

Playful experiential approach to reasoning with evidence

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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.

INTRODUCTION

The term experiential learning is given prominence in the mission statements and profiles of many universities (Stock, Cola & Kolb, 2024). However, recent editions of the journal *Experiential Learning & Teaching in Higher Education* (Vol 7,1 & 2) dedicate two special issues to the topic of Defining Experiential Education. Thus, it is apparent that the field is still evolving. The foundational definitions of Experiential Learning Theory (ELT) rely on the following components as a cycle: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization, (d) active experimentation (Kolb, 1984). There has been a lack of clarity about the nature of these stages and Kolb (2014) has had to respond to critique of his original work (Kolb, 1984), some questioning its empirical basis, others the theoretical foundations (Morris, 2020) and other models have been proposed. However, after an extended review Morris (ibid) produced a nuanced revision consisting of “*contextually rich concrete experience, critical reflective observation, contextual-specific abstract conceptualization, and pragmatic active experimentation*” (italics in the original). There may yet be extended discussion about the meaning of those amendments. At the heart of the attempts to refine what is the most widely understood conceptualisation of ELT, is the risk that ‘experience’ is poorly operationalised and as is common with many innovations, that the focus is on method rather than learning. Stock, Cola and Kolb (2024) recently argued that experiential learning extends beyond ‘having’ an experience and requires that the experience involving deep engagement and active participation, having scope to influence ‘*beliefs, feelings, ideas, and behaviours*’.

These forms of experience resonate strongly with recent research with play-based methodologies (McCusker, 2018; McCusker, 2020; McCusker, 2023a) and illuminate previous research in statistics education (Ridgway, Nicholson & McCusker, 2007; Nicholson, Ridgway & McCusker, 2010; McCusker, Nicholson & Ridgway, 2010) as well as current developments focused on updating that work.

Play, in common usage, has a wide semantic range, it is used to refer to contexts as diverse as chess and rugby, and includes activities such as drama, pretending, joking and pranks, toys, computer games and even golf. It is used to refer to recreational activity, performance, portrayal, enjoyment and fun and a number of other varied activities. Furthermore, there are academic constructions of play, for example, defined by biologists or psychologists, in ways which are very different from its colloquial use. In most contexts, play is constructed in opposition to work and often seen as frivolous and not serious.

Despite abundant evidence (Shen, 2023; Lockwood & O’Connor, 2017; Proyer, Tandler & Brauer, 2019) that play has an important role in developing and fostering creativity, it is often seen as within the domain of children and not for ‘serious adults’ (Mainmelis & Ronson, 2006). An increasing number of organisations now recognise the link between play and creativity and have integrated it within

their work environment (IDEO, Google, Pixar). However, this runs the risk of institutionalising the activity and needs to be (un)managed carefully. Many examples of ‘play’, particularly those in professional environments are not much fun. One need only think of play-based workshops, role-play activities, business games, educational games or any number of such activities which seek to harness the power of play. At the heart of this is the difference between play and playfulness. Playfulness can be seen as a disposition or mood state as opposed to an activity in and of itself (Bateson & Martin, 2013). It is characterised by, curiosity, pleasure, spontaneity and fun (Guitard, Ferland & Dutil, 2005). When Malone (1981) looked at what made computer games ‘fun’ in the context of educational games he arrived at the view that *challenge*, *fantasy* and *curiosity* were fundamental to intrinsically motivated instruction. This requisite for intrinsic motivation is echoed by Bateson and Martin (2013) in their account of what might constitute ‘play’. Guitard et al. (2005) go on to suggest that playfulness allows adults to adopt an open-minded approach, free from situational contexts and conventions, when facing challenges and to be more accepting of failure allowing original solutions to be discovered. The conceptualisation of playfulness within this paper is aligned with the creative, open and unconfined view outlined above. It is conceived as a disposition which is aligned with naïve child-like play, which is unencumbered by social norms and expectations and tries to capture the deep immersion associated with such play. This is simple state for young children but becomes increasingly difficult from adolescence as we begin to learn to constrain our behaviours and expressions through social norms and boundaries and our ego defences. In the current context, playfulness and seriousness are not seen as mutually exclusive. The work presented here is focused on states of playful play, which can also at times be serious play.

