports on an investigation that analyzed how the integration of media, Mathematics, and Statistical Education could, in the classroom, foster students' critical analysis and encourage reflection on persuasive narratives. The research was conducted with seven high school students (aged 17–18) from a public school in Brazil, using participant observation techniques. To generate data, news reports from the media and the MapBiomas platform were used, focusing on information about deforestation in Brazil. The analyses were based on students' written records and audio recordings. The results highlighted how the analysis of news and statistical data can promote the development of critical awareness on issues such as deforestation, the environment, and social inequality. Furthermore, we discuss the potential of Statistics and Mathematics as tools for the education of citizens capable of interpreting information in a conscious and reflective manner.

Link to paper: https://uni-muenster.sciebo.de/s/egAeEWCYxkXrngS

PARALLEL SESSIONS II

SESSION IV – SESSION CHAIR LILY CLEMENTS – ROOM F043

Teachers' role in promoting primary school students' integration of mathematical, statistical, and other STEAM reasoning through data-based modelling

Takashi Kawakami, Akihiko Saeki & Shohei Chiba

Data-based modelling driven by interdisciplinary contexts has emerged as a means of promoting multidisciplinary reasoning in primary school students. However, teachers play a crucial role in facilitating this process. This study aims to explore teachers' role in promoting students' integration of mathematical, statistical, and other STEAM reasoning through data-based modelling. Specifically, it analyses STEAM practice of a teacher with Grade 4 students. To do this, we adopt an interdisciplinary data-driven modelling (IDDM) framework, which includes six key components: data, an interdisciplinary context, a mathematical model, a statistical model, models in other STEAM subjects, and prediction and decision-making. We use it to identify the teacher's support related to data variability and modelling, aimed at promoting students' multidisciplinary reasoning for prediction and decision-making. The findings provide practical strategies to enhance STEAM education through data-based modelling with skills in mathematics, statistics, data science, and other STEAM disciplines.

Link to paper: https://uni-muenster.sciebo.de/s/HcbsLQz3N6eAFaP

Teaching Regression Calibration to Correct for Measurement Error to Develop Statistical Thinking

Anarina L. Murillo & Avery Maytin

Introductory statistics and biostatistics courses are essential for cultivating statistical thinking. This work explores the effectiveness of teaching measurement error (ME) methods in an introductory biostatistics course to teach three statistical concepts: bias, uncertainty, and decision-making. A sample of U.S. adults (n=600) from the National Health and Nutrition Examination Survey (NHANES) were analyzed using logistic regression models to predict diabetes status based on blood pressure levels adjusted for age, race, calories, alcohol intake, and body mass index (BMI). To imitate real world applications of ME, simulated random noise was introduced based on reliability levels. Regression calibration (RC) was applied and improved the estimate of the noisy data. Students were taught that RC may reduce the effect of ME in statistical modeling to reduce bias, and to also improve uncertainty and decision-making. This work demonstrated the utility of an ME tutorial to develop understanding of statistical bias, uncertainty, and decision-making.

Link to paper: https://uni-muenster.sciebo.de/s/tx7AgqP2SCN94rL

Data skills for agroecologists

Aboubacari Abdou Amadou, Lily Clements, Lucie Hazelgrove Planel & David Stern

This paper presents a training model developed by IDEMS to support researchers in agroecology across West Africa (Mali, Niger, and Burkina Faso) in the statistical analysis of data from agricultural experiments and surveys. As our training courses are for non-statisticians, our approach prioritises accessibility and contextual relevance. We illustrate this approach through a six-day introductory course delivered in early 2025 for NGO staff with university-level education but limited formal training in mathematics or statistics. Grounded in five guiding values: modular open educational resources, local facilitation, software-agnostic methods, the use of participants' institutional data, and an analysis-first approach, the model offers a scalable and adaptable approach to statistical education in applied, real-world contexts.

Link to paper: https://uni-muenster.sciebo.de/s/NieTjqL7HGZsHYW

KEYNOTE 2

Tuesday, September 30 16:00 – 17:00

Civic Statistical Literacy for Democratic Education

JOACHIM ENGEL
(Room F2 – Alejandra Sorto)

Democracy thrives on arguments based on evidence. Vivid democracies need well-informed citizens who can understand important social issues, discuss them and contribute to public decision-making. It has never been more important than today to be able to judge the credibility of data and its sources. Misinformation, absence of information and ignorance are all threats to our way of life. This talk highlights critical thinking and awareness of data quality as crucial components of data literacy for democratic societies. We take quality of democracy as a topic for students' data investigations in the context of existential crises such as pandemics and military conflicts. Finally, we report about the implementation and evaluation of teaching concepts, developed in the project "Data Citizen" in Ludwigsburg, that aim at empowering students to think with data in socio-political contexts.

POSTER SESSION & NETWORKING

Tuesday, September 30 17:00 – 19:00

Room Foyer 1st floor

Tuesday, September 30	
Title	**Author(s)**
Visualizing Probability: Young Children's Reasoning in Estimating Probabilities on a Probability Scale	Lena S. Jaeger
Data Literacy Education and the Center for Data Science & Simulation at TU Dortmund University	Henrike Weinert, Alexander Munteanu & Katja Ickstadt
Statistics as a Tool for Transformation: From Academia to Society CANCELLED	Victória Ekain, Letícia Torres & Antônia Xavier
Meaningful Learning of Statistics and SDGs: A Data-Based Pedagogical Experience CANCELLED	Mateus de Morais & Laira Zopellaro

Detailed Schedule, day 2

Wednesday, October 1		
09:00 – 10:30	Workshops I	F029; F030; F040; F041; F043; F072
10:30 – 11:00	Coffee Break	Foyer 1st floor
11:00 – 12:30	Parallel Sessions III	F029; F030; F042; F043
12:30 – 14:00	Lunch Break & Netlunching	F4; F5
14:00 – 15:30	Workshops II	F029; F030; F041; F042; F043; F072
15:30 – 16:00	Coffee Break	Foyer 1st floor
16:00 – 17:30	Parallel Sessions IV	F029; F030; F042; F043
17:30 – 18:00	Group photo	Foyer 1st floor
19:30	Conference Dinner (optional)	Ratskeller

WORKSHOPS I

Wednesday, October 1 09:00 – 10:30		
Title	**Session Chair**	**Room**
Multivariable Thinking in Intro Stats – Enhancing STEAM Education with JMP	Volker Kraft	F041
DATA SCIENCE EDUCATION AND CIVIC STATISTICS	James Nicholson & Sean McCusker	F029
From Data Collection to Data Evaluation: Strengthening Data Literacy with the senseBox	Helen Müller & Jan Wirwahn	F040
Fostering Young Learners' Data Sense through the Digital Tool StaLApp	Lara Billion	F030
Introduction to data analysis in CODAP	Tim Erickson	F043
Getting InSTEP with Data: A Platform for Learning to Teach Statistics and Data Science Around the World	Hollylynne Lee & Emily Thrasher	F072

WORKSHOPS I

Multivariable Thinking in Intro Stats – Enhancing STEAM Education with JMP

Volker Kraft

In an increasingly data-driven world, fostering multivariable thinking is essential for students to navigate complexity across disciplines. While the GAISE Report from 2016 explicitly recommends to “give students experience with multivariable thinking”, many introductory courses do not go beyond univariate and bivariate statistics, like simple regression and one-way analysis of variance.
This talk will demonstrate examples of simple approaches enhancing students' ability to analyze relationships between multiple variables and develop critical problem-solving skills. By integrating free JMP software and resources, educators can leverage dynamic data visualization and powerful exploratory tools in an intuitive, no-code environment. We will discuss practical teaching strategies and JMP resources that simplify statistical learning while deepening data literacy.
With its ease of use and powerful statistical tools, JMP enables students to explore data more effectively, fostering a hands-on, inquiry-driven approach to statistics and data science in STEAM education.
Participants can bring their computers with JMP software preinstalled. A free license with instructions and resources will be shared before the workshop.

