CURRICULUM AND THE HUMAN RACE.

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INTRODUCTION

> 'The National Curriculum review in no way releases schools from the danger of a squeeze caused by the combined pressure of a focus on the basics and the expectation that teachers can remedy all the ills of an increasingly sick society. The result must not lead to schools being forced to produce literate and numerate but unfit philistines.'
> (David Hart of NAHT; 'The Independent' newspaper 5/6/1999)

As can be seen from the above statement there is much concern in the teaching profession about the effect of curriculum change on the pupils going through our education system and experiencing the National Curriculum.

The word *curriculum* is Latin for a racecourse or the race itself and it is applied in an educational sense to the course of study a pupil/student has to follow whilst attending an educational establishment. It is my belief that the present curriculum has become so prescribed that it has become an obstacle course that is successfully completed by jumping the hurdles of exams and assessments without necessarily gaining a true understanding of the subject matter which will allow the transfer of skills.

> A growing number of studies suggest that even those with sophisticated formal knowledge of a subject can be bad at using it in unfamiliar surroundings or to solve novel, complex problems. This inability to transfer knowledge from one domain to another points to a lack of real understanding,------evidence suggests that many people are not coping well with the tasks and challenges of ordinary life.
> (Bentley 1998; p9)

The main focus for the education of our children seems to be preparation for the gaining of qualifications rather than a preparation for life; these problems are being addressed with the development of a variety of types of qualification but I believe more could be done for our schoolchildren. The race they are being prepared to participate in is not clearly identified as the human race!

It is intended to show that within the confines of the directed curriculum it is possible to provide experiences to enable students to consider the world around

them and how other cultures relate to the modern world and in this way broaden the focus of the curriculum.

> Education helps to glue society together, transmitting common values and cultural heritage, promoting messages about what members of society owe to each other. But when the world is connected in countless, unprecedented ways, when peoples and cultures travel with increasing lightness and speed and societies are becoming more porous and mixed, how can education act as a common core? -----Will it be able to keep up, to stay relevant to the needs and concerns of the people it is supposed to serve?
> (Bentley 1998; p3)

Bentley goes on to identify three of the most important challenges he views as facing the education system and one of these is 'learning citizenship and morality' (p5). He also identifies a common core of knowledge, concepts and understanding which he feels is central to citizenship

- historical knowledge of political and legal institutions
- concepts such as democracy, the state, freedom, obligation and civil society
- alternative theories of citizenship
- practical understanding of the constitution and how it works, the process of political decision-making, and the routes through which citizens (or subjects) can contribute to such processes, at both national and local levels.

(Bentley 1998;p70)

The idea of citizenship has also been mentioned as being high on the government's education agenda and I would like to draw out one aspect of this in terms of development education and mathematics. OXFAM has proposed the idea of Global Citizenship, as have a number of development agencies, I don't know if the government's agenda is as broad as that proposed by OXFAM, I would suspect that it is closer to that which is proposed above, but I would suggest that it should be as inclusive.

> We see the Global Citizen as someone who:
> - is aware of the wider world and has a sense of their own role as a world citizen
> - respects and values diversity
> - has an understanding of how the world works economically, politically, socially, culturally, technologically, and environmentally
> - is outraged by social injustice

- participates in and contributes to the community at a range of levels from the local to the global
- is willing to act to make the world a more equitable and sustainable place
- takes responsibility for their actions.

(OXFAM 1997; p2)

Twenty five years ago Merritt (1974) wrote in the introduction to his book, 'This book is written for teachers who feel that our present–day curriculum offerings could be significantly improved.' He writes later on of pupils who have been 'turned off' by education and those who have learned to play the examination game when in fact the curriculum should be 'designed to provide an adequate preparation for life in the modern world' (Merritt, 1974; p5). This could have been written last week, so it is not new for educationalists to be concerned about the skills that children are leaving school with/without. They are obtaining more certificates, which show the knowledge they have absorbed, and enables them to succeed in the employment market but, as pointed out above, they are not always able to transfer these skills to the workplace.

These concerns arise from curriculum changes, often seen as out of control of the teacher, but which have to be implemented by the teacher.

> The teacher is seen as the mediator between the curriculum and the child, and any attempt to change the curriculum must consider the teacher's role. Teachers can be implicated in curriculum development in two ways: as participants in the process or as users of the product.
> (Howson et. al. 1981; p63)

But it is the content of the curriculum and its administration that causes most of the concerns to those who are interested in the education of our youth.

