

Analysing teachers' approaches in design and technology in Botswana

Abstract

Design and technology education in Botswana has gone through transforming phases since independence in 1966, with the influence of the European approach; predominantly the British model of design and technology. The 1992 National Commission on Education (NCE) reviewed the Botswana's education system and produced the National Commission on Education Report of 1993. Subsequent to this report was the Revised National Policy on Education (RNPE) of 1994 that laid down the framework of the Botswana Education system over the period of 25 years. Central to the episodes of the RNPE was the raising of the status of design and technology to one of the eight core subjects. It is to this end that the three-year design and technology Junior Certificate Programme was developed. This paper is an outcome of the fieldwork that was undertaken in Botswana in the year 2000. The principal purpose of which will be to discuss data gathering processes and how it was done, presenting teachers and pupils' datamaps. Quantitative and qualitative methodology in the form of participant observation, interviews and ethnography were employed.

Background

In the past years Botswana, nestled between Namibia, South Africa, Zambia and Zimbabwe, has the fastest rate of economic growth of any country in the world. This was partly due to discovery of several minerals – in particular diamonds – which had an enormous impact on the economy. The country is democratically ruled and boast of a growing economy and stable political environment. It is the largest exporter of gemstone diamonds in the world as well as a large beef exporter to the European Economic Communities (EEC). Profits from the sale of these resources have been used for economic developments such as education.

Following ample debate of the National Commission on Education Report of 1993, the National Assembly approved a white paper (Government Paper No. 2 of 1994), which set out the Revised national Policy on Education (RNPE, 1994). One of the issues of priority identified by the Policy was the introduction of the three-year Junior Secondary Education. The three-year Junior Secondary Programme was introduced in 1996 and the first examinations were written in 1998, hence the issue of the three-year Junior Certificate design and technology programme.

Context, design and methods

In 1998 I enrolled for a PhD at Goldsmiths College, University of London. The thrust of my study is on 'assessing students capability in design and technology education in junior secondary schools in Botswana'. As part of the requirement of the research study, empirical research and fieldwork was conducted in Botswana junior secondary schools in the year 2000 for a period of seven months in two different phases (Phases 1 and 2 respectively). A variety of research strategies in the study were used such as classroom observation (participant observation), ethnographic with some degree of grounded theory and interviews.

The discussion of this paper will be the outcome of the research study with the main focus of assessing students' performance in design and technology. Underpinning the study is the research question looking at the relationship between teachers' teaching practices and teachers assessment practices in design and technology in community junior secondary schools in Botswana. I explore how the relationship transforms during the three years of the Junior Certificate programme.

Quantitative methodology was used to analyse teachers' data so far as their teaching styles, interaction with students and assessment practices were concerned. Four pupils were selected in each case to map their activities against each individual teacher in the 10 cases sampled. Qualitative methodology was used to capture the interactions during the classroom performances in a cumulative form comprising a project profile. Excel software was used to input data, create charts and tables and to analyse Phase 1 fieldwork data. Teachers' trajectories and phase plane diagrams were also used to analyse the teachers' behaviour. The principal purpose of this paper will be to discuss data gathering processes and how it was done, presenting teachers and pupils' datamaps. It will also endeavour to discuss how teachers' categories were created and the data manipulated. A summary of the initial data findings of Phase 1 fieldwork will be presented and also how other qualitative software's will be employed to triangulate, validate and check for the reliability of the study.

Defining design and technology is problematic and this paper does not intend to belabour this issue. However, reference will be made to deliberations by Jacqui Smith and Lord Sainsbury at the DATA Millennium Conference in 2000 held at the Institute of Education in London, both of whom defined design and technology by its educational benefits and described how distinctive it is

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Project length of teachers in the sample (T1-T10) in minutes

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
500	526	532	706	164	596	534	614	1112	250

Figure 1: Project length chart for 10 teachers in the sample.

from other subjects areas of the curriculum (Link, 2000). At the core of the subject is design process. And there are different models of design processes (Cross, 1999; Eggleston, 1996 and 2000; Kimbell, 1997; Layton, 1994; Stables, 1997)

Analysing teachers' approaches

Analysing data it being quantitative or qualitative can be a night mere, especially when you are confronted with lots of data sets, interviews, observation sheets, and other related data, which may be in the form of ethnographic data. The data may be captured using audiotapes, videotapes floppy disks, written documents – reports and minutes of meetings (Robson, 1998; Silverman, 1998). Feldman (1995) endorses this when he comments:

As I sit in my office up to my eyeballs in data, I am once again impressed with the enormity of the problem of analysing qualitative data. I have audiotapes, floppy disks, and written documents. I have fieldnotes. I have copies or reports and minutes of meetings... It will take me several weeks working full time just to review all these materials. How can I make sense of them? (Feldman, 1995: 1)

As teachers of design and technology we have to undertake research in our subject area to inform classroom practice. How can this be done and what is involved? Through this

paper I illustrate how I analysed teachers teaching approaches and assessment approaches to design and technology in Botswana junior secondary schools. I had 10 cases to study, teachers 1-10. There were three key variables of my cases:

- focus of interaction (interactions between the teacher and pupils/group/whole class)
- nature of interaction (directive: teacher being instructional in the teaching approach or supportive: teacher intervening to help individual students or the students initiating the interaction)
- engagement (reflecting on students engagement on tasks – stationary/ poddling/motoring). Stationary denoting students being 'off task' not engaged in design and technology activity; poddling where students are working in the task but not giving it full attention or energy and motoring where students are fully engaged and committed.

Analysing project activity

In analysing the project activity I had to capture the duration of the project for each teacher and this was done by calculating the overall time using the spreadsheets and converting this into charts. The diagram below illustrates each teacher's project profile. 'S1' denotes time frame for teacher one herewith called 'T1'.

Figure 2: Teacher 2 broad descriptors of the project in phases.

Phase 1 Introduction to design process	Phase 2 Developing ideas and research	Phase 3 Making	Phase 4 making and production plan	Phase 5 Evaluation and testing plan
<ul style="list-style-type: none"> • Needs and opportunities students recognising the need and identifying the situation and problem. • More interplay between two themes 'time' and 'storage'. • Teacher provided the situation and helped identify the problem. • Introduction to idea generation. • Introduction to development of solutions (best ideas). 	<ul style="list-style-type: none"> • Exploring and developing ideas through graphic work. • Research introduced covering elements of research such as function, cost etc. • Transferring of ideas (patterns) into acrylic pieces. • Demonstrations of shaping jewellery profiles. 	<ul style="list-style-type: none"> • Cutting pendant (jewellery) profiles from pieces of acrylic. • Basic hand tools used in making. • Silhouettes varied, e.g. fish, birds, heart shaped, other animals etc. • Recap and emphasis on design process. • Specification introduced. • Production plan introduced. 	<ul style="list-style-type: none"> • Cutting silhouette (jewellery) and shaping the profiles. • Developing and exploring ideas (and annotations). • Talk about production plan, with illustrations. • Students thinking of production plan. • Orthographic projection introduced. • Evaluation also introduced. 	<ul style="list-style-type: none"> • Students exploring and developing ideas (discussing). • Students judging artefacts. • Students evaluating as groups. • Reorganising portfolio to match teachers prescriptions. • Beautifying the portfolio presentation (re-drawing possible solutions).

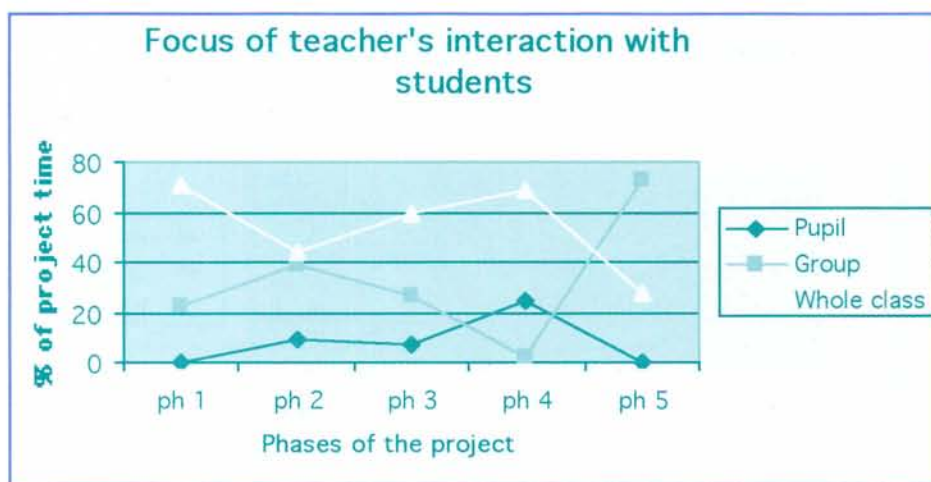


Figure 3: Teacher 2: teacher interacting with students.

Project phases

In each case the researcher divided the project length in five arbitrary phases of equal length. This enabled the researcher to construct the way teachers teach over the length of the project, herein referred to as phases. The phases of the project outlined the content coverage over that period and themes or topics covered and the activities performed during the classroom observation period. Within the phases were constructed broad descriptors of the whole project as shown in Figure 2.