DATA SCIENCE EDUCATION AND CIVIC STATISTICS

James Nicholson & Sean McCusker

Data Science programmes are emerging in many countries. Civic Statistics addresses complex contemporary social issues, involving multivariate data, and the impact of social policy decisions on citizens. We believe this makes many Civic Statistics activities strong vehicles for inclusion in Data Science courses.
This workshop will have an introduction to what makes Civic Statistics different from traditional statistics instruction. It will have a choice of activities on a variety of important contemporary social issues such as poverty, disease, education. Participants will choose one of them to work on in small groups and then report back to the full group.
Participants would benefit from reading the Open Access chapter on the Civic Stats framework ahead of the workshop (available from https://doi.org/10.1007/978-3-031-20748-8_3).
It would be helpful for participants to bring a device (iPad or equivalent) but as you will work in a small group this is not critical.

From Data Collection to Data Evaluation: Strengthening Data Literacy with the senseBox

Helen Müller & Jan Wirwahn

In today’s data-driven world, enhancing data literacy is essential to empower learners to understand, interpret, and critically evaluate data. Working with real, self-collected datasets offers an effective way to strengthen these skills. The senseBox - a modular, open-source sensor kit - provides an accessible, hands-on approach to fostering data literacy. Using environmental sensors, learners can experience the full cycle of data-driven decision-making in an authentic and engaging way. This workshop presents the potential of the senseBox for building data skills in the context of environmental education.
Following a brief theoretical introduction to geoinformatics and sensor-based data collection, participants will take part in a practical session where they will assemble and program the senseBox themselves. By collecting, visualizing, and analyzing environmental data, they will gain practical insights into how sensor technologies make data tangible and relevant. No prior technical knowledge is required.
Please bring a laptop (with USB-A connection or an appropriate adapter) to participate in the workshop.

Workshops I

Fostering Young Learners' Data Sense through the Digital Tool StaLApp

Lara Billion

In today's data-driven world, developing a foundational understanding of data is essential – even for young learners. This workshop introduces StaLApp, a digital tool designed to support informal statistical learning in primary school. The app enables learners to engage with small data sets in meaningful ways, gradually guiding them from intuitive towards more formal representations such as bar charts. Participants will first gain insight into the app's underlying educational concept. In the hands-on part of the workshop, participants will explore StaLApp themselves by investigating statistical questions using the app. Finally, we will reflect together on the didactic potential of StaLApp in the primary classroom. The discussion will focus on how the app can be integrated into teaching practice, what task formats are promising, and how these can be adapted to meet the diverse needs of learners. No prior experience with the app is required.

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Introduction to data analysis in CODAP

Tim Erickson

CODAP is the Common Online Data Analysis Platform, a free, open-source, web-based tool for learning about data. This workshop will be an introduction to data analysis in CODAP: entering and loading data, making graphs, and making various calculations—in general, finding and revealing the stories data have to tell. You'll see how dynamic graphing can enhance understanding. We'll also pay special attention to "data moves" (Erickson et al., 2019) as we reorganize and enhance datasets to make all of that possible. We will also use CODAP plugins, which extend CODAP's capabilities. Plugins help you access public datasets, create simulated data, and perform specialized analyses. There will be a special, fun lesson for people who already know about the software.

Bring a computer! If you can't, that's OK—it's always better to work in pairs, so we will share.

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Getting InSTEP with Data: A Platform for Learning to Teach Statistics and Data Science Around the World

Hollylynne Lee & Emily Thrasher

Bring your laptop or tablet to this workshop to learn about the instepwithdata.org professional learning platform. You will learn about how educators can use this online platform to engage on their own, or join groups of other educators, about key ideas and strategies for teaching statistics and data science for ages 11-18+. You will get a tour of the materials and how to use features such as recommendations, progress tracking, playlists, and groups. Discussions will include ways you can utilize materials on the platform to complement other professional development projects specific to the needs in your own country.

PARALLEL SESSIONS III

Wednesday, October 1

Time	Title	Author(s)	Session Chair	Room
11:00-11:30	Interactive oral assessment for statistical literacy	Stephanie Budgett & Leila Boyle	Anna Fergusson	F029
11:30-12:00	Enhancing Teachers' TPACK FOR Data Science in STEAM Education: Insights from a Pilot Professional Development Program in Cyprus	Michalis Gavrielides, Maria Meletiou-Mavrotheris, Efi Paparistodemou & Yianna Danidou	Anna Fergusson	F029
12:00-12:30	Branching out data science education: Developing task and computational environment design principles for teaching data science at the high school level through an international research collaboration	Fergusson, Podworny, Fleischer, Hüsing, Puloka, Biehler, Pfannkuch, Budgett & Dalrymple	Anna Fergusson	F029
11:00-11:30	Preservice Teachers' Exploration of Multivariate Data Based on Personal Interests	Susanne Podworny, Lisa Birk, Sibel Kazak & Aisling Leavy	Marcelo Vaiman	F030
11:30-12:00	The potential use of AI for conducting follow-up assessments in massive statistics courses	Eduardo León Bologna & Marcelo Vaiman	Marcelo Vaiman	F030
12:00-12:30	Teaching with Real Data	Gail Burrill	Marcelo Vaiman	F030
11:00-11:30	"How is this possible?" - Secondary PSTs' Conceptualizations of Variability in the Context of Probabilistic Thinking	Arabella Denk	Jakim Eckert	F042
11:30-12:00	Fostering data literacy by engaging in data cleaning	Jakim Eckert, Sarah Schönbrodt & Martin Frank	Jakim Eckert	F042
11:00-11:30	Quantifying the benefits to students of faking your fluency in English in recorded lectures	Karol P. Binkowski & Greg Baker	Florian Weber-Stein	F043
11:30-12:00	INNOVATING MOBILE LEARNING IN STATISTICS: PROFILING UNIVERSITY STUDENTS' NEEDS AND EXPECTATIONS	Felipe Ruz, Francisca Ubilla, Patricio Videla, Juan Zamora & Javiera Herrera	Florian Weber-Stein	F043
12:00-12:30	Civic Statistics in Teacher Education. Effects among Future Math and Civic Teachers	Florian Weber-Stein & Olawale Awe	Florian Weber-Stein	F043

PARALLEL SESSIONS III

SESSION I – SESSION CHAIR ANNA FERGUSSON – ROOM F029

Interactive oral assessment for statistical literacy

Stephanie Budgett & Leila Boyle

In the quest to distinguish fact from fiction in a world awash with misinformation and disinformation, statistical literacy is more crucial than ever. One of the key characteristics of a statistically literate citizen is their ability to communicate and justify their reaction to data-based information encountered in various contexts. An interactive oral assessment (IOA) can be a valuable and authentic way of assessing these skills. IOAs involve genuine, unscripted conversations, facilitating opportunities for an instructor to query responses to evaluate students' understanding more fully and allowing students flexibility in demonstrating their knowledge. IOAs are also less prone to academic misconduct than their more traditional written or online counterparts. This paper presents the rationale for introducing an IOA in an introductory statistical literacy course, outlines the implementation process, and shares reflections from course instructors alongside preliminary student feedback.

