Centre for Statistical Education

Solving the Problem of Teaching Statistics?

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Summary

i. Background to the review of statistics and handling data in the curriculum

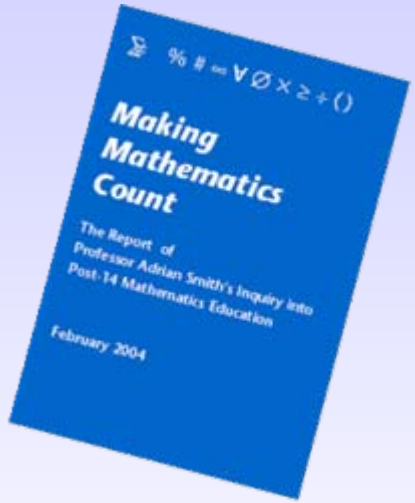
ii. Results:
   a. re-thinking the teaching of statistics
   b. using a problem solving approach
   c. exemplar resource

iii. Applications to undergraduate teaching

iv. Introducing statistics to undergraduate social science students

RSSCSE-QCA Project
Statistics and Handling data

Adrian Smith's Post-14 Maths Inquiry



recommendation 4.4:
"(i) ...restore more time to the mathematics curriculum ...and (ii) [recognise] the key importance of Statistics and Data Handling as a topic in its own right and the desirability of its integration with other subject areas ."

QCA decided to review the S&HD content of GCSE maths.

To determine:

- what should remain core
- what may be beneficially seeded through other subjects

RSSCSE commissioned to complete the research

Outcomes: re-thinking the teaching of statistics

Stage one (Apr – Dec '05)

20% sample of schools surveyed

5 recommendations made to the QCA

Key recommendations…

Teach statistics through **real world examples** *within* the mathematics curriculum.

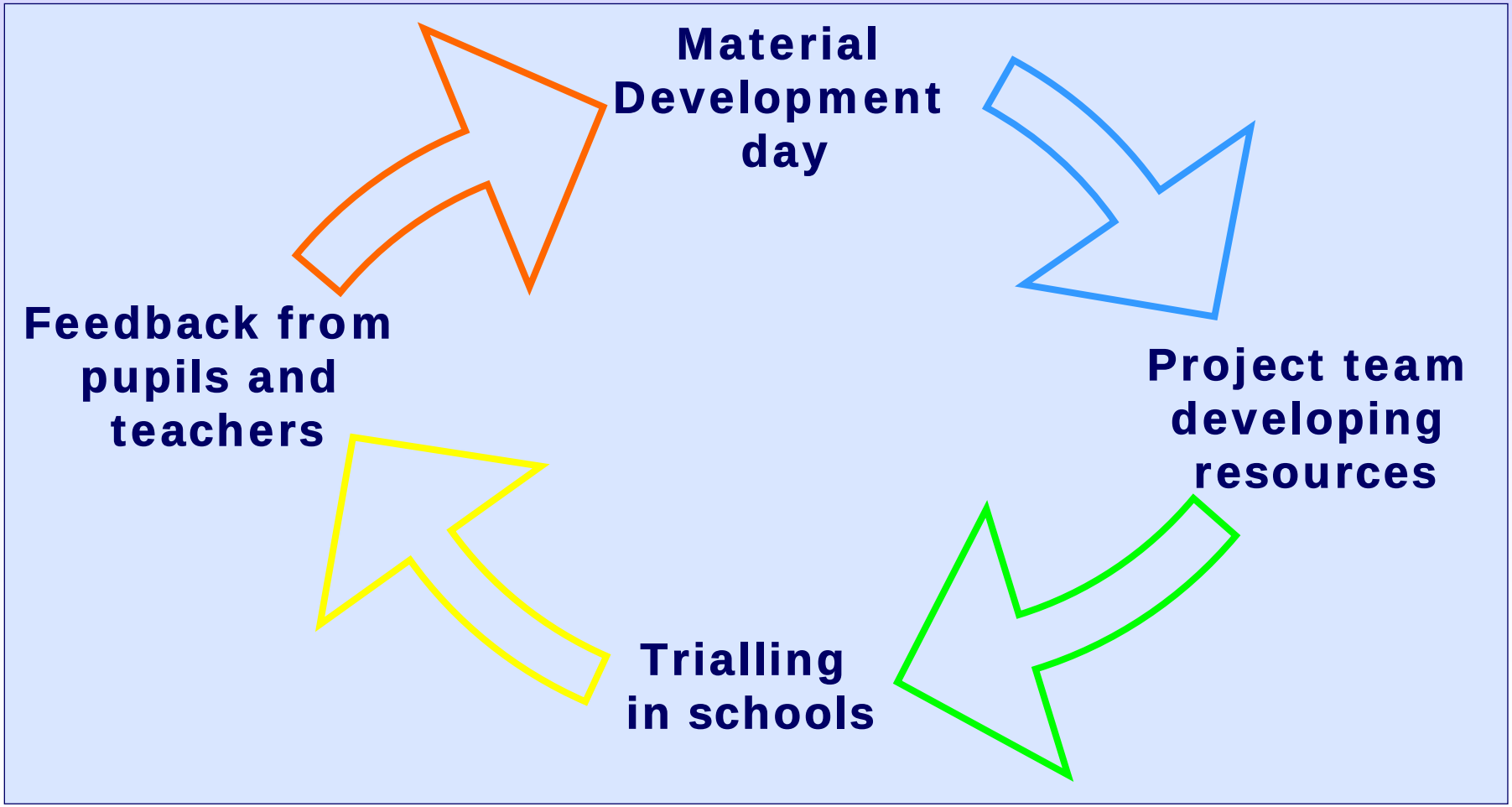
Trial new ways of assessing the statistics and handling data coursework