Within each phase or broad descriptor of the project are identifiable the classroom activities that took place during that phase. For instance, in Phase 3 of teacher 2 broad descriptors the main topic or content area was 'Making' and the activities included cutting of the pendant profile using basic hand tools and the introduction of the production plan.

Capturing and analysing teacher interactions

The data was firstly captured using Excel software to enter both the qualitative and quantitative data. From the teacher datamaps, which entailed teachers' teaching styles, description of the activities (qualitative data) and interactions with pupils, the researcher was able to make meanings out of data captured by constructing charts from the spreadsheets (quantitative data). Different forms of charts were drawn as illustrated below in which line charts were used to illustrate 'Teacher interaction with students' during the classroom observations.

Figure 3 suggests that teacher 2 spent most of the time interacting with the 'Whole class' while interaction with the individual pupils was marginalised.

Directive or supportive interventions

One way of showing the teachers' teaching styles was to aggregate their time spent in each area of teacher intervention, them

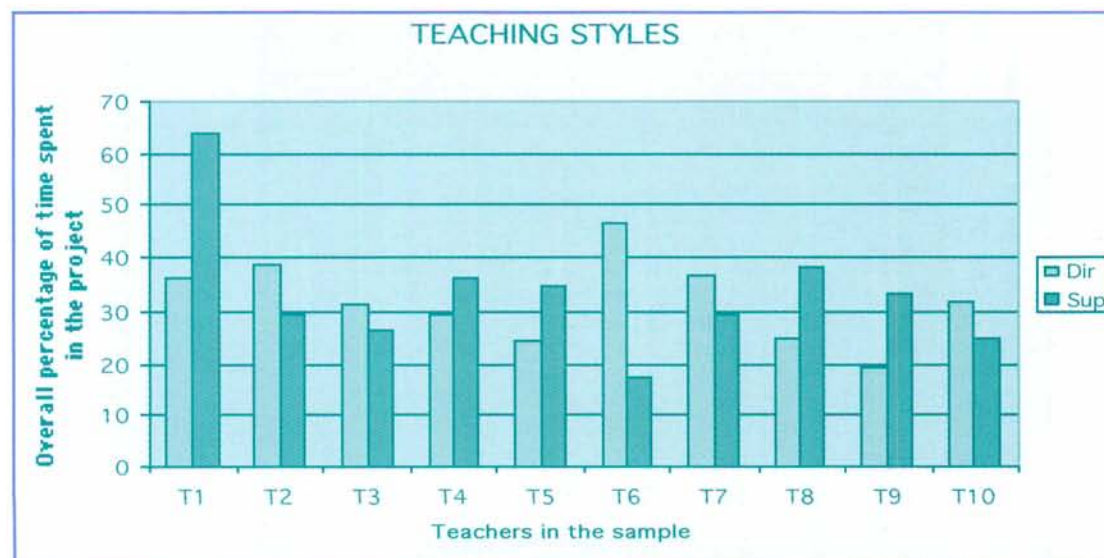
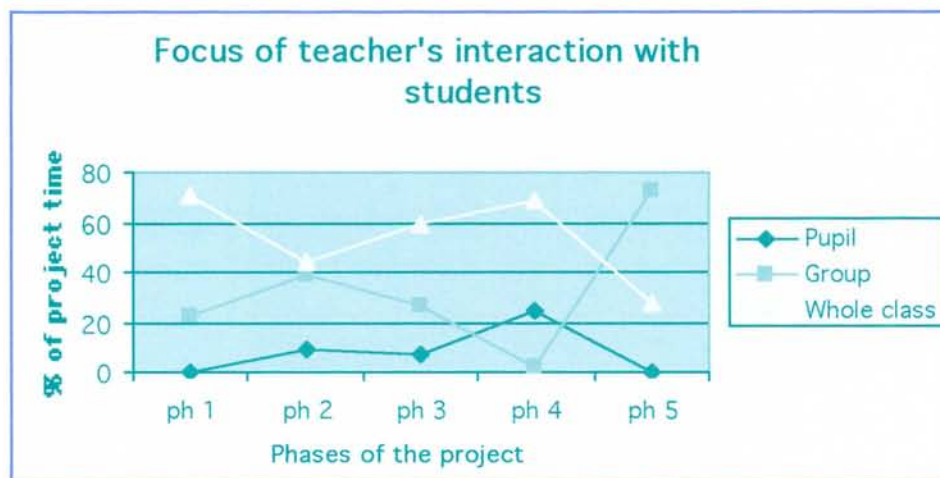


Figure 4: Teaching styles.