> The pupil is thereby 'schooled' to confuse teaching with learning, grade advancement with education, a diploma with competence and fluency with the ability to say something new.
> (Illich 1970, p9)

> Children are not naturally good. They need firm, tactful discipline from parents and teachers with clear standards. Too much freedom for children breeds selfishness, vandalism and personal unhappiness.
> (Cox and Boyson 1975; p1 quoted in Ernest 1991; p145)

Here are two diametrically–opposed views of education driven from different political ideologies and calling for differing approaches to implementation. It may

be clear that the determination of the curriculum content is directly influenced by the political/ideological leanings of those who have the power and the responsibility to influence them.

In recent years in England a National Curriculum has been introduced by a Conservative government with 'right–wing' views on application and implementation. This is an assessment driven curriculum and it is strictly divided into subject areas reflecting a philosophy of individualism and achievement by results; the acquisition of knowledge possibly without understanding.

The fact that some cross–curricular work is included and the claim that it should be a broad and balanced curriculum is to be applauded. Also the fact that revisions have made it more flexible for both pupil and teacher and that it has encouraged more formative assessment are positive developments. The introduction of Data Handling as an attainment target and a greater emphasis on statistics in the mathematics curriculum in particular is also an improvement because an understanding of statistical representation is an important skill in today's world where more and more information is presented in this way. This aspect of the maths curriculum will provide a means of introducing the material that will be used in the research that follows. However, overall, and perhaps long before the introduction of the National Curriculum, I believe that the emphasis in education has been towards an instruction for a society in which self-improvement and wealth creation without concern for others are the ideals. In fact we live in an interdependent world, a fact that is becoming more obvious as technology and commerce open up the 'global village'.

It is this aspect of education, interdependence, that I intend to look at in the following project by introducing, during work on handling data, UN statistics on the status of health and the economy in the poorer countries of the world to be compared with corresponding data from industrialised countries. In this way it is intended that the pupils will have their awareness raised through the work on comparing data thus stimulating some thought on the condition of people in the developing world. The intention would be that some of the issues addressed tangentially in the maths class would stay with the students provoking some thinking on the reasons for differences between life in the developed world and the developing world. Despite appearing controversial I claim that this is politically neutral because it is the roots and solutions that may be contentious, not the

problems. It may be, however, that even raising the problems is seen by some to be contentious.

REVIEW OF LITERATURE.

The United Nations, on its foundation, declared that education was an inalienable human right and subsequently there has been an attempt in most countries to provide universal primary education followed by secondary and tertiary education systems with a variety of levels of access. The structures being in place, at least in part, the next problem to address is ‘What to teach in the schools?’ or ‘What knowledge is of most worth?’ This, of course, is a question that is not easily answered, or, more accurately, a question that has a variety of complex answers depending on one’s view of humanity, society and knowledge. Nor is it possible to ignore the influence of historical precursors of Curriculum

What is taught in schools is referred to as ‘The Curriculum’ and this is a complicated area;

> Is the primary aim of education to instil basic skills or to foster critical thinking? Should education aim to mould future citizens, to engender personal development, or to inspire academic achievement? Must education have an aim? And what beliefs, values, or attitudes are learned from the way classrooms are? That is, what lessons are acquired but taken for granted, taught but not planned?
> (Flinders et.al. 1997 page vii)

These questions, the authors maintain, are at the core of curriculum studies and it is the latter considerations on which I intend to focus in this study. Whatever the answers it is almost universally accepted that literacy and numeracy are vital components of any schooling system. In England and Wales the1988 Education Reform Act introduced the National Curriculum and defined English, mathematics and science as three ‘core’ subjects for study.

At this stage it is important to look at two aspects of the curriculum, which may be termed the ‘formal curriculum’ and the ‘hidden curriculum’. The formal curriculum may be defined as that which the school plans and intends the pupils to learn; on the other hand the ‘hidden curriculum’ is what the pupils experience through everyday goings on in the school and the values implicit in the formal curriculum.

