Theatre of statistics: A systematic review of performative approaches for enhancing statistical literacy

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This paper investigates how theatre and drama can enhance statistical literacy by transforming abstract concepts into embodied and participatory learning experiences. Through a systematic integrative review of 93 peer-reviewed studies (2010–2024), we map drama and theatre-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 and public science theatre 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.

INTRODUCTION

Statistical literacy—defined by Gal (2002) as the ability to interpret data together with dispositions such as curiosity, critical reflection, and ethical judgment—can be regarded as a foundation of informed citizenship. Data influence decisions in health, politics, and the environment, yet for many people, statistics still appear abstract and disconnected from everyday life.

Despite decades of curriculum reform, statistics education often continues to place greater emphasis on procedural skills than on reasoning (Tishkovskaya & Lancaster, 2012). Many learners find statistical concepts difficult to visualise and struggle to connect them to meaningful contexts (Garfield, 1995; Wild & Pfannkuch, 1999).

In other disciplines, performative methods have been acknowledged for their capacity to help learners engage with complex ideas, lower anxiety, and reflect on social and ethical dimensions (Ridgway et al., 2011; Ødegaard, 2003). Ødegaard (2003) in particular identifies drama as a way of learning *about concepts, about the nature of science, and about science's interactions with society*, showing how performance can act as both a pedagogical and epistemic tool. Yet, as Braund (2015) points out, the field still suffers from a lack of theorisation—an "empty space" that Brook (1968) described more broadly as the potential of theatre to become a site for cognitive and embodied exploration.

In statistics, this "empty space" is even more evident: drama and theatre are almost entirely absent, despite their documented potential in other disciplines. This gap prompts our central research question: *Which performative approaches—already effective in other fields—might be adapted to teach and communicate statistics?*

To address this question, we review literature on theatre in educational, scientific, and public engagement contexts, identifying practices that could be transferred to statistics. We then present the *Theatre of Statistics*: a framework that integrates classroom drama (participatory, curriculum-based activities) and science theatre (public performances exploring scientific themes). The aim is to make statistics more engaging—fostering wonder, curiosity, and deeper learning.

Challenges in Statistics Education

Despite reforms, statistics education appears to continue facing persistent barriers that may influence how students understand and engage with statistical ideas. Gal's (2002) model—combining cognitive skills and dispositions—offers a useful lens through which to examine these difficulties. As summarised in Table 1, learners struggle with abstraction, experience limited emotional engagement, lack opportunities for contextual understanding, and find it challenging to develop critical reasoning (Garfield, 1995; Tishkovskaya & Lancaster, 2012; Wild & Pfannkuch, 1999).

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Table 1. Core pedagogical challenges in statistics education and their implications for statistical literacy.

Challenge	Description
Abstraction of Concepts	Students struggle to grasp abstract constructs like probability, variability, and correlation without concrete or embodied analogies. (Gal, 2002)
Low Motivation	Perceived irrelevance and lack of narrative engagement reduce student interest in statistics. (Watson, 2006)
Statistics Anxiety	Negative emotions limit performance and participation (Angelianawati, 2019).
Lack of Contextual Learning	Teaching often lacks real-world, interpretive scenarios. (Estrada et al., 2018)
Epistemic Disconnection	Learners see statistics as procedural rather than a way of reasoning or ethical reflection. (Gigerenzer et al., 1999)
Limited Multimodal Integration	Few courses integrate visual, narrative, or performative modes, excluding non-traditional learners. (Irving, 2015)
Digital Disengagement	Online statistics courses often replicate didactic models, failing to utilize interactive, embodied tools. (Rodighiero et al., 2022;)

These persistent challenges highlight the need for pedagogical approaches beyond procedural instruction. To respond to this need and guide our review, we developed a conceptual framework—The Theatre of Statistics. This model offers a lens through which to interpret the strategies identified in the literature.

The Theatre of Statistics

The Theatre of Statistics addresses the need for learning experiences that are emotionally engaging, contextually meaningful, and intellectually stimulating. It integrates immersive, performative strategies that make abstract concepts tangible, memorable, and culturally resonant. Its aim is to evoke epistemic emotions—such as curiosity, awe, and wonder—which are closely linked to deeper exploration, sustained engagement, and long-term retention (Heylighen, 2025; Gilbert & Gray, 2019).

A fundamental dimension of this approach is authenticity—the degree to which an activity feels credible, meaningful, and relevant (Jackson & Leahy, 2005; Walmsley, 2013). Authentic contexts foster trust and emotional investment, creating the conditions for deeper learning. As one child in a process drama observed, "If you're enjoying yourself, you might take in more …" (Jackson & Leahy, 2005, p. 4), pointing to the link between enjoyment, engagement, and memorability. Closely related is immersion which cultivates sustained attention and lasting emotional resonance, echoing Csikszentmihalyi's (1990) notion of *flow*—where deep engagement transforms learning into memorable experience (Aykol, 2017). Embodiment enables learners to enact statistical concepts, making abstractions such as correlation and sampling error tangible through movement and physical enactment (Irving, 2015). Finally, co-creation emphasizes collaborative meaning-making: learners become active "spect-actors" (Boal, 1979) rather than passively receiving knowledge. Neuroscientific research confirms that active participation enhances attention and engagement, providing a biological basis for the epistemic power of participatory learning (Gallese, 2009; Rizzolatti & Sinigaglia, 2010).