Link to paper: https://uni-muenster.sciebo.de/s/gX2bL5StMbccZY8

Enhancing Teachers' TPACK FOR Data Science in STEAM Education: Insights from a Pilot Professional Development Program in Cyprus

Michalis Gavrielides, Maria Meletiou-Mavrotheris, Efi Paparistodemou & Yianna Danidou

In today's data-driven world, education systems face growing pressure to equip students with data science literacy and critical thinking skills. While STEAM education offers a natural interdisciplinary setting for fostering these competencies, teachers often lack the confidence, training, and pedagogical strategies needed to integrate data science into their practice. The EU-funded DataScEd4CiEn project responds to this challenge by designing and implementing a Professional Development (PD) program tailored mostly for STEAM educators. This paper presents an exploratory study of a pilot implementation in Cyprus, aimed at investigating how the program supports teachers in adopting data-driven, interdisciplinary approaches. Using a Design-Based Research (DBR) methodology, the study iteratively refines the PD model while collecting mixed-methods data to examine changes in teacher knowledge, instructional practices, and collaborative engagement. Preliminary findings highlight the transformative potential of targeted PD in advancing data science integration and empowering teachers to meet the evolving demands of 21st-century education.

Link to paper: https://uni-muenster.sciebo.de/s/arnJLHWexPN4mcs

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Branching out data science education: Developing task and computational environment design principles for teaching data science at the high school level through an international research collaboration

Fergusson, Podworny, Fleischer, Hüsing, Puloka, Biehler, Pfannkuch, Budgett & Dalrymple

Data science is rapidly emerging as a desired component of education, yet generalisable design principles for tasks and computational environments remain underdeveloped. This paper reports on a design-based research collaboration between Germany and New Zealand, which aims to develop and refine such design principles for high school data science education. Drawing on literature and prior research, we propose that the design of tasks and computational environments should integrate humanistic, algorithmic, and programming approaches. The three key design "branches" of our research are: (1) emphasising a humanistic focus through data construction and exploration; (2) using decision trees to develop algorithmic modelling concepts; (3) using computer programming for gaining insights, thereby supporting creativity and model tinkering. These branches are illustrated through examples from our collaborative work. Our research contributes to the development of effective educational strategies for data science education and could inform the development of professional development for high school teachers.

Link to paper: https://uni-muenster.sciebo.de/s/7xRtAdgbKkgYpsx

Parallel Sessions III

Session II – Session Chair Marcelo Vaiman– Room F030

Preservice Teachers' Exploration of Multivariate Data Based on Personal Interests

Susanne Podworny, Lisa Birk, Sibel Kazak & Aisling Leavy

The DataSETUP project addresses the critical need for data science competencies in teacher education by developing short, modular courses for preservice teachers. Based on the DataSETUP framework, these modules guide future teachers through key data science processes, including data exploration, problem formulation, modeling, and results communication. In a pilot study, preservice primary teachers used a real-world dataset to explore digital gaming habits of young people. Findings show that students effectively formulated statistical questions and created visualizations to answer them. However, they tended to select their own topics and struggled to connect their analyses to the module's thematic context, highlighting both the motivational potential and the challenges of working with large, multivariate datasets.

Link to paper: https://uni-muenster.sciebo.de/s/bzbBBb6TTRdQrJB

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The potential use of AI for conducting follow-up assessments in massive statistics courses

Eduardo León Bologna & Marcelo Vaiman

This study explores the use of generative artificial intelligence (AI) for grading written papers in a large university-level Statistics course for Psychology students. Nine student papers were independently graded by three instructors and ChatGPT, following a structured calibration process. Inter-rater agreement was analyzed using Kendall's W and an ANOVA test to compare consistency between human and AI-based grading. Results showed high agreement among human raters ($W = .787$) and similarly high agreement when AI was included ($W = .767$), with no statistically significant differences in total scores. While agreement varied by task, the overall findings suggest that AI can perform grading tasks comparably to expert instructors when appropriately guided. This approach offers scalable and consistent grading, potentially mitigating the effects of rater fatigue and facilitating personalized feedback in large courses. The study provides empirical support for the integration of AI as a complementary grading tool in higher education, while highlighting the need for refined rubrics and increased training for complex assessment tasks.

Link to paper: https://uni-muenster.sciebo.de/s/Hg7RiTJLyacg5pr

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Teaching with Real Data

Gail Burrill

The importance of preparing students to navigate a world driven by data has been recognized by many, and advances in technology make working with large data sets possible and accessible. But this world of data is essentially missing from the school curriculum, and while educators are considering the content of a data science curriculum at the school level, little attention has been paid to how does/should using real data change what and how we teach. This paper addresses these questions from two perspectives; 1) designing data-driven lessons that support learning and 2) suggestions for teaching when using multi-varied contextual data. The focus is on using data in teaching and learning in any course. The paper contrasts teaching mathematics and teaching with data, provides principles for designing and implementing data driven lessons with several examples, and presents ideas to support teaching those lessons.

Link to paper: https://uni-muenster.sciebo.de/s/jbZzim4sHxjjRjN

PARALLEL SESSIONS III

SESSION III – SESSION CHAIR JAKIM ECKERT – ROOM F042

“How is this possible?” - Secondary PSTs’ Conceptualizations of Variability in the Context of Probabilistic Thinking

Arabella Denk

In the past, the consideration of (data) variability has been repeatedly characterized as a fundamental element of statistical thinking. However, motivated by recent curricular changes in Austrian secondary schools, this study situates the concept within the context of individual conceptualizations of probabilities in random experiments. A thematic analysis of pre-service teachers’ answers to a pen-and-paper study in October 2024 give insight in which ways variability is conceptualized within the interplay of patterns and deviations in the context of the eLLN at the beginning of their tertiary stochastics training.

Link to paper: https://uni-muenster.sciebo.de/s/QMrPmkw2QZmkzBL

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Fostering data literacy by engaging in data cleaning

Jakim Eckert, Sarah Schönbrodt & Martin Frank

The increasing societal relevance of data-driven technologies highlights the importance of fostering data literacy in education. One important part is data cleaning, which plays a crucial role in data-driven technologies and offers authentic opportunities to foster data literacy through critical engagement with real-world data. Despite its mathematical richness, data cleaning – particularly outlier detection – remains underrepresented in school curricula and educational research. This paper presents a design-based research project focusing on the mathematical foundations of outlier detection methods. Using the four-level approach by Hußmann and Prediger (2016), we specify and structure the mathematical topic of boxplots for outlier detection. We explore how these concepts can be meaningfully embedded in intended learning trajectories to promote students’ understanding of variability, robustness, and the impact of assumptions. The material is based on real datasets and aims to support critical reflection on data-driven decision-making.