CURRENT CONTEXT

It may come as a surprise to some within the statistics education community, that in the wider population there are a number of people who do not see statistics as a natural site of fun, play or playfulness. A brief review of recent statistics questions within the UK GCSE and A’ Level examinations identified the following contexts; the height of adult males born in 1996, recycling of waste in the London borough of Hackney, the age of people on the electoral register of the West Midlands, registration of cars and motor cycles per quarter, the association between flower arranging and needlecraft, mass of tins of spaghetti, interval between rain showers, an unspecified game with random number generators and dice, quality control of a machine in a toy factory (Pearson 2023 GCSE Statistics, AQA & A’ level Further Mathematics Statistics paper 2023). These are an opportunistic selection, chosen to illustrate a point, and there are others which may have some sporting or hobby interest, e.g. team match scores, heights of professional players or fish and frog populations within a specific geographical area. However, they are largely of contexts which don’t really engender a playful disposition. Furthermore, the statistical reasoning required to find solutions understandably rely on statistical techniques, but little engagement with and exploration of data. Mark schemes tend to be associated with a correct answer rather than reasoning and drawing conclusions with real-world data. There is little scope for ‘playing’ or reasoning with the data, in fact there are occasions where such engagement would lead to an ‘incorrect’ answer. (Nicholson, Ridgway & McCusker, 2009). These approaches might be reasonable in the context of the aims of current statistics curricula, with some emphasis on formal inferential methods and techniques. However, in the UK at least, wider demands across other disciplines require more open and less deterministic approaches to dealing with statistical evidence. Most of life’s interesting problems involve many more compounding and confounding factors, than the single or two variable problems encountered within the pre-university curriculum and whilst a case may be made that such problems are at a level of complexity, beyond the majority of school-age pupils, there is evidence that presented in the right format and with the right motivation, they are capable of reasoning with complex data, well beyond that encountered within school syllabi. (Ridgway, Nicholson & McCusker, 2007; McCusker, Nicholson & Ridgway, 2010)

The lack of opportunity to explore and engage with realistic and real data which models issues encountered beyond the educational domain, results in a necessarily limited aptitude to engage with some of the larger issues associated with global challenges such as migration, climate change, poverty and scarcity of resources. The tension which arises is that between accessibility and accuracy (Higgins & Katsipataki, 2016) because of the lack of analytical tools, data in the public domain is often presented

in reductive terms so that it can be understood by the general public, but this lacks the authenticity to communicate the wider picture of complex phenomena. However, if data were currently presented in a format which more accurately represented the issue at hand, the complexity of the statistical reasoning would make it inaccessible to the general public.

HISTORICAL CONTEXT

The SMART Centre, previously at Durham University, now based at Northumbria University, have developed a series of data interfaces which allowed complex real data to be displayed in ways which made it accessible to 14-year-old pupils over a wide range of abilities. (e.g. Nicholson, Ridgway & McCusker, 2009). Contexts were chosen to engage the target audience and were related to issues relevant to their lives. Rather than trying to elicit a correct answer, pupils were encouraged to explore the data landscape and draw their own conclusions and report these in any way they felt appropriate (e.g. letter to the editor, podcast, interview etc.) The data exercise was presented in a way which had many resonances with more recent work in play, playfulness and experiential learning, allowing a reconsideration of the pupils' interactions through the lens of play and playfulness allowing us to think about the way the data is presented as well as prompts and provocations which motivated the pupils. (See Fig. 1 and Fig. 2). The data interface and exercises developed by the SMART Centre encouraged an exploratory approach to the data analysis, without any specified 'correct' answers, beyond drawing reasonable conclusions from the data available. In some cases (e.g. STI / Heart disease), users are encouraged to draw their own conclusions about the nature of the disease, and in some respects, the extent to which they may be affected by them. There is no predetermined 'direction' for the data exploration although the complexity of the stories told and the inter-relation of the underlying data, is broadly evaluated within the framework of the SOLO taxonomy (Biggs & Collis, 1982).

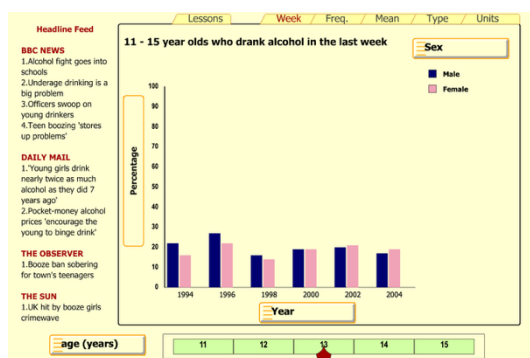


Figure 1. SMART Plotter of alcohol use with links to news articles.