The framework draws on two main traditions:

- Classroom drama: immersive, participatory, curriculum-based activities, including process drama, improvisation, Live Action Role Play (LARP), and embodied metaphors (O'Toole & Haseman, 2019).

- Science theatre: scripted or semi-improvised performances that bring scientific themes or historical cases to life—making complexity accessible and stimulating public discourse (Ødegaard, 2003).

Emerging technologies, especially AI, can support improvisation, co-creation, and scenario generation across both traditions (Zakopoulos et al., 2023).

METHODOLOGY

Rationale, Objectives, and Aim of the Review

This review adopts an exploratory, integrative design, following Torraco's (2016) framework for developing integrative literature reviews. At the same time, it draws on the principles of systematic review articulated by Tranfield, Denyer, and Smart (2003), which emphasize transparency, replicability, and methodological rigor. To further support transparency in reporting, we also followed the PRISMA guidelines (Moher et al., 2009). The aim is to examine how performative approaches can enhance statistical literacy by fostering inclusion, engagement, and interdisciplinarity. Accordingly, the review maps strategies already applied in statistics education and identifies transferable practices from STEM, language education, arts pedagogy, and digital learning. Prior literature highlights the cognitive and affective benefits of performative pedagogies, including those supported by digital tools (Zakopoulos et al., 2023; Jusslin et al., 2022). Role-play and improvisation enhance analytical discourse and emotional engagement (Lee et al., 2015), echoing perspectives on how theatrical methods engages with scientific complexity (Campos, 2013; Sleigh & Craske, 2017). Immersive practices help learners "inhabit" abstract concepts such as variation and uncertainty, fostering deeper epistemic understanding (Bergner et al., 2021).

Review Design and Data Collection Strategy

We included peer-reviewed studies (2010–2024) adopting embodied or performance-oriented teaching strategies relevant to epistemic learning. Eligible works originated from STEM, language education, drama education, and arts-based pedagogy, provided they addressed embodiment, abstraction reduction, affective engagement, or multimodal meaning-making.

We conducted a two-phase systematic search using Google Scholar, ERIC, and Scopus:

Phase 1: Broad search ("science theatre" OR "drama-based learning") AND ("STEM education" OR "statistics education") retrieved 158 records. After removing duplicates and excluding studies lacking empirical grounding, using drama metaphorically, lacking educational/epistemic focus, or outside the 2010–2024 window, 95 remained. Only one—Bhargava et al. (2022)—explicitly addressed statistics.

Phase 2: Targeted search ("theatre," "drama," "embodied learning") AND "statistics education" yielded 55 records; 3 met inclusion criteria: Using Dance to Teach Statistical Concepts (Irving, 2015), Leveraging Interest-Driven Embodied Practices to Build Quantitative Literacies (Bergner et al., 2021), and Immersive Architectures for Visual Data Literacy (Rodighiero et al., 2022).

In total, 213 records were screened, and 93 were retained after applying the inclusion and exclusion criteria.

RESULTS

The retained studies originated primarily from interdisciplinary journals in science education, applied arts, and digital pedagogy. Only four articles explicitly addressed statistics, confirming the marginal role of performative approaches in this field. Two focused on embodied learning through gesture and motion (Irving, 2015; Bergner et al., 2021), one on immersive data visualisation installations designed to enhance spatial data literacy (Rodighiero et al., 2022), and one on participatory data theatre—a civic practice that stages datasets to foster community engagement and critical reflection, rather than formal instruction (Bhargava et al., 2022). Across disciplines, the most frequently adopted strategies included role-play, process drama, improvisation, embodied metaphors, and narrative storytelling. LARP and public science theatre appeared less common but demonstrated potential for engagement.

Meta-analyses (Lee et al., 2015; Jusslin et al., 2022) show that drama-based approaches consistently improve students' learning outcomes, motivation, and capacity for reflective dialogue about

their own reasoning. Research in science communication demonstrates that theatre can make abstract or complex ideas more accessible to wider audiences, lowering cognitive and emotional barriers to engagement.

Theatre and Drama in Statistics Education: Transferable Techniques

Building on the previous sections, this part examines how performative strategies can address persistent challenges in statistics. Guided by our framework, the Theatre of Statistics, we identified a range of formats that show potential for transfer to statistical learning.

The techniques listed in Table 2 were selected for their capacity to address the pedagogical challenges outlined in Table 1, including conceptual abstraction, low motivation, statistics anxiety, epistemic disconnection, and limited multimodal integration.