Link to paper: https://uni-muenster.sciebo.de/s/QYgzQaH5nTwYJnW

PARALLEL SESSIONS III

SESSION IV – SESSION CHAIR FLORIAN WEBER-STEIN – ROOM F043

Quantifying the benefits to students of faking your fluency in English in recorded lectures

Karol P. Binkowski & Greg Baker

Heavily accented speech can hinder learning, particularly for non-English speaking students who struggle with comprehension and engagement. This study explores whether AI-generated voice-modded lectures, mimicking native English speech, improve academic outcomes and engagement in lectures by non-native English-speaking instructors. The study was conducted in an Introductory Statistics large enrolment service unit and compared student performance across original and AI-enhanced lectures. Surveys were used to collect engagement feedback from both domestic and international students. No significant performance difference was observed for international students. However, domestic students showed improved marks when exposed to synthetic lectures, highlighting this intervention's low-cost, scalable impact. This research offers practical insights into using AI voice-modding to improve engagement and equity in large, diverse classes.

Link to paper: https://uni-muenster.sciebo.de/s/K4xaygMfQyacsNt

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INNOVATING MOBILE LEARNING IN STATISTICS: PROFILING UNIVERSITY STUDENTS' NEEDS AND EXPECTATIONS

Felipe Ruz, Francisca Ubilla, Patricio Videla, Juan Zamora & Javiera Herrera

This study explores university students' profiles and expectations for the use of a mobile application to support statistics learning. Using a mixed-methods approach, 440 undergraduates participated in a survey combining quantitative Likert-scale responses and over 200 qualitative open-ended answers. A factor analysis revealed four key dimensions shaping students' perceptions toward mobile-assisted learning, while cluster analysis identified three distinctive user profiles with varying levels of engagement. Topic modeling of qualitative responses revealed critical preferences and concerns, such as the need for real-data applications, interactive tools, gamification features, and intuitive design. Concerns included excessive advertising, poor interface usability, and lack of personalized feedback. These findings offer a framework for developing adaptable, student-centered mobile applications in statistics education, aligned with learner diversity and pedagogical goals.

Link to paper: https://uni-muenster.sciebo.de/s/Tf3wGRWBKx6dopE

Civic Statistics in Teacher Education. Effects among Future Math and Civic Teachers

Florian Weber-Stein & Olawale Awe

This paper presents findings from an interdisciplinary seminar for pre-service mathematics and civics teachers aimed at fostering civic statistical literacy. Based on the concept of civic statistics, the course integrated statistical learning with critical engagement with data in social and political contexts. Pre- and post-survey data were used to compare baseline differences between groups, assess learning outcomes, and explore how interdisciplinary learning develops through engagement across disciplinary boundaries.

Link to paper: https://uni-muenster.sciebo.de/s/fRPF3bkmn7JBcaq

NETLUNCHING

Wednesday, October 1

12:35-13:15

DATA SCIENCE IN HIGHER EDUCATION

BENJAMIN RISSE & EDZER PEBESMA
(Room F4)

13:20-14:00

LESS MATH, MORE INSIGHT: RETHINKING STATISTICS FOR NON-MAJORS

THOMAS SKILL
(Room F5)

WORKSHOPS II

Wednesday, October 1 14:00 – 15:30		
Title	**Session Chair**	**Room**
Multivariable Thinking in Intro Stats – Enhancing STEAM Education with JMP	Volker Kraft	F041
DATA SCIENCE EDUCATION AND CIVIC STATISTICS	James Nicholson & Sean McCusker	F029
Teaching with real environmental data: Unlocking the potential of the openSenseMap	Thomas Bartoschek	F042
Fostering Young Learners' Data Sense through the Digital Tool StaLApp	Lara Billion	F030
Introduction to data analysis in CODAP	Tim Erickson	F043
Getting InSTEP with Data: A Platform for Learning to Teach Statistics and Data Science Around the World	Hollylynne Lee & Emily Thrasher	F072

Workshops II

Multivariable Thinking in Intro Stats – Enhancing STEAM Education with JMP

Volker Kraft

In an increasingly data-driven world, fostering multivariable thinking is essential for students to navigate complexity across disciplines. While the GAISE Report from 2016 explicitly recommends to "give students experience with multivariable thinking", many introductory courses do not go beyond univariate and bivariate statistics, like simple regression and one-way analysis of variance.
This talk will demonstrate examples of simple approaches enhancing students' ability to analyze relationships between multiple variables and develop critical problem-solving skills. By integrating free JMP software and resources, educators can leverage dynamic data visualization and powerful exploratory tools in an intuitive, no-code environment. We will discuss practical teaching strategies and JMP resources that simplify statistical learning while deepening data literacy.
With its ease of use and powerful statistical tools, JMP enables students to explore data more effectively, fostering a hands-on, inquiry-driven approach to statistics and data science in STEAM education.
Participants can bring their computers with JMP software preinstalled. A free license with instructions and resources will be shared before the workshop.

DATA SCIENCE EDUCATION AND CIVIC STATISTICS

James Nicholson & Sean McCusker

Data Science programmes are emerging in many countries. Civic Statistics addresses complex contemporary social issues, involving multivariate data, and the impact of social policy decisions on citizens. We believe this makes many Civic Statistics activities strong vehicles for inclusion in Data Science courses.
This workshop will have an introduction to what makes Civic Statistics different from traditional statistics instruction. It will have a choice of activities on a variety of important contemporary social issues such as poverty, disease, education. Participants will choose one of them to work on in small groups and then report back to the full group.
Participants would benefit from reading the Open Access chapter on the Civic Stats framework ahead of the workshop (available from https://doi.org/10.1007/978-3-031-20748-8_3).
It would be helpful for participants to bring a device (iPad or equivalent) but as you will work in a small group this is not critical.

Teaching with real environmental data: Unlocking the potential of the openSenseMap

Thomas Bartoschek

Open environmental data offer valuable opportunities to familiarize learners with authentic, real-world datasets. The openSenseMap is a freely accessible online platform that stores and visualizes sensor data from a global network of citizen science stations. It enables users to explore various environmental parameters such as air quality, temperature, and UV intensity in real time. This workshop introduces the openSenseMap as a practical tool for working with open data and developing data literacy skills.
Participants will gain an overview of the platform's structure, data sources, and educational potential. In a guided, hands-on session, they will learn how to search for, filter, and download sensor data for their own analysis and interpretation. Practical examples will demonstrate how open data from the openSenseMap can support teaching and learning across a wide range of educational contexts.

Workshops II

Fostering Young Learners' Data Sense through the Digital Tool StaLApp

Lara Billion

In today's data-driven world, developing a foundational understanding of data is essential – even for young learners. This workshop introduces StaLApp, a digital tool designed to support informal statistical learning in primary school. The app enables learners to engage with small data sets in meaningful ways, gradually guiding them from intuitive towards more formal representations such as bar charts. Participants will first gain insight into the app's underlying educational concept. In the hands-on part of the workshop, participants will explore StaLApp themselves by investigating statistical questions using the app. Finally, we will reflect together on the didactic potential of StaLApp in the primary classroom. The discussion will focus on how the app can be integrated into teaching practice, what task formats are promising, and how these can be adapted to meet the diverse needs of learners. No prior experience with the app is required.

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Introduction to data analysis in CODAP

Tim Erickson

CODAP is the Common Online Data Analysis Platform, a free, open-source, web-based tool for learning about data. This workshop will be an introduction to data analysis in CODAP: entering and loading data, making graphs, and making various calculations—in general, finding and revealing the stories data have to tell. You'll see how dynamic graphing can enhance understanding. We'll also pay special attention to "data moves" (Erickson et al., 2019) as we reorganize and enhance datasets to make all of that possible. We will also use CODAP plugins, which extend CODAP's capabilities. Plugins help you access public datasets, create simulated data, and perform specialized analyses. There will be a special, fun lesson for people who already know about the software.