Figure 5: Teacher 2 interacting with students.



directing the whole class (Dir) or supporting individual students (Sup). In so doing the following chart was drawn showing teaching styles of 10 teachers in the sample.

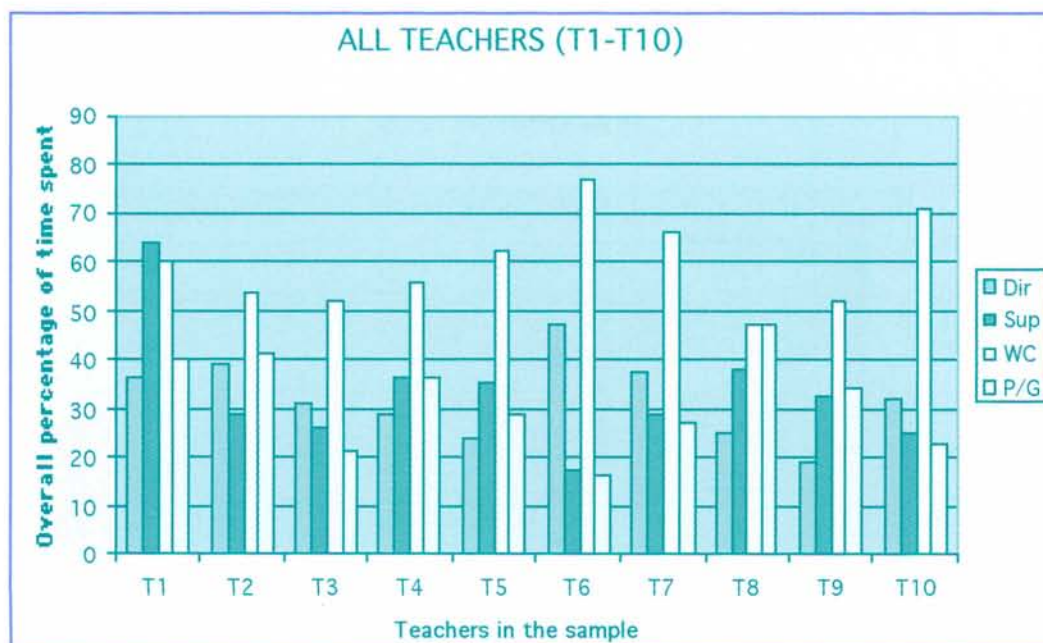
Relating broad descriptors of the whole project to interaction charts

Having demonstrated how teachers in the sample project activities were analysed, and broad descriptors of the project arrived at, these will now be related to the interaction charts to see how they function together throughout the project phases. In the diagram below a significant increase (crescendo) in teacher interaction with groups is evidenced in Phase 5 where interaction with whole class was reduced. The teacher at this stage wanted students to have one complete portfolio for the group arranged in sequence of linear design process and had to evaluate their artefacts as a group.

Teaching styles and trajectories

Teaching styles reflected teachers' actions in the classroom while interacting with students. The ethnographic and observations data evidence suggest that most lessons are lecture method-based where explanations with less illustrations are the core of the design activities. The actions that promote passive learning where students are engaged in simple recall learning activities. Reference is made from the evidence derived from the chart below, which was constructed from the spreadsheets raw data. In the chart below the datamaps suggest that most teachers are whole class practitioners focusing on teacher centred methods and highly instructional in their teaching strategies. T1-T10 illustrated the number of cases studied and the teacher concerned, e.g. in case one teacher 1 coded 'T1' was studied.

Figure 6: Teacher interactions (showing teacher interactions with students).