Table 2. Performative Strategies for Statistical Literacy.

Format	Challenges Addressed
Drama	
Role-Play: Ethics debates where participants simulate stakeholder perspectives and negotiate policies	Adds real-world context; reduces epistemic disconnection; lowers statistics anxiety (Braund, 2015)
Live Action Role-Playing (LARP): Immersive simulations with narratives, complex roles, and optional costumes	Reduces epistemic disconnection; boosts motivation; supports concept abstraction (Mochocki, 2014)
Improvisation: Real-time scientific decision-making in evolving scenarios, requiring collaborative responses	Supports abstraction; lowers anxiety; fosters flexible, evidence-based dialogue (Holdhus et al., 2016)
Embodied Metaphors: Using physical movement to model abstract phenomena like distributions or correlation	Grounds concepts physically; lowers anxiety; promotes multimodal integration (Varelas et al., 2022)
Theatre	
Demonstration Science Theatre: Performances where science itself is the protagonist, often using curiosity and humor to engage audiences.	Boosts interest and comprehension; lowers barriers to scientific content (Carpineti et al., 2012)
Public Science Theatre: Staged performances that embed scientific concepts within a narrative structure — including characters, story arcs, and emotional resonance.	Promotes multimodal integration; enhances motivation and emotional connection; supports memorability (Schulte et al., 2020; Rodighiero et al., 2022)

Two notable examples directly applied to statistics are *Data Theatre (*Bhargava et al., 2022), which engages students in performative classroom exercises to critically explore the narrative and ethical dimensions of real datasets; and *Dancing Statistics* (Irving, 2015), a YouTube series that illustrates statistical concepts through dance, has attracted almost 400,000 global views, and demonstrates how digital platforms can scale embodied learning.

Among the reviewed works, only Bravo et al. (2021) extend drama-based pedagogy into educational robotics. Students co-create science narratives using programmable robots as "actor-characters," combining embodiment, narrative, and behavior. This example bridges to the next section, which explores how AI can expand the dramaturgical ecology of statistics education.

AI Embodiment, and Performance: A New Dramaturgical Ecology for Statistics Education

AI tools, particularly LLMs like ChatGPT, may act as dramaturgical partners—co-authoring scripts, supporting improvisation, and guiding learners through uncertainty. They appear to foster engagement in technology-enhanced drama education (Piriyaphokanont & Sriswasdi, 2022), potentially expand opportunities for narrative simulation and role-play in learning environments (Hwang et al., 2022), and can be used to co-create scripts and interactive performances for both classrooms and public science theatre (Zakopoulos et al., 2023). In this way, AI could help amplify the expressive potential of performative pedagogy and science communication.

Implications and Future Directions

The challenges outlined in Table 1 and the strategies in Table 2 illustrate how performative methods can help overcome cognitive, affective, and contextual barriers in statistics—across classrooms, theatres, and public spaces—by deepening engagement, fostering emotional resonance, and broadening participation. This calls for a form of statistical literacy that integrates procedural fluency with performative and narrative modes of reasoning. When paired with AI and digital tools, theatre emerges as a multimodal epistemic practice (Zakopoulos et al., 2023) that unites language, gesture, and embodied action (Jusslin et al., 2022).

Critical data literacy perspectives (Markham, 2018; Luka & Markham, 2022) further stress the ethical and political dimensions of data, with performative pedagogies fostering reflexivity and civic awareness—transforming statistics into a practice of engaged citizenship.

From this synthesis, four priorities emerge for advancing statistical literacy: using drama-based strategies to reduce abstraction and engage conceptually, affectively, and ethically (Braund, 2015); adapting public science theatre to embed uncertainty and ethical reasoning (Heras & Tàbara, 2014); integrating multimodal and performative methods in educator training to build creativity and reflexivity (Jarvis, 2012); and leveraging generative AI to co-create embodied, narrative-rich decision-making scenarios (Zakopoulos et al., 2023)—all aligning with calls for inclusive, resonant, and ethically grounded data engagement (Henriksen et al., 2022; Berk, 2009).

CONCLUSION

This paper aims to advance innovation in statistical pedagogy by positioning drama and theatre not as peripheral tools, but as a central epistemic practice—grounded in emotional, ethical, and embodied learning. More specifically, it highlights the complementary roles of drama-based and theatre-based approaches: the former rooted in participatory and improvisational classroom activities, the latter in scripted or semi-scripted performances designed to engage audiences through narrative and emotional resonance. Despite its broader uptake in other disciplines, performative approaches remain largely absent in statistics. The Theatre of Statistics proposes a performative ecology that reframes reasoning as affective, situated, and experientially rich. Future research should explore the cognitive, emotional, and epistemic impact of these strategies through mixed-method and longitudinal designs. Ultimately, drama and theatre are not merely methods—they offer a way of thinking with data.

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