Bring a computer! If you can't, that's OK—it's always better to work in pairs, so we will share.

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Getting InSTEP with Data: A Platform for Learning to Teach Statistics and Data Science Around the World

Hollylynne Lee & Emily Thrasher

Bring your laptop or tablet to this workshop to learn about the instepwithdata.org professional learning platform. You will learn about how educators can use this online platform to engage on their own, or join groups of other educators, about key ideas and strategies for teaching statistics and data science for ages 11-18+. You will get a tour of the materials and how to use features such as recommendations, progress tracking, playlists, and groups. Discussions will include ways you can utilize materials on the platform to complement other professional development projects specific to the needs in your own country.

PARALLEL SESSIONS IV

Wednesday, October 1

Time	Title	Author(s)	Session Chair	Room
16:00-16:30	Modeling Equity Using Multiple Technologies for Teaching Statistics with Preservice Teachers	Christopher Nazelli, S. Asli Özgün-Koca & Jennifer M. Lewis	Lonneke Boels	F029
16:30-17:00	Designing for Fusion in Statistics Education: A Variation Theory Approach	Hanan Innabi & Per Nilsson	Lonneke Boels	F029
17:00-17:30	The Role of Dotplots in Statistics Education Practice	Lonneke Boels & Vuslat Şeker	Lonneke Boels	F029
16:00-16:30	Handing Missing Values: A STACK-Based Assessment	Lily Clements	Emily Thrasher	F030
16:30-17:00	Designing Online Professional Learning to Support Advances in Teaching Strategies in Statistics and Data Science	Hollylynne S. Lee, Gemma F. Mojica & Emily Thrasher	Emily Thrasher	F030
17:00-17:30	A design research project on fairness in data-driven algorithmic decision-making	Sarah Schönbrodt & Steffen Schneider	Emily Thrasher	F030
16:00-16:30	Critical Statistics Education: High School Students' Experiences in Statistical Thinking within the Context of Brain Drain	Gamze Kurt & Başak Özer	Maria Meletiou-Mavrotheris	F042
16:30-17:00	Integrating Data Science Education and Responsible AI in Teacher Training: A Pilot Study within STEAM-Based Graduate Learning	Meletiou-Mavrotheris, Bakogianni, Danidou, Paparistodemou & Kofteros	Maria Meletiou-Mavrotheris	F042
17:00-17:30	Integrating Data Literacy into Teacher Education: Fostering Reflection and Critical Thinking regarding AI	Susanne Hilger & Carina Büscher	Maria Meletiou-Mavrotheris	F042
16:00-16:30	Can code be responsible? - How to study and communicate algorithmic accountability	Weinert, Eckardt, Elmer, Goldschmidtböing, Ickstadt & Lange	Amanda Shaker	F043
16:30-17:00	Theatre of Statistics: A Systematic Review of Drama-Based Pedagogies for Enhancing Statistical Literacy	Elena Sorba, Francesco Massara & Elisabetta Risi	Amanda Shaker	F043
17:00-17:30	Investigating links between student awareness and use of Generative AI tools, and student anxiety and confidence when studying statistics	Shaker, Marshall, Owen, Calvert, Sanchez A., Hoh, Larkins, Binkowski, Dunn & Derrick	Amanda Shaker	F043

PARALLEL SESSIONS IV

SESSION I – SESSION CHAIR LONNEKE BOELS – ROOM F029

Modeling Equity Using Multiple Technologies for Teaching Statistics with Preservice Teachers

Christopher Nazelli, S. Asli Özgün-Koca & Jennifer M. Lewis

Mathematical knowledge for teaching requires strong content knowledge, yet statistical content knowledge is often overlooked in elementary teacher education. Many elementary preservice teachers (PSTs) struggle with core statistical concepts like mean and median, and even those with strong content knowledge may lack effective teaching strategies. This study describes the design and implementation of a statistics lesson aimed at promoting equitable learning experiences using technologies such as GeoGebra and Padlet. Data collected included the mathematical work and reflections of 27 PSTs, video recordings of the lesson, and observers' field notes; all were analyzed using qualitative methods. Analysis showed that technology-supported statistics learning encouraged understanding of statistical concepts for PSTs as learners, and that reflecting on pedagogical strategies used in the lesson allowed PSTs to analyze the lesson as future teachers. These findings underscore the need for teacher preparation courses that emphasize both content and pedagogy in teaching statistics.

Link to paper: https://uni-muenster.sciebo.de/s/4Q5cWPnXks4ZLf6

Designing for Fusion in Statistics Education: A Variation Theory Approach

Hanan Innabi & Per Nilsson

This paper presents a design approach for teaching statistics in STEAM education, grounded in variation theory and enriched by real-world contexts drawn from Education for Sustainable Development (ESD). Variation theory serves as the central theoretical framework, offering a way to support learners in discerning critical aspects of the object of learning through structured variation. A key feature of variation theory is the coordination of part–whole relationships, enabling students to learn statistics not as a set of fragmented procedures, but as an integrated and coherent whole. Within this framework, we suggest that sustainability-related problems provide powerful contexts for supporting the development of statistical reasoning, particularly when aligned with the interdisciplinary goals of STEAM education. The paper outlines how these elements can be brought together in a coherent instructional design to foster purposeful, conceptually grounded learning in statistics.

Link to paper: https://uni-muenster.sciebo.de/s/xNCtAfbnSi9NAmk

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The Role of Dotplots in Statistics Education Practice

Lonneke Boels & Vuslat Şeker

Statistical graphs play a crucial role in data literacy, yet pupils frequently misinterpret histograms (Kaplan et al., 2014). In education, textbooks typically progress from case-value plots to histograms but research suggests that dotplots and their variants (e.g., histodots) can support this transition. The study asked: How and how often are dotplots and their variants used in Dutch textbooks? An analysis of 19 Dutch textbooks (Grades 7–10) showed that dotplots are rare and not used to support transitions to histograms or boxplots. Variants like hatplots and histodots were absent. Hence, a gap is apparent between research on learning progressions in statistics education and the Dutch curriculum as implemented in textbooks, which teachers often closely follow. Although the reasons for this limited uptake of research remain speculative, possible explanations include a lack of exemplary large-scale or quasi-experimental studies and a shortage of exemplary, classroom-tested materials to support implementation.

Link to paper: https://uni-muenster.sciebo.de/s/PnA9Krr44ZRPcGf

PARALLEL SESSIONS IV

SESSION II – SESSION CHAIR EMILY THRASHER – ROOM F030

Handing Missing Values: A STACK-Based Assessment

Lily Clements

Handling missing data is an important but often neglected skill in statistics education. This paper presents a STACK-based formative assessment designed to address this gap by helping students develop strategies for interpreting and managing missing values. Using a simulated farm survey dataset, students must determine the most and least profitable crops and calculate average profits, while accounting for different types of missingness, such as whether a crop was not grown or grown but unsold. The assessment dynamically generates new datasets and uses STACK's Potential Response Trees (PRTs) to diagnose student misconceptions and deliver tailored feedback. Initial responses show common errors, such as treating all missing values the same or excluding them entirely. By surfacing these issues and encouraging reflection through immediate, specific, and iterative feedback, the assessment promotes deeper conceptual understanding. The approach is scalable, adaptable, and aligns with GAISE recommendations to use real data and focus on statistical reasoning in data science education.