> For example, through the hidden curriculum, students may receive stereotypical messages about minority groups, and male and female roles, due to messages implicit in a teacher's actions, everyday occurrences in the school, or from textbooks.
> (G. McCutcheon; 1997 page 188)

Clearly the school management has more control over the 'formal curriculum' but the 'hidden curriculum' can be impinged on in both its positive and negative qualities if teachers are sensitive to it.

> An important role teachers have vis-à-vis the hidden curriculum is observing and reflecting on its nature and the possible effects of such an opportunity for learning. Through doing this, teachers can improve the hidden curriculum, thereby rendering more of it overt; because it has been reflected upon it moves into the intended realms.
> (G. McCutcheon; 1997 page 189)

So, what should be our priorities in education? The curriculum is divided into subject areas and the probability, therefore, is that we store our information in terms of concepts based in the subject areas in which we learnt the information. The fact is that most of the areas in which we work are not related to a particular curriculum area (education being a major exception). Admittedly there has been a discussion in recent years on cross-curricular initiatives but the idea of 'bridging' has not been so prevalent. By bridging I mean making a link between the concept or skill as taught and learned in a formal lesson and an application of the concept or skill in a more obvious role in every day life.

The control of the curriculum and its content lies in the hands of the government and in English and Welsh education this central control has become greater since the introduction of the National Curriculum. Clearly the beliefs of those designing a curriculum will influence what is contained in it, on its intended use and also on how it is administered. In the debate on curriculum which developed as the importance of industry grew and the demand for education for all was realised, the development of three protagonist groupings was identified by Williams (1961) and referred to as ' industrial trainers', 'old humanists' and 'public educators'. From another perspective Holmes & McLean (1989) have identified four major curriculum theories in the history of education

- Essentialism. In this model the aim of education is to sustain a just society the main feature of which is stability

- Encyclopaedism. This model is based on the premise that the content of education should include all human knowledge.
- Polytechnicalism. The fundamental premise on which this is based is that the content of education should be deliberately interpreted in terms of the productive life of society.
- Pragmatism. The knowledge most worthwhile in this model is that knowledge that enables young people to tackle problems and prepares them to solve the problems they are likely to meet as adults in a democratic society.

Holmes and McLean maintain that the English system has grown through an Essentialist tradition though the growth of child–centred philosophies has challenged this, especially in primary schools and early secondary education; the 1988 Education Reform Act and developments thereafter in National Curriculum revision may have inhibited this however.

> Yet the essentialist tradition has not been seriously challenged in planning curricula for the majority of pupils aged 14 and above in the mainstream system. The attitudes not only of teachers but also of university academics and, rather strangely, of employers in their recruitment practices suggest that the essentialist is still very fully entrenched.
> (Holmes and McLean 1989, p 49.)

A further refinement of the of the intellectual and moral positions which produce ideologies of education is produced by Ernest (1991) when the ‘technological pragmatist’ and the ‘progressive educator’ are added to the three groups listed by Williams (1961). These are necessary, argues Ernest, because of the complexity of the social and political influences on modern British education. These two new categories introduce a view between the ‘industrial trainer’ and the ‘old humanist’. (See Table 1 below) This latest analysis deals primarily with the British education system and, as such, is most pertinent to this study, and the one on which it focuses is the ‘public educator’.

> This theory sees children as needing to actively engage with mathematics, posing as well as solving problems, discussing the mathematics embedded in their own lives and environments (ethnomathematics) as well as broader social contexts.
> (Ernest 1991, p208)

The term ‘ethnomathematics’ was coined to refer to ‘mathematics which is practised among identifiable cultural groups, such as national-tribal societies, labour groups and so on’ (D’Ambrosio [1985] p.45) (quoted in Abraham and Bibby

1992; p182). In the same article reference is made to the geometrical thinking involved in Mozambican weaving and the claim by Gerdes(1986) that the weavers