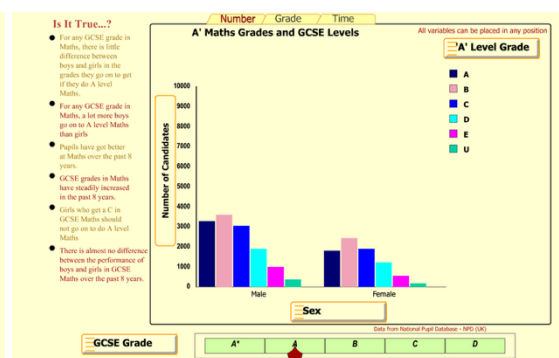


Figure 2. SMART Plotter of alcohol use with prompts / provocations.

Experiences with LEGO® Serious Play® and Clowning have been illuminating in recognising the characteristics of the interactions identified in the use of the SMART interface. Resonances were found between the engagement of the users and Bateson and Martin's (2013) view that 'new forms of behaviour' and 'modes of thought' emerge from play and particularly from playful play.

PLAY EXPERIENCES

LEGO® Serious Play™

LEGO® Serious Play™ (LSP) is a methodology which was developed primarily for use in business contexts and has been widely used by a number of commercial organisations (e.g. IKEA, Samsung, Microsoft). However, the principles which underpin the LSP methodology are supported within the literature on educational research, by Papert's (1986) ideas of constructionism, the use of conceptual metaphors (Lakoff & Johnson, 1980) and research on the affordances of play and serious play amongst adults (Bekebrede, Lo, & Lukosch, 2015; Winnicott, 1971; Schrage, 1999; McCusker, 2014).

In LSP facilitated workshops, participants are encouraged to construct, express, share and develop their ideas and conceptualisations through the use of LEGO® bricks. Central to the practice of LSP workshops is the principle that all voices are heard, equally and that the discussion is not led by dominant individuals or ‘conventional wisdom’. The playfulness of LSP is a central aspect of the method, it is that playfulness which opens up dialogue either with oneself or with others. Where a child at play may ‘think aloud’ in dialogue with themselves, with an imaginary other or with a friend, such activity is generally frowned upon in adulthood and the benefits of this are often not realised. In its practice LSP encourages visceral responses to prompts. The playful aspect of the method encourages participants to filter less their initial response and to explore their intuitions. This makes space for more creative and inventive expression or interpretations.

Clowning

The application of clowning to the educational domain is somewhat less widespread than LSP, whilst there are examples of clowning being used in professional and ‘serious contexts’ such as healthcare and medicine (Finlay, Baverstock & Lenton, 2014), social work (Steggall & Scollen, 2024) and in the political and humanitarian arenas (Ramsden, 2015, Parsley, 2022), clowning and its application in the educational domain is relatively new (McCusker, 2021, 2023a, 2023b). Nevertheless, there is much to be learned from this domain, relevant to the teaching and practice of statistics and data science. The clown takes a non-linear approach to problem solving, continually redefining and testing for solutions through an empirical deductive process. Clowning principles encourage the abandonment of preconceptions, promote improvisation and experimentation, challenge assumptions and reframe the issues at hand. The state of ‘clownhood’ is one in which the individual is stripped of all masks and ego and is open to all possibility. The clown is familiar with improvisation, failure and the liminal space or wilderness of ‘not knowing’. Nalle Laanela’s clown Manifesto proposes that for clowns, “*It’s not about acting stupid, it’s about daring to be perceived as stupid*” (Laanela & Sacks, 2015, p. 15). This principle opens up the scope for clown-statisticians to experiment with exploratory and creative approaches to analysis. What they need is the tools which enable this, without limiting them to a series of computationally heavy analytical processes which can stand as a barrier between the analyst and the data.

Principles of play

One of the central components of playful play is ‘letting go’. This the letting go of inhibitions, of preconceptions and of fear. In LSP and clowning this letting go is achieved in two ways. LSP encourages open and candid expression through immersion in what (Csikszentmihalyi, 1990) refers to as a ‘flow state’ of effortless engagement. In this state, the participant is fully absorbed, where consideration of time, hunger and self-consciousness are of lesser concern. Core to achieving this state is to engross the participant in activities which engage their interest and forges a balance between their levels of challenge and skill, with each of these incrementally increasing in concert, until high levels of both can be achieved. This can be seen by the building of complex metaphors in LEGO® or in expertise at high levels in computer games. In clowning, this state of ‘letting go’ is achieved through engagement with increasingly challenging tasks, which are doomed to failure, such that the clown learns to adapt ‘in the moment’ to whatever challenge they are faced with. Through this they build an expertise and reliance on an ability to improvise, without having solid expectations of positive outcomes, confident in the knowledge that even in failure, positive outcomes can be achieved (McCusker, 2023b). Through constant immersion in a liminal space of ambiguity, uncertainty and unpredictability, the clown moves away from the dichotomy of success and failure, trusting that something positive or even extraordinary will emerge (Micha Usov in Lebank & Bridel, 2015)