Link to paper: https://uni-muenster.sciebo.de/s/gB3EXTrbBZw6xs3

Designing Online Professional Learning to Support Advances in Teaching Strategies in Statistics and Data Science

Hollylynne S. Lee, Gemma F. Mojica & Emily Thrasher

This paper describes the design of an innovative online platform that has over 50 hours of learning experiences to support educators in further advancing their understandings and pedagogical skills in teaching statistics and data science to learners age 11-18+. Two frameworks are described that support effective classroom practices: a Data Investigation Process and Seven Dimensions of Teaching Statistics and Data Science. Examples of features and interface designs are included to illustrate how the frameworks work together to support teachers' learning in a cohesive way, even as they personalize their experience and engage in different learning pathways.

Link to paper: https://uni-muenster.sciebo.de/s/Dt99KYP89NFSxoa

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A design research project on fairness in data-driven algorithmic decision-making

Sarah Schönbrodt & Steffen Schneider

Data-driven algorithmic decision-making systems, including many AI-technologies, are ubiquitous in today's society. Early engagement with these systems and the promotion of critical statistical literacy are therefore essential. This involves not only fostering a basic understanding of how such systems work, but also addressing their broader social impact. As part of a design research project, we developed a learning activity that enables upper secondary students and pre-service teachers to explore issues of fairness in the context of automatic credit granting. In this paper, we present the design of the activity, outline the intended learning trajectory, and report on initial implementations with pre-service teachers. We also discuss preliminary findings from a qualitative analysis of students' fairness-related arguments.

Link to paper: https://uni-muenster.sciebo.de/s/tz2QfkSTrxQ7LFA

Parallel Sessions IV

Session II – Session Chair Maria Meletiou-Mavrotheris – Room F042

Critical Statistics Education: High School Students' Experiences in Statistical Thinking within the Context of Brain Drain

Gamze Kurt & Başak Özer

This study explores how high school students engage in critical statistical reasoning through a real-world inquiry on brain drain. Drawing on critical mathematics education, critical statistics education, and the critical statistical literacy habits of mind (CSLHM) framework, the study integrates social context into a statistics lesson to foster critical awareness and data-informed thinking. The research involved 90 ninth-grade students from three public schools. Working in small groups, students formulated statistical questions, collected or interpreted data, and presented findings through posters. Data sources included worksheets, audio recordings, and student-created artifacts. Thematic analysis based on CSLHM dimensions revealed students' abilities to question data limitations, interpret findings critically, and propose socially grounded solutions. Preliminary findings show the potential of context-rich, inquiry-based statistics instruction to support both statistical thinking and social agency. The study highlights how data literacy can serve as a tool for engaging students in civic reasoning and transformation.

Link to paper: https://uni-muenster.sciebo.de/s/n2G7aMmac7dgqbw

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Integrating Data Science Education and Responsible AI in Teacher Training: A Pilot Study within STEAM-Based Graduate Learning

Maria Meletiou-Mavrotheris, Dionysia Bakogianni, Yianna Danidou, Efi Paparistodemou & Alexandros Kofteros

This pilot study explores the integration of data science and responsible AI within a STEAM-based graduate course for education majors, developed as part of the EU-funded DataSETUP project. Focusing on a single module—Responsible AI & Data Science: Ethics, Society, and Citizenship—the research examines a group-based activity in which student teachers collaboratively built an image classification model using Google's Teachable Machine. Participants engaged with core elements of the machine learning pipeline and reflected on issues such as data quality, algorithmic bias, and educational relevance. To analyze student learning, a five-dimension analytical framework was developed, synthesizing concepts from data science, statistics education, and critical data literacy. The framework captures both technical engagement and student teachers' evolving understanding of the social and ethical implications of data-driven AI decision-making. Findings indicate that focused, hands-on experiences within a targeted module can meaningfully enhance student teachers' data science literacy and their critical awareness of responsible AI use in education.

Link to paper: https://uni-muenster.sciebo.de/s/j7Ax5B3D8RQbKnp

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Integrating Data Literacy into Teacher Education: Fostering Reflection and Critical Thinking regarding AI

Susanne Hilger & Carina Büscher

The increasing prevalence of data-driven technologies, including artificial intelligence (AI), underscores the need to develop data literacy skills and the ability to critically reflect on these technologies. This is especially important in teacher education, as educators play a crucial role in fostering such competencies in future generations. However, the reflective discussion is underrepresented compared to the demonstration of the performance and learners find it challenging to connect theoretical concepts to their lives. A seminar concept for prospective math teachers was developed that explicitly aimed to stimulate reflections on mathematical foundations of AI and the implications for society and the students' own life. The material was tested twice. In the second iteration of the study, modifications were made by including concrete examples from the students' lifeworld. An analysis of the contextual references in the students' discussions shows that in the second round, indeed, more and more diverse context-related answers were given.

Link to paper: https://uni-muenster.sciebo.de/s/tnyj7kKDbeKPkEj

PARALLEL SESSIONS IV

SESSION IV – SESSION CHAIR AMANDA SHAKER – ROOM F043

Can code be responsible? - How to study and communicate algorithmic accountability

Weinert, Eckardt, Elmer, Goldschmidtböing, Ickstadt & Lange

Before we can trust algorithms, we must learn how to question and understand them. Based on this principle, we explore how algorithmic accountability can be taught through interdisciplinary, project-based learning as a part of the Digital Humanities Ruhr project. We present a seminar involving students of journalism, statistics, computer science, and data science. In interdisciplinary teams, they investigated real-world algorithmic systems and presented their findings in accessible public formats. The seminar demonstrates how algorithmic accountability can become an integral part of interdisciplinary education in the humanities and beyond. To accomplish this, we reflect on lessons learned and outline future improvements, such as expanding participation and enhancing mentoring to support both the selection of algorithmic cases and the choice of communicative formats. We integrate our improved seminar into the broader Data Literacy Certificate at TU Dortmund University, contributing to the development of micro-credentials in Digital Humanities across the University Alliance Ruhr.

Link to paper: https://uni-muenster.sciebo.de/s/TR2iDcjN6fxnEnS

Theatre of Statistics: A Systematic Review of Drama-Based Pedagogies for Enhancing Statistical Literacy

Elena Sorba, Francesco Massara & Elisabetta Risi

This paper investigates how theatre can enhance statistical literacy by transforming abstract concepts into embodied and participatory learning experiences. Through a systematic integrative review of 98 peer-reviewed studies (2010–2024), we map drama-based strategies and formats adopted in science, literacy, and arts education. Though rarely applied in statistics, these approaches enhance understanding, engagement, and reflection. Building on these insights, we introduce the Theatre of Statistics framework, which integrates classroom drama, public science theatre, and generative AI into a unified model. Drawing on the tradition of science theatre, it aims not only to teach, but also to inspire wonder, curiosity, and long-lasting emotional connections with statistical thinking. In this way, it advances inclusive, multimodal participatory approaches that bridge education and public dissemination of statistics in a digitally connected world.