INTEREST GROUP	Industrial Trainer	Technological Pragmatist	Old Humanist	Progressive Educator	Public Educator
POLITICAL IDEOLOGY	Radical right. 'New' right	Meritocratic, conservative	Conservative	liberal	Democratic socialist
EPISTEMOLOGY	Absolutist	Absolutist	Absolutist	Progressive Absolutist	Fallibilist
VIEW OF MATHEMATICS	Set of truths and rules	Unquestioned body of useful knowledge	Body of structured pure knowledge	Process view; personalised mathematics	Social constructivist
SET OF VALUES	Authoritarian Victorian values and morality choice, effort, self help, work. Us-good Them-bad	Utilitarian, pragmatism Expediency, wealth creation, technological development	'Blind' justice, objectivity, rule centred, structure, hierarchy, paternalistic, 'Classical view	Person centred, caring empathy, human values, nurturing, maternalistic, 'Romantic' view	Social justice, liberty, equality, fraternity, social awareness, engagement and critical citizenship
THEORY OF SOCIETY	Rigid Hierarchy, Marketplace	Meritocratic hierarchy	Elitist, class stratified	Soft hierarchy, welfare state	Inequitable hierarchy needing reform
THEORY OF THE CHILD	Elementary school tradition; child 'fallen angel' and 'empty vessel'	Child: 'empty vessel' and 'blunt tool' future worker and manager	Dilute elementary school view, character building, culture tames	Child centred progressive view, child 'growing flower' and 'innocent savage'	Social conditions view; 'clay moulded by environment' 'sleeping giant'
THEORY OF ABILITY	Fixed, inherited. Realised by effort	Inherited ability	Inherited cast of mind	Varies but needs cherishing	Cultural product, not fixed
MATHEMATICAL AIMS	'Back to Basics' numeracy and social training in obedience	Useful maths to appropriate level and certification. (Industry centred)	Transmit body of mathematical knowledge. (Maths centred)	Creativity, self-realisation through mathematics. (Child centred)	Critical awareness and democratic citizenship via mathematics.
THEORY OF LEARNING	Hard work, effort, practice, rote	Skill acquisition, practical experience	Understanding and application	Activity, play, exploration	Questioning, decision making, negotiation
THEORY OF TEACHING MATHEMATICS	Authoritarian, transmission, drills, no 'frills'	Skill instructor, motivate through work relevance	Explain, motivate, pass on structure	Facilitate personal exploration. Prevent failure	Discussion, conflict questioning of content and pedagogy
THEORY OF RESOURCES	Chalk and talk only, anti calculator	Hands on and micro computers	Visual aids to motivate	Rich environment to explore	Socially relevant authentic
THEORY OF ASSESSMENT	External testing of simple basics. Avoid cheating.	External tests and certification, skill profiling	External examinations based on hierarchy	Teacher led internal assessment. Avoid failure	Various modes, use of social issues and content
THEORY OF SOIAL DIVERSITY	Differentiated schooling by class. Crypto-racist, monoculturalist	Vary curriculum by future occupations	Vary curriculum by ability only (maths neutral)	Humanise, maths for all	Accommodation of social and cultural diversity a necessity

Table 1 : Overview of the Five Educational Ideologies. (P. Ernest 1991; pp138-139)

engage in complex mathematical thinking through their activity; this would be an example of ethnomathematics. The authors go on to advocate a ‘Mathematics in Society’ curriculum that studies the relationship between mathematics and society based on an understanding of the nature of mathematics and the nature of society

> Essentially our approach differs from the ethnomathematics perspective in the sense that we wish to see a mathematics education which, in part, aims to enable students/pupils to understand how knowledge is established (including, and sometimes especially in those spheres of social activity of which they have no immediate experience) and critically relate this understanding to their own experiences.
> (Abraham and Bibby 1992;p188)

Reference is made to the ‘Mathematics in Society Project’ (MISP) which was being developed in the UK, USA and Australia in the eighties. The project was based around eight themes that show how mathematics can be used in society and thus provide a motivation for the study of mathematics. The authors are critical of this, and other projects, as they do not encourage a critical analysis of the differences between sets of data and their reliability, though the authors acknowledge that the constraints of examinations would make assessment of these skills difficult. This is one of five policy problems identified by the authors in the development of a public educator mathematics curriculum.