Develop a freely available comprehensive range of teaching materials using *real data*

The materials should teach through a *statistical problem solving approach (PSA).*

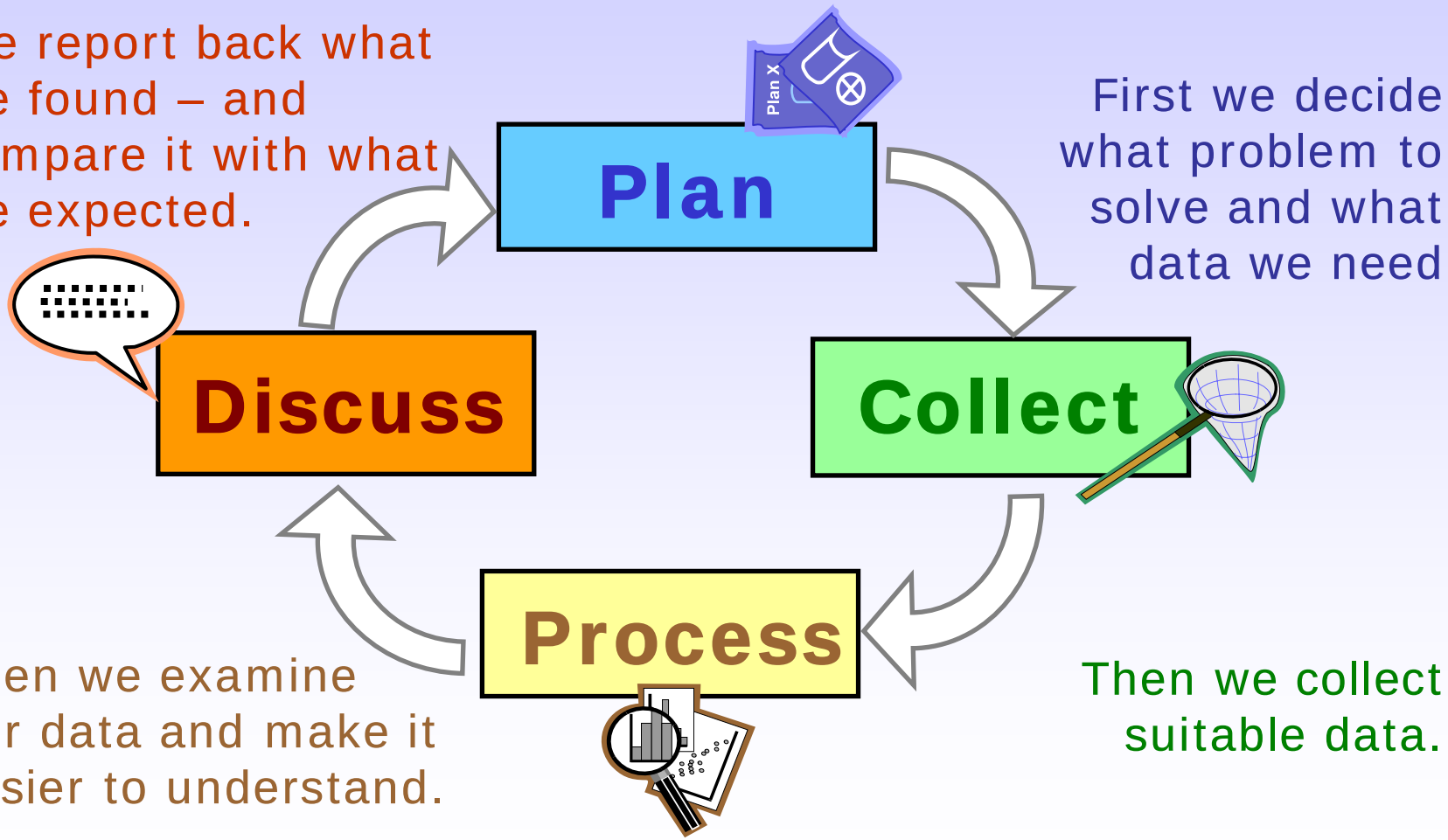
Stage two (Jan – Dec ’06)