LESSONS FOR REASONING WITH EVIDENCE

Bateson and Martin (2013) identify that much behaviour amongst humans and animals, involves a trade-off. A balance between conflicting needs which often result in locally optimal solutions. These result in meta-stable equilibria often representing a globally sub-optimal solution which requires perturbation or disruption to dislodge them to allow a search for better solutions and a global optimum to be identified. Such approaches are often desirable in terms of making sense of data, where

preconceptions may engender a limited exploration of the phenomena. Stock, Cola and Kolb (2024) make the point, in terms of experiential learning, that to benefit from an experience, a learner must “*become personally engaged with it, fully present, deeply involved and actively participating either through reflection or action*” (p. 83). These principles have a strong resonance with the ideas of Reasoning with Evidence which underpinned the design and use of the materials developed by the SMART centre over the years.

The SMART plotter (Figures 1-6) is particularly suited to such explorations allowing rapid plotting and replotting of data with the scope to adjust parameters and variables, with little overhead and requiring only basic technical skills. The interface is largely transparent in terms of analysis and has the flexibility to allow complex and multivariate data analysis as well as more simple bivariate comparisons allowing engagement with the phenomena without the obstacle of navigating the mediating model. The open format of the data presentation encourages the user to explore the data more comprehensively rather than seeking a single solution, encouraging thoroughness and higher order operations such as generalisation and extrapolation. The interface encourages a playful approach to data analysis allowing hypothesis to be suggested and tested rapidly. We observed rapid and deep engagement with the interface. With users scaffolding their own work, initially making pairwise comparisons but soon moving on to make more general multivariate statements. With less structured instructions, rather than being told what to find, students were able to and develop their own analyses of the data and draw their own conclusions, highlighting aspect they felt were most interesting and relevant to them.

DESIGN PRINCIPLES

The SMART Plotter original software was developed in Macromedia Flash which has since stopped being supported by web browsers thus the data represented in Figs 1 and 2 are somewhat outdated, nevertheless observations about the functionality and engagement with the software are still relevant. A new version of the software is under development, in web compatible HTML5 and JavaScript (Figs 3-6) (https://research.northumbria.ac.uk/smartcentre/?page_id=43) and whilst the interface still lacks the full facilities of the original, the basic functionality and useability remain the same, the interface has been trialled informally, and additional reflections are included here in the context of future design of materials.

Topics have been chosen to engage pupils using data which has current relevance to their lives or those around them, such as Alcohol Use, Sexually Transmitted Diseases, Exam Results, Access to HE, BMI and Obesity, or topics which have global relevance such as Global Access to Education and Poverty and the Sustainable Development Goals. In some cases, pupils were presented with stimuli or provocations and asked to either support or rebut these statements, e.g. Fig 1, where they were presented with headlines, common at the time when the interface was developed, which sought to demonise youth and highlighted teenage drinking as a new and serious problem. Suggestions were that low-priced alcohol and easily accessible ‘alcopops’ were amongst the causes of the problem. Suggested solutions in the media tended to be around education or police enforcement. This data has been reported on previously (McCusker, Nicholson & Ridgway, 2010). However, recent work in the area of play and playfulness has allowed further reflection on the data collected and observations made at the time and continue to inform future developments

PLAYFUL PLOTTING

Engagement with the SMART plotter has always been largely intuitive with little instruction needed, beyond explaining to users that the axes titles were draggable and interchangeable. Where provocations were used, learners were able to be led through increasingly complex analyses, e.g. Fig 1 from “*Young girls drink nearly twice as much alcohol as they did seven years ago*” which amounts to a graph reading exercise, to more nuanced analyses, such as “*underage drinking is a big problem*” which requires users to contextualise alcohol consumption in terms of population, age, variation over time, amount and frequency of alcohol use, as well as personalised judgements on what constitutes a ‘problem’. Nevertheless, data showed that 14-year-olds were able to engage with the data and produce sophisticated responses (McCusker, Nicholson & Ridgway, 2010). Data showing that populations having experienced lessons about alcohol use behaved in ways very similar to those who had not had lessons, sparked interest and engagement in initially reluctant students. What was noticeable was that