> These are (i) political ideology (ii) subject maintenance (iii) teacher education (iv) student expectations and the examination system (v) differentiation and ability stereotyping.
> (Abraham and Bibby 1992; p192)

The first of these will present the biggest problem in that the authors quote the reaction to a 1986 C. S. E. examination question using data on military spending derived from the Swedish International Peace Research Institute. As a result of the reaction, including the Daily Mail asking ‘ What has arms spending to do with a maths exam?’, examination boards were expected to vet future papers for political content. The idea of promoting mathematics as a problem – generating activity is addressed by Lerman (1992) and he shows that perspectives of the teaching of mathematics can be embedded in the issues of the role of education as a whole ‘the use of knowledge as social control, and the relationship between knowledge and power.’ Lerman (1992; p177) He maintains that the problem–solving and

investigational activities at present used in the curriculum still leave the teacher as the person who knows and who will eventually reveal the answer

> The further step that may be seen to be potentially revolutionary, is that by presenting mathematics as concerned with looking at situations, --------, and developing and encouraging the posing of problems to be investigated mathematically, by teachers and pupils, we are making at least three important, new and revolutionary changes:
>
> I. mathematics belongs to everyone, and is not the esoteric, teacher-owned totalitarian subject as usually presented,
> II. teacher and pupils are engaged together in the learning and doing of mathematics,
> III. the world at large is seen to be accessible to analysis, criticism and transformation by everyone, and we do not have to accept the way the world is, in a resigned and powerless manner.
>
> (Lerman 1992; p176)

This revolutionary approach which is advocated above would probably come up against the same sort of reaction as was generated by the C.S.E. question mentioned earlier if care is not taken with the type of situation and data presented. With this in mind the use of questions based in development education with, data from the UN, might prove a less contentious way of promoting critical problem posing within the hidden curriculum.

THE INVESTIGATION

> Mathematics worlds are social worlds. But what kind of social worlds are they? How do they fit into the larger cultural scheme of things? What interests do they mathematics worlds serve? What kinds of human beings inhabit mathematics worlds? What sorts of values do mathematics worlds create and sustain?
> (S. Restivo 1994; p219)

For a number of years I have been interested in issues surrounding Third World development and how these might be introduced into the curriculum in general and mathematics in particular. A number of agencies working in the field have produced materials to use in a maths class but they suffer from being issue-based rather than mathematics-based and tend to get lost, once they have been covered in the classroom, as a component of a larger topic of work. Sometimes it is difficult to fit them into the curriculum with ease and they are better suited to lessons other than maths; this is not to deny their value. What is needed is a whole piece of work, or

module, relating to a section of the mathematics curriculum using information based on poor world development issues. My aim is to conduct a small scale investigation into whether pupils will take note of the data presented as part of a routine maths lesson and somehow make it part of their general store of knowledge. If the trial is successful then it could be developed into a larger body of work. The use of the curriculum in this way equates to a 'public educator' view of the education system and an 'action research' model of enquiry into education.

> In adopting a view of truth and action as socially-constructed and historically-embedded, action research is not distinctive; ------ unlike interpretive researchers who aim to understand the significance of the past to the present, action researchers aim to transform the present to produce a different future.
> (Carr and Kemmis 1986; p182)

This is often referred to as a critical research paradigm and it is based on the theory, as noted above, that knowledge is socially-constructed. This theory views that knowledge is actively built up by the student not passively received, and that the individual learns by adapting and thus builds up their own experiential world rather than discovering some external 'real' world.

> I moved towards a social constructivist view as I considered the importance of social interactions in the classrooms I studied and the necessity of reconciling alternative perceptions in drawing conclusions from my research. My perspective was one of belief in individual construction within the social environment. This environment is very successful in raising issues and constraints which challenge individual construction and force modification of response.
> (B. Jaworski 1994; p25)

In summary the aim of my experimental intervention was to see if a considered intervention in the planned and the hidden curriculum would produce an interest in and a concern for, the problems and difficulties of the peoples of the lesser-developed areas of the world. This will then lead to deliberation on the part of the teacher as to whether further intervention of this nature would be of benefit in developing any interest engendered.

> Action research provides data that informs deliberation. This leads to *praxis* and improvement because it allows teachers to question their own practice and to formulate actions and a theory of actions upon which they have deliberated carefully,
> (G. McCutcheon; 1997 page 196)