Creating and trialling resources and an assessment regime based on the **problem solving approach (psa)**



Outcomes: using a Problem Solving Approach

Problem solving approach



Resources on website (www.rsscse.org.uk/qca)

QCA - RSS Centre Review of Handling Data and Statistics in GCSE Mathematics

Centre for Statistical Education

NOTTINGHAM TRENT UNIVERSITY

Homepage

Introduction

Resources

How safe is your area?

Crime Scene Evidence

Virtual Reality Gloves

Where's worst?

How far, fast and high?

How old is your height?

What's in your bowl?

World Population

Software

Microsoft PowerPoint Viewer 2003

Get Adobe Reader

How safe is your area?

This task uses a **Problem-Solving Approach** and is designed to take approximately 3 hours of teaching time.

The resource enables teachers to help pupils consider the problem of safety of an area for living in.It involves the use of primary and secondary data.

- More detail

For Teachers

Please start here by looking at the online guidance and teachers notes before looking at other materials.

- Online guidance
- Teacher's overview
- QCA scheme of work
- Teacher Feedback

To download any of these materials, right click on

Lesson Materials

Please select a version:

- Powerpoint version
- OHP version

For Pupils

- Pupil worksheet 1
- Pupil questionnaire
- Pupil feedback

Data sheets

First select a region

then select data required

then select type of file:

pdf csv

Download file

Online databases

Resources on website (www.rsscse.org.uk/qca)

Materials draw on examples and contexts from real world and other subjects.

The resources include:

- Online guidance module
- Teachers' overview
- PowerPoint presentation with teachers' notes embedded
- Pupil worksheet(s)
- Supporting data

Stage two (Jan – Dec ’06)

- Eight problems made available with supporting documents
- All materials properly trialled/refereed
- Regime trialled for assessing the cycle *as a whole*

Outcomes: Exemplar resource

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Online databases

How safe is your area?

Plan | Collect | Process | Discuss

How safe is the area you live in?

Setting the Scene

Plan | Collect | Process | Discuss

How safe is the area you live in?

TV, radio and newspapers regularly report crimes and crime statistics.