with structures and approaches which demonstrated to students that subversion and dissent were sanctioned, initial reticence was soon overcome. The use of real data encouraged pupils to explore ways to overcome dominant rhetoric and to construct their own narratives of the messages in the data. This in the context of Hand's (2009) affirmation “*But it is statisticians for whom the raison d'être is the extraction of meaning from data...*” (p. 288) demonstrates the potential of the plotters. In the more open formats of the plotter (Figures 3-6), users explore the data more freely. The interface displays data on sexually transmitted disease, with factors of age range, type of STI, region of England, sex and timeline. After basic instructions in its use, users rapidly engage with the data, creating and exploring their own questions and hypotheses. Interestingly, in the context of the current paper, users rapidly accelerate along the ‘flow channel’ increasing the complexity of their analyses as they learn to navigate the interface, balancing their skill with the level of challenge they set themselves. Ultimately, analysing and describing coherent messages of data in 6 dimensions.

The facility of the SMART Plotter, to explore freely, to plot and replot and frame and reframe the data rapidly with little or no negative consequences, leads to playful approaches to data analysis. Users begin with wide search strategies looking for strong messages but soon settle into more structured methods. However, aligned with play-based methodologies, the mode of engagement is unencumbered by fear of being ‘wrong’, it is improvisational and adaptive, at times subversive and looking to counter dominant conceptions. Ambiguity and uncertainty, if not embraced are at least tolerated and the open format, with rich data, allows users to drive their own analyses exploring their intuitions, allowing more creative interpretations with a multiplicity of outcomes.



Fig. 3. SMART Plotter of STI incidence Age Range 20-24.

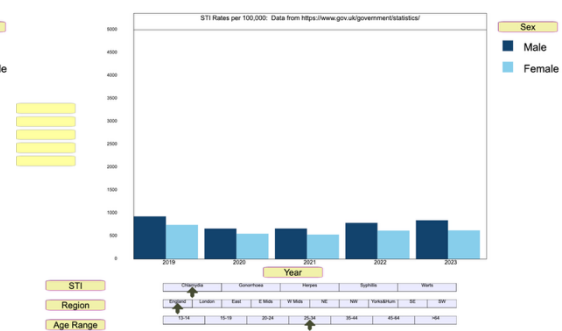


Fig. 4. SMART Plotter of STI incidence Age Range Adjusted.

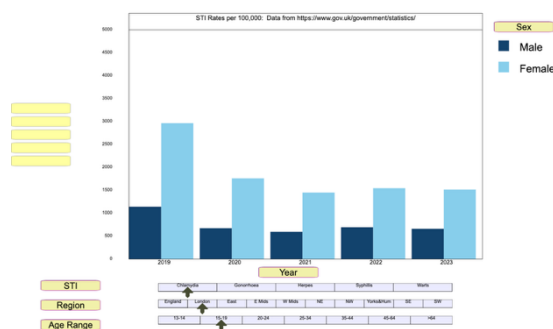


Fig. 5. SMART Plotter of STI incidence Age Range and Region adjusted.

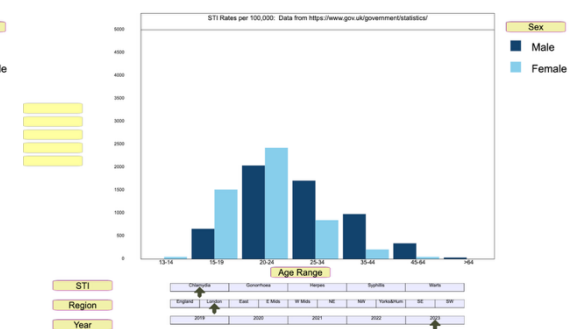


Fig. 6. SMART Plotter of STI incidence Variables positioned to change focus.

CONCLUSION

The SMART Plotter has been used successfully for more than 15 years and has been part of an argument for more realistic data modelling, suited to the affordances of technology, the abundance of rich data and the complexity of the challenges faced by modern citizenship. Recent work in the area of play and playfulness has illuminated previous experiences with the SMART Plotter and informs developments of the updated web compatible interface. There are many resonances between the drivers

of play and the principles of data handling and statistical literacy. The suggestion here is not that we don red noses in our attempts to teach statistics, but rather than we pay close attention to opportunities for play and playfulness and observe those who are able to embrace that freedom of expression. By harnessing those imperatives which allow us to be playful and implementing them in our pedagogical design, we can develop more inclusive and open approaches to data analysis and sense making which might increase engagement with public data, thorough accessible and empowering approaches.

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