Using this as a basis for the investigation I decided to raise some of the development issues impinging on the poorer countries of the world and evaluate the impact these might have on the pupils in the study. The vehicle for considering these issues was the Rio Earth Summit of 1992 and the Agenda 21 developments from that summit. (Agenda 21 is the set of commitments on the environment and development to which 178 governments signed at the Earth Summit). The data would be presented in a series of lessons and the pupils would be asked to extract information from the data and present an analysis of data comparing a country in Europe and a country in Africa. Examples of the data given and the work presented are given in Appendix 2. After the work had been covered in class the pupils would be questioned two months later with regard to what they had remembered about the contrasts between the two countries considered in their work. The work would be introduced by a discussion on the Rio Summit to ascertain the level of knowledge of the pupils with regard to world development issues. The pupils involved in the investigations attend a residential special school for pupils with Specific Learning Difficulties and are taught in groups of eight. All the pupils involved experience some difficulty with reading and writing skills and were in a Y10 group following an EdExcel foundation/intermediate GCSE course. The area of the Curriculum to be addressed would be Handling Data 2a and 2c statements in the National Curriculum (see italics below). The mathematics involved had already been addressed and the aim was to build on the basic skills as part of a spiral curriculum.

> **2. Processing and interpreting data.**
> a. design and use data collection sheets, *access required information from tables, lists and computer databases*, and make frequency tables for grouped data, where appropriate.
> c. *construct appropriate diagrams and graphs to represent discrete and continuous data including bar charts*, line graphs, pie charts, frequency polygons, scatter diagrams and cumulative frequency diagrams.

This also fits into the OXFAM suggestion for a Global Citizenship Curriculum

> **Social justice and equity.**
> Understanding of inequality and injustice within and between societies. Knowledge of basic human needs and rights and of our responsibilities as Global Citizens.
> (OXFAM 1997, p14)

The issues were addressed in a series of lessons in the Spring term before the half-term break. Each of the lessons was 40 min. in duration.

Lesson 1

The Rio Summit was introduced and some discussion on why it happened and what the outcomes were. Some data from Agenda 21 was introduced and the pupils were asked to do some work on the figures. This involved producing charts from tabular data. We concentrated on Global Trade.

Lesson 2

A review and completion of work from the previous lesson and Introduction of new data from 'World Resources'. This involved finding the largest and smallest pieces of data in some of the columns.

Lesson 3 and Lesson 4

Use of data collection sheet to access data from tables on two countries; one from Europe and one from Africa, and preparation of report on comparison of the two chosen countries.

(More details of the lessons can be found in Appendix 1)

The pupils responded well after some initial confusion, as the introductory work was not something they had experienced before. None of them had heard of the Rio Summit, which is not surprising, though it did surprise me that none of them knew where Rio de Janeiro was! The data from Agenda 21 was well received and the inequality of trade in the developing and developed world was not a surprise to them and they were able to give some well-reasoned explanations to some of the changes in percentages since 1970. The pupils were able to produce bar charts with little difficulty and the choice of pie charts for the display of some of the data was encouraging. Some help was required with the latter.

The three areas for the data collection sheets were chosen by myself and I included infant mortality and life expectancy as it seemed important to cover health issues as well as economic and pollution issues. The use of gross and per capita data also allowed for discussion around how data can be misleading unless it is properly presented, and the importance of comparing like for like.

Unfortunately the size of the numbers presented some problems as the pupils were not confident in dealing with very large numbers and this necessitated some work on billions being introduced into the lessons. The difference in size of the numbers also presented some difficulties in representing the data on Excel as part of their report. (This was part of their IT work and used as a cross-curricular aspect of the project.) In fact only two of the pupils fully completed the report aspect of the work.

The method used for testing the efficiency of the project was an interview with the pupils involved at a time three months after the lessons had been taught in the classroom. The aim of the interview was to check on the effect of the poor country data on the consciousness of the pupils rather than to check on the mathematics learning on the pupils. In this model all the questions asked were related to development issues and the countries investigated by the eight pupils in the study.

CONCLUSIONS

Teaching the lessons was an enjoyable process and some of the discussion generated was refreshingly different from the normal dialogue in the classroom. It was encouraging to see and hear pupils so animated by the data they were investigating, especially the data on infant mortality and life expectancy. One lunchtime meal was spent in discussion of the data with two of the pupils, in particular discussing whether I would in fact be alive if I lived in an African country, or rather if I had been born in an African country; an opportunity for discussing grammar as well!

The introductory session on the World Resources data also proved successful with the pupils being thoroughly engaged in finding the largest and smallest numbers in the columns, they were amazed at some of the variances in size.

The major problem in the mathematical content of the work lay in the lack of proper planning and preparation put into the work thus creating difficulties when the pupils encountered very large numbers and when they tried to analyse the data with the use of spreadsheets.