Collecting Data

Homepage

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Online guidance

Teacher's overview

QCA scheme of work

Teacher Feedback

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Lesson Materials

PowerPoint file

PowerPoint notes

- OHP version

For Pupils

Pupil worksheet 1

Pupil questionnaire

Pupil feedback

Data sheets

First select a region

East Midlands

then select data required

Last 6yrs Statistics
2005/06 Statistics
2004/05 Statistics
2003/04 Statistics
2002/03 Statistics
2001/02 Statistics
2000/01 Statistics
Survey of pupils

Census At School

Crime statistics UK

Data Downloaded from Website

How safe is your area?

Plan Collect Process Discuss

East Midlands

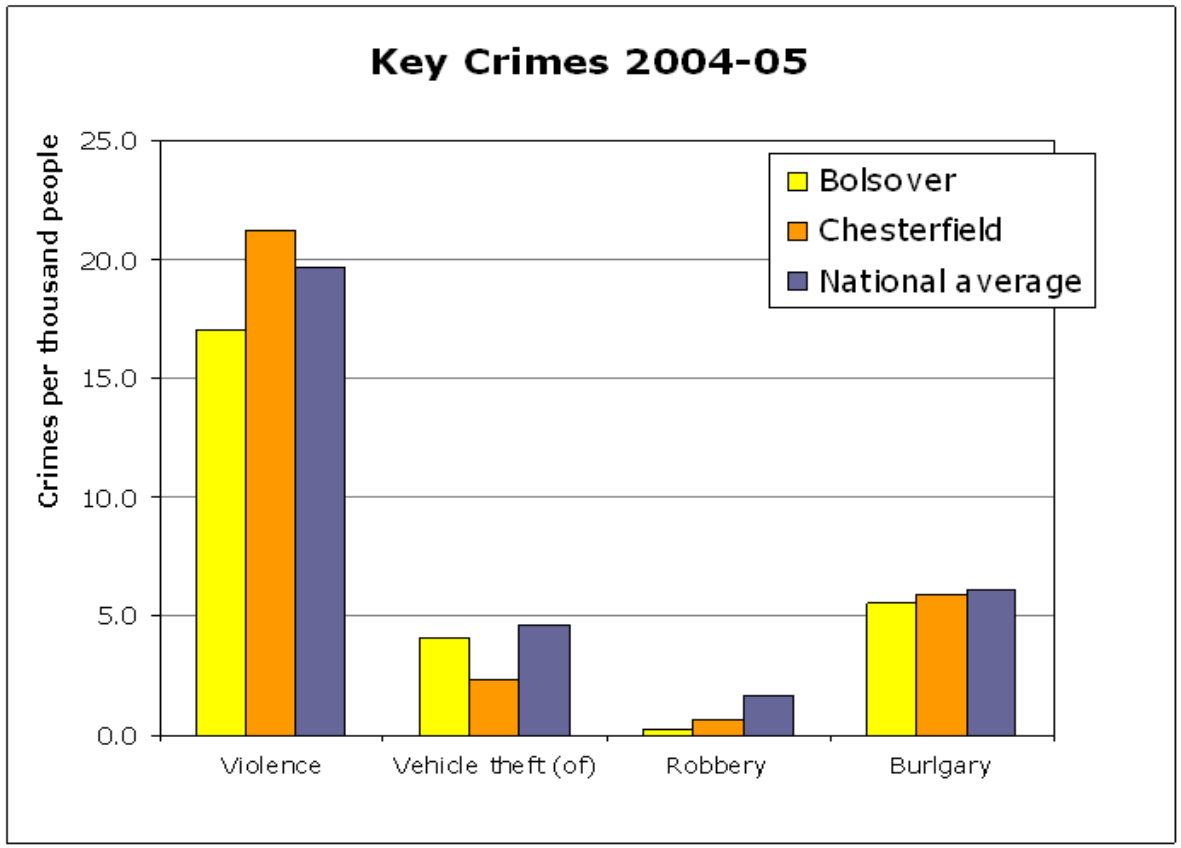
Crime Statistics

2005-06	Population	Violence	Sexual	Robbery	Burglary	Theft of a vehicle	Theft from a vehicle
Derbyshire	979,226	15,960	1,117	772	4,133	2,693	7,174
Amber Valley	118,193	1,764	136	36	409	308	730
Bolsover	73,252	1,132	75	23	337	236	469
Chesterfield	99,737	2,121	138	60	506	257	590
Derby	233,741	5,300	394	490	1,408	820	2,253
Derbyshire Dales	69,863	685	41	4	135	103	420
Erewash	109,979	1,675	131	80	465	404	1,168
High Peak	90,554	1,436	81	28	270	167	491
North East Derbyshire	97,412	972	61	22	341	201	534
South Derbyshire	86,495	875	60	29	262	197	519