Link to paper: https://uni-muenster.sciebo.de/s/6nHEB3Rfqwa83SX

Investigating links between student awareness and use of Generative AI tools, and student anxiety and confidence when studying statistics

Shaker, Marshall, Owen, Calvert, Sanchez A., Hoh, Larkins, Binkowski, Dunn & Derrick

Statistics anxiety is common amongst Higher Education students, with an estimated 70–90% experiencing anxiety while studying statistics. The emergence of Generative AI (GenAI) allows for new possibilities for how students might support their learning of statistics. In this international, multi-institutional study, we consider links between student awareness, perceptions, and usage of GenAI with student anxiety and confidence while studying statistics. Data were collected from students at universities across the UK and Australia during 2024 and 2025. Findings suggest that while GenAI usage is modest, it is more common among postgraduate students, and using GenAI tools can have a positive impact by reducing student anxiety and improving confidence while studying statistics. This study informs GenAI-driven pedagogy in higher education by highlighting the value of GenAI tools in supporting student learning of statistics and reducing student anxiety while studying statistics.

Link to paper: https://uni-muenster.sciebo.de/s/kiQQkki6E47mCNS

Conference Dinner

Wednesday, October 1		
19:30	Conference Dinner (optional)	Ratskeller

Location of the Ratskeller
Prinzipalmarkt 8,
48143 Münster

DETAILED SCHEDULE, DAY 3

Thursday, October 2		
09:00 – 10:30	Parallel Sessions V	F029; F030; F042; F043
10:30 – 11:00	Coffee Break	Foyer 1st floor
11:00 – 12:30	Panel Discussion	F2
12:30 – 13:00	Closing Ceremony	F2

PARALLEL SESSIONS V

Thursday, October 2

Time	Title	Author(s)	Session Chair	Room
09:00-09:30	Fairness in Machine Learning: A Design Research Study for Secondary Education	Clara Müller, Katharina Bata, Martin Frank & Jasmin Hörter	Henrik Ossadnik	F029
09:30-10:00	Core Ideas for Teaching Hypothesis Testing – Structure, Concepts and Validation	Henrik Ossadnik & Jürgen Roth	Henrik Ossadnik	F029
10:00-10:30	Project-Based Learning in Life Sciences Statistics Courses: Dynamics, Pitfalls, and Educational Gains	Anna Khalemsky & Yelena Stukalin	Henrik Ossadnik	F029
09:00-09:30	Expansion of the Data Moves Framework to Support Data Processing, Analysis and Modeling	Stephanie Casey, Gemma F. Mojica, Hollylynne Lee & Rick Hudson	Stephanie Casey	F030
09:30-10:00	An initial exploration of teacher integration of interactive technology in statistics education	S. Asli Özgün-Koca & Anna Fergusson	Stephanie Casey	F030
10:00-10:30	Early Statistics: Introducing Informal Inferential Reasoning through Storytelling-Based Learning Task in Grades 1-3	Soledad Estrella, Alejandra Mondaca-Saavedra, Maritza Méndez-Reina & Brahiam Ramírez	Stephanie Casey	F030
09:00-09:30	Data-based argumentation tasks in the context of climate change and primary students' reported self-efficacy growth in climate change-related discourse participation	Sebastian Kuntze, Svenja Knöbel & Jens Krummenauer	Sebastian Kuntze	F042
09:30-10:00	Pre-Service Teachers' Use of Eye-Tracking Data to Diagnose Students' Misinterpretations in Statistical Graphs	Şeker, Boels, Alexander, Heursen, Schreiter, Van Dooren, Reinhold & Abt	Sebastian Kuntze	F042
09:00-09:30	How the level of inference in visualizations influences participants' performance in Bayesian reasoning	Michael Rößner, Theresa Büchter & Nicole Steib	Michael Rößner	F043
09:30-10:00	The integration of probability-based arguments in risk-related contexts	Theresa Büchter, Karin Binder & Andreas Eichler	Michael Rößner	F043
10:00-10:30	An hypothetical learning trajectory of the multiplication law of probability: Simulations, tree diagrams, and infographic representations	Per Nilsson	Michael Rößner	F043

PARALLEL SESSIONS V

SESSION I – SESSION CHAIR HENRIK OSSADNIK – ROOM F029

Fairness in Machine Learning: A Design Research Study for Secondary Education

Clara Müller, Katharina Bata, Martin Frank & Jasmin Hörter

This conceptual paper presents a design research study that explores fairness in machine learning (ML) as an interdisciplinary learning opportunity for secondary education. Drawing on the societal relevance of algorithmic decision-making systems, the study emphasizes the importance of integrating technical and ethical perspectives within a cohesive teaching-learning arrangement – an approach that is still rarely implemented in practice. The paper provides an overview of fairness definitions and algorithmic intervention strategies, alongside a review of relevant educational research on ML and fairness in both school and higher education contexts. It outlines the methodological foundations of the design research study and introduces preliminary ideas for a prototypical teaching-learning arrangement, accompanied by guiding research questions that frame the study.

Link to paper: https://uni-muenster.sciebo.de/s/Pf38wEnXWMZ4cg3

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Core Ideas for Teaching Hypothesis Testing – Structure, Concepts and Validation

Henrik Ossadnik & Jürgen Roth

Hypothesis testing is often perceived as an inaccessible and difficult to teach topic in school education, partly due to weak curricular connections from lower to upper secondary levels. The complexity of key statistical concepts further contributes to this challenge. Additionally, instruction often emphasizes computational procedures over conceptual understanding and reasoning. To address these issues, we propose a spiral curriculum that utilizes core ideas as conceptual anchors to support early informal understanding and facilitate the transition to more formal understanding of hypothesis testing. Four preliminary core ideas were theoretically derived and now validated through an expert survey. Initial findings confirm the relevance of the core ideas while highlighting the need for modifications in terms of core ideas' content and adjustments to the relationships among them. This underscores the importance for further refinement of the theoretical framework prior to classroom implementation and simultaneously lays the foundation for developing learning environments within a design-based research project.

Link to paper: https://uni-muenster.sciebo.de/s/pwj5o7mCWGgXAxg

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Project-Based Learning in Life Sciences Statistics Courses: Dynamics, Pitfalls, and Educational Gains

Anna Khalemsky & Yelena Stukalin

This study explores how project-based learning (PBL) enhances statistics education for students in the two departments—biotechnology and medical laboratory sciences. Semester-long practical projects enable students to simulate real-world data analysis and develop research skills by selecting topics, building databases, reviewing literature, applying various methods using analytical software, interpreting results, and drawing conclusions. MedLab students, who take the course early in their studies, express strong motivation to take initiative and work independently throughout the project. In contrast. Biotechnology students, who are at a more advanced stage in their academic studies, rate communication with peers and lecturer very high. The study draws on two surveys: a Likert-scale questionnaire completed by 64 students to assess PBL experiences, and an open-ended survey of 27 students analyzed using natural language processing to identify sentiment and themes. Findings reveal key differences and similarities, informing how PBL can be tailored to enhance learning in STEM education.

Link to paper: https://uni-muenster.sciebo.de/s/ATmPjjkQANeXd3b

Parallel Sessions V

Session II – Session Chair Stephanie Casey – Room F030

An initial exploration of teacher integration of interactive technology in statistics education

S. Asli Özgün-Koca & Anna Fergusson

Our study explored how secondary mathematics teachers integrate the DOTS applet, a digital tool designed to support distributional reasoning, into statistics tasks. Three pre-service and in-service teachers participated in a retrospective qualitative case study, where they created and reflected on tasks that integrated the applet. Qualitative content analysis of the teachers' written submissions focused on technology integration and the development of distributional reasoning. Results revealed both similarities, such as promoting interactive engagement, and differences, including the use of context, conceptual focus, and the balance between exploration and guidance. These findings highlight that the same technology can be used in diverse ways to support student learning, emphasizing the importance of intentional task design aligned with specific learning objectives. This research contributes to STEAM education by providing indications of how teachers' pedagogical intentions shape the integration of technology in statistics education.