In questioning the pupils after three months all of them could remember the work and 75% of them could even remember the names of the countries they had looked at. Only one of the pupils remembered the term Earth Summit and had to be reminded about what came out of it. All except one reported having enjoyed the piece of work

and were prepared to talk about some of the difficulties of those in the developing world, some more so than others.

I did not keep extensive notes of the lessons at the time they were taking place and if I were to repeat this type of research this would be one area in which there could be improvement. The same applies to the responses of the pupils to the questioning after the three-month interval. The questioning was carried out quite informally without arranging a special interview and on reflection this was not satisfactory. Ideally this should have been tape recorded and a written set of questions used such that all the pupils would be given the same opportunities to respond and give their opinions of the tasks they had been set.

The types of questions asked were;

- Do you remember the work we did on Earth Summit?
- Do remember when we compared African countries with others?
- What do you think are the issues involved?

In light of this I would feel confident in saying that the investigation was satisfactory as a pilot in that it prompted discussion and reflection among the pupils on the issues intended. It is probably worthy of a more sustained piece of research that would require a number of refinements, some of which are mentioned above.

Since beginning the investigation I have found that Population Concern have produced a CD named ‘The Population & Development Database’ which contains information on 198 countries, statistics, maps and other resources for teachers.(See Appendix 4) This would be a better source of material for classroom use as it is already designed for this use.

The aim of linking The Earth Summit into the other data did not really work in terms of a cohesive presentation of the development issues as the data was such that an understanding of the tabular form and the mathematics of the task took the majority of the discussion time. Finally, in terms of this investigation, more work also needed to be done on working out a final format for the finished scheme of work; there are good examples on the ‘Population and Development Database’ CD. (Appendix 4). Though these have a particular political ‘angle’ to them which may not be appropriate on all cases or for all circumstances.

I feel that that the study shows that there is place in the curriculum for a public educator philosophy of education as outlined by Ernest (1991). Issues of social

justice can be accommodated in the curriculum without pupils feeling that they (the issues) are out of place, though there would need to be careful thought about how the issues were introduced and what issues were to be addressed, as the reported C.S.E. question shows (Abraham and Bibby 1992). The use of the hidden curriculum, carefully managed, would seem to be a suitable vehicle for this and it would also encourage reflection on and management of an area which researchers see as being an important facet of school life. (Flinders et. al. 1997 and McCutcheon 1997). The need to constantly review the proposals would be an essential part of the critical research/social constructivist approach to education as outlined by Carr and Kemmis (1986), but the use of this type of material may go some way to answering some of the questions posed by Restivo (1994).

In conclusion it would be fair to say that there is potential benefit in pursuing the development of this type of presentation for an extended set of exercises in the mathematics curriculum, or maybe a whole curriculum based on social justice issues.

With the government focussing on the area of citizenship and agencies like OXFAM pressing for a greater awareness of Global Citizenship this might be the time to look into !

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Appendix 1

Details of the Lessons Delivered in the Investigation.

- Lesson 1
- Lesson 2
- Lessons 3 and 4

Lesson 1

The Rio Summit was introduced and some discussion on why it happened and what the outcomes were. Some data from Agenda 21 was introduced and the pupils were asked to do some work on the figures. This involved producing charts from tabular data. We concentrated on Global Trade.

A.T.	Handling data

Key Questions:	**Resources:**
Can the pupils represent graphically two sets of data?	Data from the Rio Summit Agenda 21 (on World Trade) Data presented on a sheet. Real data from official UN sources. Use a photocopy from an original source as this looks more official than a worksheet.
Learning objectives: The pupils: • to be able to represent data graphically. • to be able to interpret the charts drawn • to be able to represent data in the form of pie charts • The pupils: • see that there is an inequality in world trade • see that the inequality is static • see that the increase in some countries is at the expense of others	**Activities:** Discuss as a group the origins of the data. Questions: • Have you heard of the Rio summit? • Do you Know where Rio de Janeiro is? • What are developing countries? • Where are the developing countries? • Remembering what we have covered before, how would you represent this in another form • Having done that can you think of another way of representing the data? (this will lead to work on pie charts)
Outcomes: All the pupils produced bar charts of one form or another. All went on to begin the production of pie charts. All needed some support though two required considerable support. (Pie charts had been covered before, but only with data which totalled multiples or factors of 36.)	**Evaluation:** The discussion didn't go as well as anticipated. It became more of a teaching session. A lot of interest in the idea of *developed* and *developing countries.* Probably too much work as the end of lesson was rushed and disjointed.