Leicestershire	945,480	21,000	1,361	1,244	5,147	2,566	7,413
Blaby	91,581	982	74	42	300	195	585
Charnwood	157,477	3,044	174	145	957	404	1,157
Harborough	79,857	750	49	13	268	141	342
Hinckley and Bosworth	102,231	1,601	107	43	489	290	561
Leicester	285,097	11,156	729	925	2,284	1,032	3,293
Melton	48,332	660	40	5	158	130	365
North West Leicestershire	88,271	1,534	107	32	388	239	731
Oadby & Wigston	56,107	932	50	37	183	74	232

Processing the Data

Plan | Collect | Process | Discuss

Using Crime Statistics



Discussing the Results

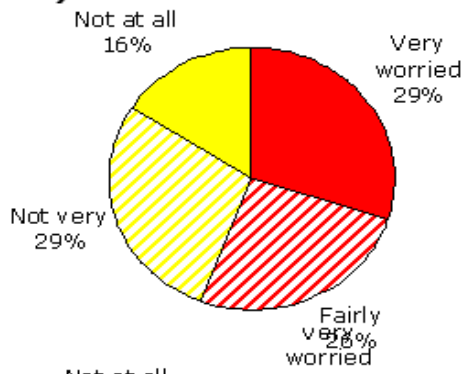
Plan | Collect | Process | Discuss

How safe is the area you live in?

Here are a random sample of results from a questionnaire of pupils (living in the South West of England).

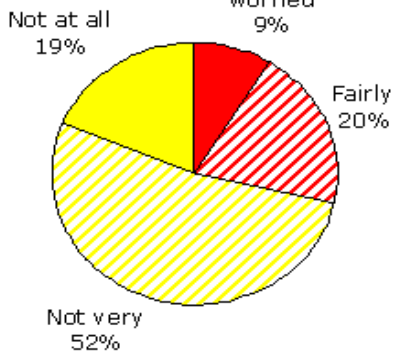
Victim of violence

Very worried	**21**	29%
Fairly worried	**18**	26%
Not very worried	**20**	29%
Not at all	**11**	16%



Being Insulted

Very worried	**6**	9%
Fairly worried	**14**	20%
Not very worried	**37**	52%
Not at all	**13**	19%



The PSA and undergraduate teaching

Support for Problem solving/case study scenarios in undergraduate teaching:

- Business and Industry - Stuart (2003)
- Agresti and Franklin (2007) provide excellent examples
  - Non-specialist students, typically HE level 1

Exemplar materials from the RSSCSE schools project provide a useful template for HE