Link to paper: https://uni-muenster.sciebo.de/s/NPcczf8Z7f7P8nJ

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Expansion of the Data Moves Framework to Support Data Processing, Analysis and Modeling

Stephanie Casey, Gemma F. Mojica, Hollylynne Lee & Rick Hudson

Erickson et al. (2019) defined a data move as an action that alters a dataset's contents, structure, or values. They also proposed a framework of six data moves from their work with CODAP. We have expanded their framework through reflection on the use of data moves by ourselves and teachers. Our framework has added new data moves, restructured the relationship of data moves, and added purposes for each data move. We will explicate our expanded framework and how it supports data processing, analysis, and modeling through exploration of a dataset involving recent adult obesity levels in Western Pacific and South-East Asian Countries. We will also discuss how teachers' intentional use of the framework can enhance students' understanding of data science.

Link to paper: https://uni-muenster.sciebo.de/s/EC7WWNP4xtEbNWJ

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Early Statistics: Introducing Informal Inferential Reasoning through Storytelling-Based Learning Task in Grades 1-3

Soledad Estrella; Alejandra Mondaca-Saavedra; Maritza Méndez-Reina & Brahiam Ramírez

This study presents part of a hypothetical learning trajectory designed to introduce inferential reasoning, support, and expand emerging understanding of statistical concepts in grades 1 to 3 (n=59). Through a design-based research approach, a playful activity was designed and implemented based on a pirate story involving gold pearls, allowing children to construct, analyze, and refine data models in scenarios of uncertainty. Students worked in teams with assigned roles (counter, recorder, and shaker) to collect and record data. In whole-class dialogues guided by the teacher, students completed three dot plots, visualized sample variability, and made inferences about the distribution of the pearls. The results show that children can develop key notions such as randomness, empirical sample variation, and maximum sample frequency by interacting with data and comparisons of groups. This study provides evidence of how the children complete data modeling tasks, articulate mathematical and statistical concepts, and make informal inferences.

Link to paper: https://uni-muenster.sciebo.de/s/XMQ4Nt4t4bMbGXm

PARALLEL SESSIONS V

SESSION III – SESSION CHAIR SEBASTIAN KUNTZE – ROOM F042

Data-based argumentation tasks in the context of climate change and primary students' reported self-efficacy growth in climate change-related discourse participation

Sebastian Kuntze, Svenja Knöbel & Jens Krummenauer

Education for sustainable development should enable citizens to take part in social discourses and decision-making through argumentation in favour of the protection of resources. As misinterpretations of statistical data are often part of sustainability-related discourses, the mathematics classroom should empower future citizens by building up competence in data-based argumentation as well as fostering self-efficacy necessary for responding to misinterpretations of data and actively participating in sustainability-related discourses. However, empirical research about the role of data-based argumentation for self-efficacy in taking part in climate-related discourses is scarce, especially for young learners. This study responds to this research need: 86 primary students took part in a survey in which they were asked to comment on incorrect interpretations of climate-related data and to justify their answers. These stimuli showed impacts on students' reported self-efficacy growth with respect to argumentational participation in climate change-related discourse.

Link to paper: https://uni-muenster.sciebo.de/s/4iXXPMgZYBY8LAF

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Pre-Service Teachers' Use of Eye-Tracking Data to Diagnose Students' Misinterpretations in Statistical Graphs

Şeker, Boels, Alexander, Heursen, Schreiter, Van Dooren, Reinhold & Abt

This study explores how a pre-service mathematics teacher interprets eye-tracking data to diagnose students' reasoning when working with histograms. Using a qualitative case study design, the participant engaged with an eye-tracking vignette, featuring a student's gaze plot, answer, and cued recall explanation. The targeted error was frequency–value confusion, a common systematic error where students treat bar heights as measured values. Findings show that the participant initially relied on assumptions rather than the gaze data itself. Over time, her reasoning shifted to a more reflective analysis, integrating multiple data sources to better understand the student's thought process. She also identified the limitations of interpreting gaze data in isolation, especially when no clear pattern was evident. This study suggests that the use of eye-tracking data, when scaffolded through structured tasks, can enhance pre-service teachers' diagnostic skills in the interpretation of statistical graphs.

Link to paper: https://uni-muenster.sciebo.de/s/WmqLJH3yiLETNpM

PARALLEL SESSIONS V

SESSION IV – SESSION CHAIR MICHAEL RÖßNER – ROOM F043

How the level of inference in visualizations influences participants' performance in Bayesian reasoning

Michael Rößner, Theresa Büchter & Nicole Steib

We conducted a study with 2,400 participants that had to solve six Bayesian reasoning tasks in one out of eight different visualization types (no visualization, regular 2×2 table, graphical 2×2 table, unit square, implicit tree diagram, explicit tree diagram, double tree, net diagram) in a probability, proportion or frequency format. The aim of the study was to investigate whether the levels of inference have an influence on the participants' performance in the tasks. The level of inference is characterized by the number of mental steps that are needed to arrive at the correct solution, which vary between the visualization types. The results show that the levels of inference indeed influence performance. This can be used to teach students to adaptively and flexibly use probabilistic visualizations for different types of tasks.

Link to paper: https://uni-muenster.sciebo.de/s/6XkSTYL8iwoF83a

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The integration of probability-based arguments in risk-related contexts

Theresa Büchter, Karin Binder & Andreas Eichler

Probabilistic reasoning is key for decision making, especially in risk-related contexts. For example, erroneous HIV self-test results pose risks that must be evaluated when considering public approval. This requires incorporating probabilities (e.g., for not being infected even though a positive test result is given) into the decision-making process. We examine how upper secondary school students use such probability-based arguments in risk-related contexts before and after an intervention on conditional probabilities. A qualitative content analysis classifies their arguments as (i) mathematical, (ii) context-related, (iii) transitional (between mathematical and context-related), (iv) affective, or (v) based on anticipated personal experience. A central result of the analysis is that after the intervention, students used mathematical arguments more frequently than prior to the intervention on conditional probabilities.

Link to paper: https://uni-muenster.sciebo.de/s/HFCN2ps7EzpZTa4

An hypothetical learning trajectory of the multiplication law of probability: Simulations, tree diagrams, and infographic representations

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This study presents the initial iteration of a hypothetical learning trajectory designed to support students' understanding of the multiplication law of probability (MLP) through simulations, tree diagrams, and infographics. Using educational design research in a Grade 8 classroom, the study introduces Infographic Random Experiment Trees (IRET) to scaffold students' understanding of the MLP in making sense of compound stochastic events (CSEs). The HLT unfolds in three stages, guiding students from empirical simulations to generalizations in uniform and non-uniform CSE contexts. The results show that students can use MLP in structured tasks, but initially it seems more natural to reason in terms of division instead of multiplication. The design of IRET shows promise in enhancing comprehension but also reveals persistent challenges in relation to students' interpretations of tree diagrams.

Link to paper: https://uni-muenster.sciebo.de/s/RN85WpFZr6wPrn7