**Innovative ICT - Engagement, Inclusion and Interaction**

Final project Report – Alcohol and a Mashup: Exciting and Engaging Data Displays

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**The Project**

Every important social issue – crime, drugs, poverty, health, education – involves the interplay of a variety of factors. These are complex issues which are multivariate in their nature. Life is multi-variate. However, most of the education we provide to young people does not prepare them to engage with multi-variate concepts. We teach, almost exclusively, uni-variate, linear relationships in our Maths and Statistics classes. In other subjects, major issues are rarely addressed by examining quantitative data. If we want an informed citizenry, we need people to be able to engage in debates and decisions about issues which are of great import to them. Much of the debate in the media on these important issues is grounded in opinion and speculation rather than evidence. This research project explored the extent to which pupils across the ability spectrum can reason effectively with multivariate data on a topic of direct personal relevance, and can relate evidence to what they read in newspapers.

We created a series of interactive multivariate displays on alcohol use amongst young people. Data to populate the displays were sourced from the Office of National Statistic (ONS) and the NHS Information Centre (IC). These displays were integrated with current media articles creating a mock ‘mashup’. A Mashup is a webpage which combines web based media form a variety of sources, resulting in a hybrid or derivative display.

**Research Focus**

We were interested in the ability of children across the educational spectrum, particularly low attaining pupils, to use the new interfaces to engage with complex data in a way which allowed them to relate information to issues of relevance in their own lives.

We were also interested to see if the constructivist activities led to a greater engagement and understanding of the issues at hand, and if pupils could deconstruct media articles in a critical way and report back in a format with which they felt comfortable.

We were also looking for common misconceptions or errors in pupil descriptions of evidence.

**Materials and Activities**

Lesson plans and data displays were created and populated with data concerning issues which are of relevance to young people. The first of these was a series of multivariate displays about smoking behaviour amongst young people, used as a familiarisation piece, which allowed the children to get used to the software and start engaging with multi-dimensional data. The mashup interface comprised a multivariate plotter, populated with data on young people’s drinking behaviour, displayed alongside a series of 8 newspaper headlines taken from a range of news based websites (BBC, Daily Mail, Observer, The Sun). Each of the headlines acted as a link to the full article behind the headlines. Task were set which required the children, in groups or individually, to deconstruct the articles and formulate a response in a variety or formats, ranging from a written article to a mock news report. Children were encouraged to record their response in whatever way they felt most engaging.

**Method**

Pupils were presented with the Mashup software which brought together; news headlines from a range of daily newspapers and news websites and real data sourced from the NHS Information Centre and the Office of National Statistics. The data were presented in the SMART Centre interface (<http://www.dur.ac.uk/smart.centre1/mashup/alcohol.htm>)

The news articles were typical of those which the target audience might meet in their everyday lives. As is common, the articles presented much speculation about drinking habits as ‘fact’. The reports tended to demonise youth. The Mashup software allowed pupils to interactively investigate survey data which covered details such as the percentage of boys and girls who reported drinking alcohol within the previous week, over the period 1994 to 2004. Other data included the frequency of alcohol consumption for groups of children aged 11 to 15 who had and had not received lessons about alcohol consumption (published in 2008) and amount and types of alcohol consumed by boys and girls over time.

By manipulating the axes in the graphs, pupils were able to vary for example sex, age range and time period for the variable under investigation.

About 300 children from 10 classes of varying ability groups in 5 schools around the country were involved in the research project. Students worked individually or in groups of up to 4. The majority of these produced written artefacts, though there were also a few video reports, the best of which are available on the SMART Centre Website (<http://www.dur.ac.uk/smart.centre>), with appropriate permissions from the schools and parent / guardians. In total about 100 reports were produced and analysed for the purposes of this project.

Typically, activities extended over 3 hours of teaching time. This allowed pupils to familiarise themselves with the operation of the software, then tackle the main task of creating a media report on the topic of Alcohol and Young People. These reports took the form of letters to the editor, TV news reports, newspaper articles, voice recordings and interviews or any format the pupils felt comfortable or familiar with. Some of class sessions were orchestrated by the researchers and some by mathematics class teachers or specialist teachers.

The structure for student outputs was very open. Pupils were not given strong guidance on what they were required to produce or how they should go about interpreting the data. They were very much encouraged to explore the domain and report on their findings, with some regard to the news media articles.

**Analytical Framework**

The student work was in the form of open responses, these needed to be categorised in some way so that the work could be analysed in terms of engagement with the data. To achieve this two of the researchers discussed the range of artefacts produced by the pupils. This was followed by each of the researchers writing some formative feedback on a sample of student artefacts. Analysis of the formative feedback allowed a preliminary analytic framework to be constructed and used to formalise the key features of the formative feedback.

Categories for the framework, are briefly outlined here:

Use of Argument: Use of data to build and support the case being made.

Use of Empirical Data: Extend to which data is investigated and exploited

Literary Style: Writing style, sense of audience, structure and coherence.

Further details are available within publications on the SMART Centre website as are some examples of student work.

**Results and Findings**

In general, children were enthusiastic with the task, though some of the more disengaged pupils required more encouragement and coaching to identify the contentious points within the news articles. Once this had been achieved, it became easier to elicit at least spoken responses, with and without reference to the data displays. Observation of the classroom activities and analysis of the responses led to some interesting insights about levels of engagement with the tasks, the interfaces and the data.