Applications to undergraduate teaching

2001 enquiry into using data sets in HE

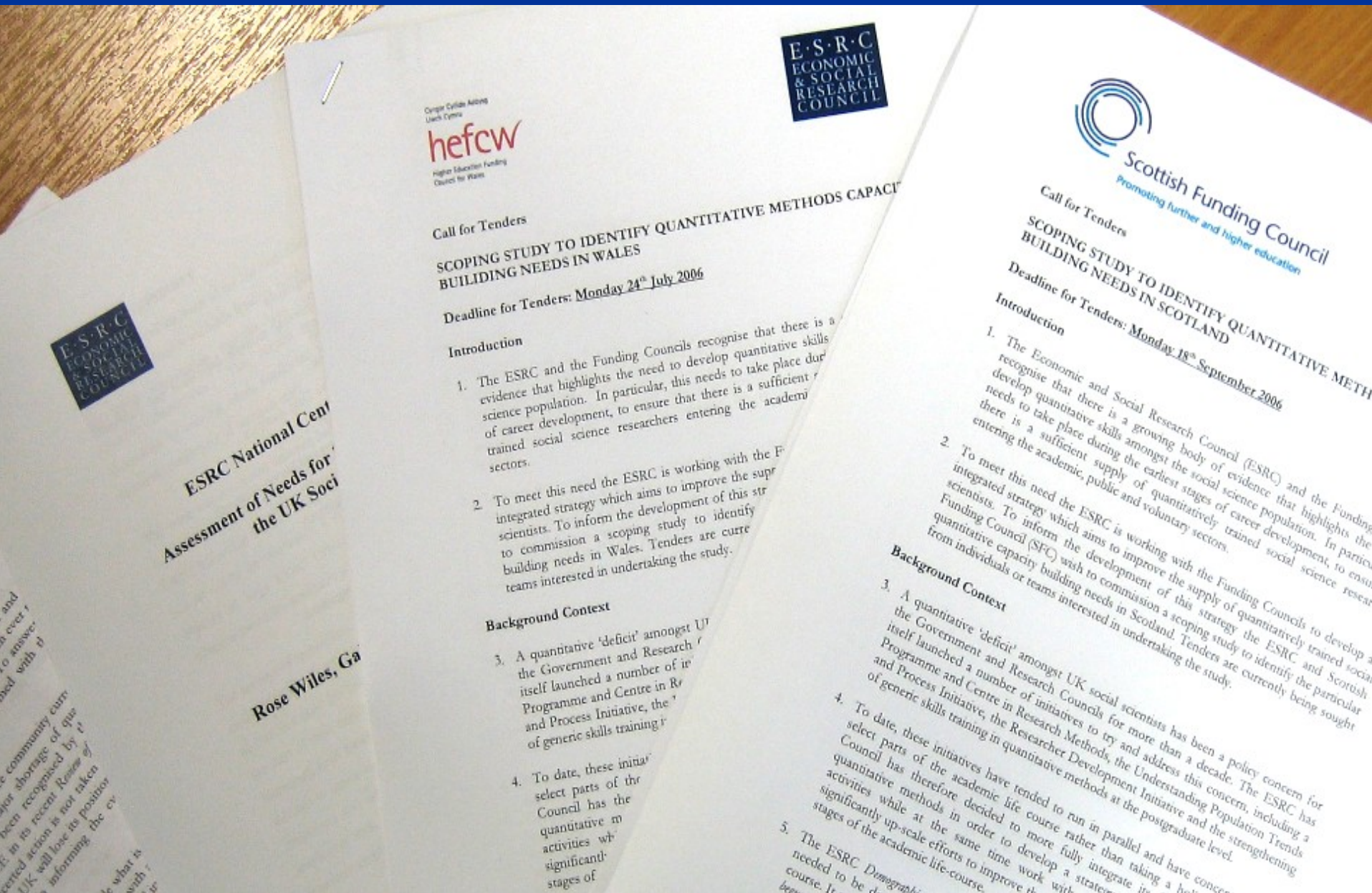
Commissioned by the Joint Information Systems Committee Rice et al (2001) recommended:

- Promoting subject-based statistical literacy for students
- Corresponding support for teaching staff
- Development of high quality teaching materials using major UK datasets

Problems faced by social science undergraduates

- Murtonen and Lehtinen (2003)
  - many social science students have problems with quantitative methods
- Williams et al (2004)
  - Crisis in the production of quantitative academic output in UK Sociology
  - A “societal problem of numeracy”

Economic and Social Research Council Response



Economic and Social Research Council Response

In 2006 there were calls for proposals to develop undergraduate curricula that:

- use real data to show the value of quantitative methods
- show students they have the foundation skills that can build on their school experience
- encourage students to collect their own data and analyse them
- encourage students to carry out their own research projects using data

Social Sciences and the PSA

- Approach social science problems through evidence-based decision making
- Teach the ‘social scientific research method’
- Use the problem solving approach to engage HE students in real social science problems
- Employ real data collected by the undergraduates themselves
- Employ relevant secondary data and introduce undergraduates to UK social science data bases

Motivating / engaging new undergraduates

- New undergraduates will be concerned about the town where they are attending university
- Social Science students will, at some stage, consider the social effects of crime
- The ‘How safe is your area’ problem developed for the RSSCE/QCA project is an example that is of interest to social science undergraduates

The first quantitative methods lecture

- Introduce the problem
- Discussion
- Student questions
- Choose data
- Reminder of the PSA

Introduce the problem

Plan | Collect | Process | Discuss

How safe is the area you live in?

TV, radio and newspapers regularly report crimes and crime statistics.

Discussion

Are the crime figures as bad as some of the newspapers suggest?

Where in the UK is the 'safest' place to live?

In which areas of the UK is crime increasing?

What are the crime figures like in your area?

Are crime figures increasing each year?

Which places are improving?

Where is the 'crime capital' of the UK?

Should people be more / less concerned about certain crimes?

Questions of Interest

Plan | Collect | Process | Discuss

How safe is the area you live in?

When crime statistics are reported, newspapers and other media concentrate on *particular* crimes:

These are called the **Six Key Crimes**.

Burglary
Robbery
Sexual offences
Theft from a vehicle
Theft of a vehicle
Violence

Choosing data

Plan | Collect | Process | Discuss

How safe is the area you live in?

The question 'how safe is your area' can be looked at in two ways- by finding out the actual crime figures and by looking at how worried people are about crime.

Which approach will you use?

Local crime figures

Select

People's perceptions of crime

Select

The First Seminar / Workshop - Collect

- The students complete a short questionnaire (online)
- The questionnaire comprises
  - Three demographic questions including date of birth
  - Four questions taken from the British Crime Survey (www.statistics.gov.uk/ssd/surveys/british_crime_survey.asp)

The First Seminar / Workshop – Process and Discuss

- Students revise data summary presentation
  - use their collective seminar data for this
  - summarise their seminar group's perceptions
- Students draw tentative conclusions
  - limitations of the seminar 'sample' discussed
  - possibility of using the whole module group's responses in next seminar session discussed

The Second and Subsequent Lectures

- From the start the students have been involved in
  - the formulation of the problem being investigated
  - their own data being collected
- The impetus is maintained by
  - reminding the students of the PSA
  - using their data to illustrate the *Process* and *Discuss* stages of the PSA
  - just introducing the statistical tools/techniques they need *in the context of their data* and at the time it is required

The Second Seminar / Workshop

- Process – produce summaries for the whole cohort and subgroups
- Discuss - comparison of different perceptions with respect to
  - seminar group
  - gender
- Return to the questions raised in the lecture and refine the Plan
  - Plan how they would re-write the questionnaire and construct additional questions

Subsequent Seminar / Workshops
What do other people think?

- Plan and Collect
  - Design their own questionnaire and Collect data by conducting a survey
- Process the survey data
- Discuss
  - Consider the results from their survey
  - Access the British Crime Survey data and compare with the perceptions from their sample

Subsequent Seminar / Workshops
What is the crime profile of their area?

- Plan
  - Decide what are the key questions about the safety of their university town they want to answer and what data they need
- Collect
  - Secondary data sources, for example the Crime Statistics for England and Wales

(www.crimestatistics.org.uk/output/Page1.asp)

Conclusion

- The psa can be used to engage pupils and teach statistics in schools
- With some imagination problems that engage undergraduates can be developed
- Using the psa will introduce undergraduates to the “evidence based decision making” approach in their discipline