Lesson 2

A review and completion of work from the previous lesson and Introduction of new data from 'World Resources'. This involved finding the largest and smallest pieces of data in some of the columns.

A.T.	Handling data

Key Questions:	**Resources:**
Can the pupils extract information from tables of information given certain criteria?	Data from the UN publication 'World Resources' on a variety of industrial and health topics. Data presented on a sheet. Real data from official UN sources. Use a photocopy from an original source as this looks more official than a worksheet
Learning objectives: The pupils: • to be able to find required table of data from a number presented. • to be able to select specific information from the data • to be able to represent and interpret the data using spreadsheets The pupils: • see there are big differences in the data • to see there is a consistency in the best' and 'worst' areas • begin to think about why there are such great differences	**Activities:** Discuss as a group the origins of the data. Questions: GNDP = Gross National Domestic Product • Which countries have the highest and smallest populations (individually or in pairs) • This is repeated for all the tables using GNDP and carbon dioxide emissions. In this case we also look at per capita data. • Can you find lowest and highest life expectancy? • (Explain *infant mortality*) • Can you find lowest and highest infant mortality rates? Choose a European and African nation and compare the data for each in the above categories.
Outcomes: All the pupils finished off the work started in the last lesson. After an initial reluctance (probably because the data looked intimidating) the exercise went extremely well. All the pupils were fully engaged in the exercises and were reluctant to stop. Once they understood the way the data was presented the pupils were able to find their way around the tables with some ease, with reading help as necessary.	**Evaluation:** A very enjoyable session, the pupils were fully absorbed in the extraction of data from the tables and were reluctant to stop. The final activity was not addressed. They began to choose their own categories to find the biggest and smallest for, though this became a little competitive as to whom would be first. The pupils were intrigued by the *per capita* breakdown of the data especially the GNDP. Infant Mortality and Life Expectancy were also areas that proved attractive to the pupils.

Lesson 3 and Lesson 4 (Double Session)

Use of data collection sheet to access data from tables on two countries; one from Europe and one from Africa, and preparation of report on comparison of the two chosen countries.

A.T.	Handling data

Key Questions:	**Resources:**
Can the pupils extract information from tables and put it into a data collection sheet? Can pupils enter data from a data collection sheet into a computer spreadsheet program? Can pupils analyse data on a spreadsheet?	Data from the UN publication 'World Resources' on a variety of industrial and health topics. Data presented on a sheet. Real data from official UN sources. Use a photocopy from an original source as this looks more official than a worksheet.
Learning objectives: The pupils: • to be able to find required data from available data • to be able to enter specific information onto the data collection sheet • to be able to transfer the data onto a spreadsheet • to be able to analyse the data and represent it diagrammatically The pupils: • to become aware of the inequalities between nations • to begin to think about reasons for this inequality • to begin to feel a sense of injustice	**Activities:** Show the data collection sheet and discuss it in a group discussion Choose a European and African nation and compare the data for each in the given categories. Task involves: • extraction of data from tables • entering data into a computer data base • produce graphs/charts • combine charts with written interpretation into a report.
Outcomes: All the pupils managed the first part of the task and completed the data collection sheets. (Some support needed with choice of European and African countries) The entry of data into a database was completed by all the pupils though here some work had to be done on very large numbers, Analysis completed by all but two of the pupils. Two pupils produced a report.	**Evaluation:** A good session in which all the pupils were busy initially. Dealing with some of the data was a problem as the size of numbers presented problems which had not been considered in the planning Computer skills of the pupils were variable and the lesson was a team teaching session with the computer teacher. This enabled some of planning problems to be overcome. Some of the pupils focussed entirely on the skills required, but some especially the two who completed the task, begin to think about the reasons for inequalities.

Appendix 2

Data Sheets and Data Collection Sheet

- Agenda 21 Data
- World Resources Data (Enlarged to A3 for pupils)
- Data Collection Sheet

Appendix 4

Example of Contents of The Population and Development Database

The CD can be obtained from:

Population Concern
178-202 Great Portland Street
London W1N 5TB

U.K.