The analysis of the material showed that most of the pupils engaged well with the tasks. Reports were generally well presented and written with a good sense of target audience and structure: only four reports failed to meet all of these criteria adequately.

* Over 80% of the reports used data, with about 60% using it accurately and appropriately to critique the media articles or in the creation of their own articles.
* Just over 20% of the reports described trends in a clear and accurate manner, and a further 10% described trends with at least some degree of success.
* About 15% of the reports made mention of 2-way interactions: this is interesting as such interactions are usually considered to be too complex for the current age group. In fact such analyses are not required even within the A Level Mathematics and Statistics curricula in England.
* Over three quarters of the responses showed some evidence of data manipulation within the interactive displays. More groups may well have manipulated the interfaces, without showing evidence of this in their reports.
* A considerable proportion (20%) of the groups used data external to that provided within the displays: most of these used data pertinent to the issues, though a small proportion (<5%) used irrelevant data from, for example, US sources.

***We were interested in the ability of children across the educational spectrum, particularly low attaining pupils, to use the new interfaces to engage with complex data in a way which allowed them to relate it to issues of relevance in their own lives.***

Poor literacy skills and a lack of engagement are often strong indicators of poor achievement in mathematics. Teachers reported the level of discussion amongst low-attaining pupils to be much more focussed than they had previously seen from those pupils. The pupils themselves reported that they found being able to explore the data, and discover the ‘stories’ in the data for themselves, to be far more satisfactory than the way they normally encounter sensitive data – where they felt ‘preached at’. Because the activities involved collaborative work in small groups, with discussion, more than writing individually, those with weak literacy skills appeared to be at less of a disadvantage than they are with more traditional materials.

***We were also interested to see if the constructivist activities led to a greater engagement and understanding of the issues at hand and if pupils could deconstruct media articles in a critical way and report back in a format with which they felt comfortable.***

Anecdotally, pupils reported that they enjoyed the interaction with the data displays, they felt it was very different from the usual data handling they were presented with. In general there was a sense that there had been a change in the didactic contract, in that the pupils became the holders of the information and the way in which they extracted the important aspects, and indeed what they considered important, was up to them.

Further verbal reports from session leaders were very positive. Reports were of high levels of engagement and interaction, both with the exercise and with each other. From the point of view of the researchers the general sense was that they were pleased with the increased levels of interaction and engagement with the data and the PSHE issues.

***We were also looking for common misconceptions or errors in pupil descriptions of evidence***

Pupils’ interpretation of graphs was consistent with a large body of literature which shows that ‘differences’ real or imagined are over interpreted. . Often pupils failed to see variance as just that, and tended to report small year on year variations for example, as important year on year changes. Preconceived notions of what they expected to find was sometimes reported as what was there. For example, some pupils identified a positive difference between the drinking behaviour of those who had had alcohol awareness lessons and those who had not, even thought this is not evident in the data.

It was also recognised that even though most pupils manipulated the data interfaces and viewed the data in multi-variate displays, the reporting of multiple interactions was some what limited.

Without overstating the anecdotal evidence, it was felt that these limitations were perhaps due to pupils not having had any experience of reporting or recognising multi-variate interactions. There was little doubt that the interfaces allowed the pupils to observe such interactions; however, their unfamiliarity with the ideas and even the language of ‘interactions’ limited their ability to report on it.

**Summary**

This study has shown that school pupils are able to work effectively with complex multi-variate data presented in the appropriate format. Current curricular conceptions overcomplicate and misjudge the difficulty level of reasoning with complex evidence. Within this project we have developed classroom based material and an analytic framework that enables the development of skills associated with reasoning with complex data.

**Future Developments**

Further work should be centred on a series of lessons over an extended period which familiarised pupils with the language and concepts of multi-variate data and multiple interactions.

**Dissemination Activities**

The following presentations have been (or will soon be) given. All presentations include acknowledgement and thanks to BECTa for funding some of the work reported. In addition to these presentations, a paper based on the work has been submitted to BJET.

Nicholson, J., Ridgway, J., and McCusker, S. One Small Step For A Pupil - One Giant Leap For Citizens. Paper to be presented to the IASE satellite conference, Durban SA 2009

Ridgway, J., Nicholson, J, and McCusker, S. (2008). *Alcohol and a Mash-up: Understanding Student Understanding*. ENAC biannual conference, Berlin.

Ridgway, J., Nicholson, J., and McCusker, S. (March 2009). Engaging Naïve Users in Reasoning with Sophisticated Evidence. Paper presented to the Health Protection Agency, London.

Ridgway, J., Nicholson, J., and McCusker, S. (March 2009). Sexually transmitted diseases, alcohol abuse and CVAs –an experiential approach. Paper presented to the Health Services User Group, Royal Statistical Society, London.

Ridgway, J., Nicholson, J., and McCusker, S. (2008). *Sex, Drugs and Alcohol - an Experiential Approach.* Workshop at the International Conference on Mathematics Education, Monterrey, Mexico.

Ridgway, J., McCusker, S., and Nicholson, J. (2009). DD4D4D – Displaying Data in 4 Dimensions – for Deconstruction - studying students working with multivariate data to deconstruct newspaper accounts. Paper presented at the joint IIID and OECD Conference *Data Designed for Decisions,* Paris 18-20 June.