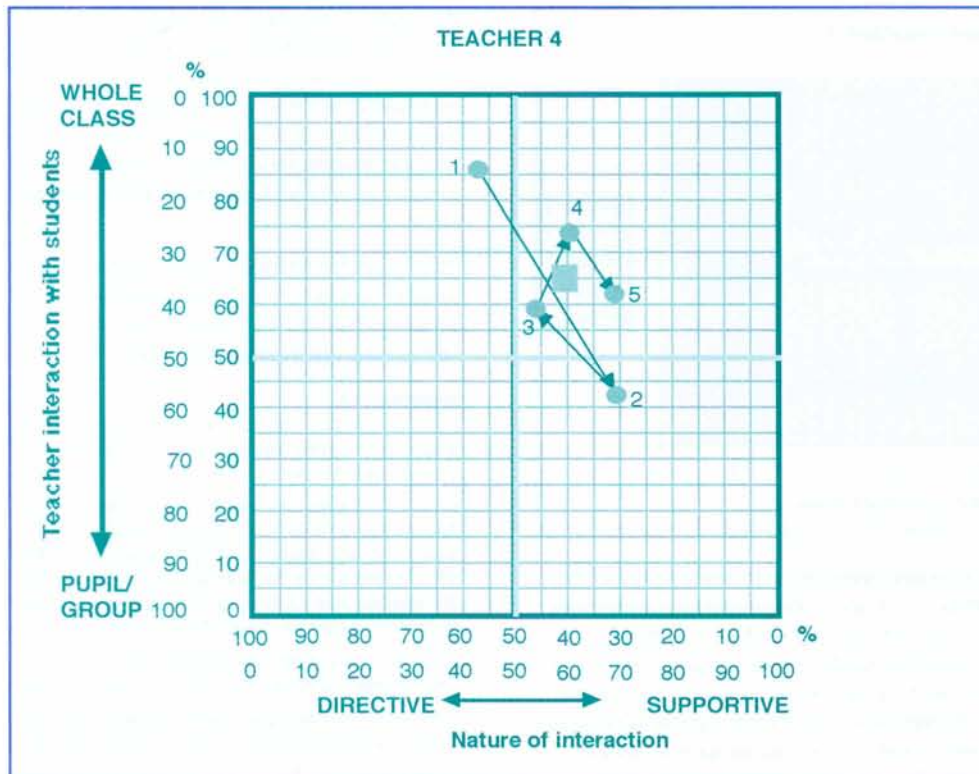


Figure 7: Teacher 4 trajectory showing interactions.

Explaining teachers trajectories – based on phase data

Teachers' trajectories are individual teachers' movements throughout the project using the time sample showing teacher's behaviour and how it changes over the length of the project. Evidence drawn from classroom observations

based on Phase 1 research data has been used to construct teachers' trajectories. An example of teacher trajectory using interactions variables (nature of interaction and teacher interacting with student's variables) is illustrated below. In this case teacher 4 (T4) trajectory was constructed from the empirical raw data. In Phase 1 of the project, the teacher

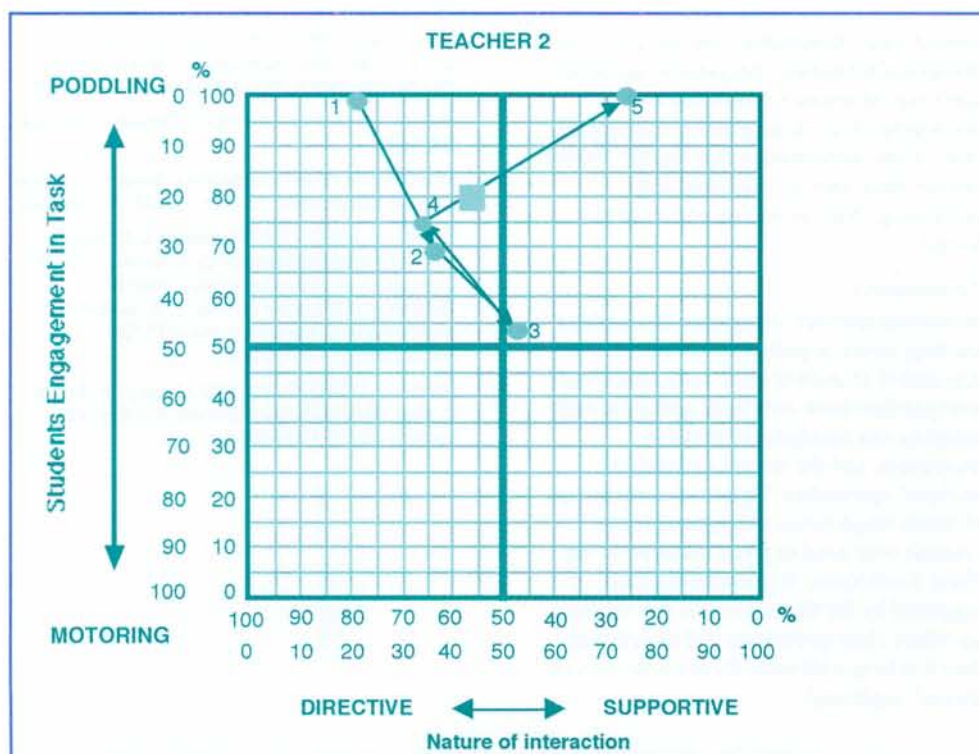


Figure 8: Teacher 2 trajectory showing the students poddling mode and nature of interaction.

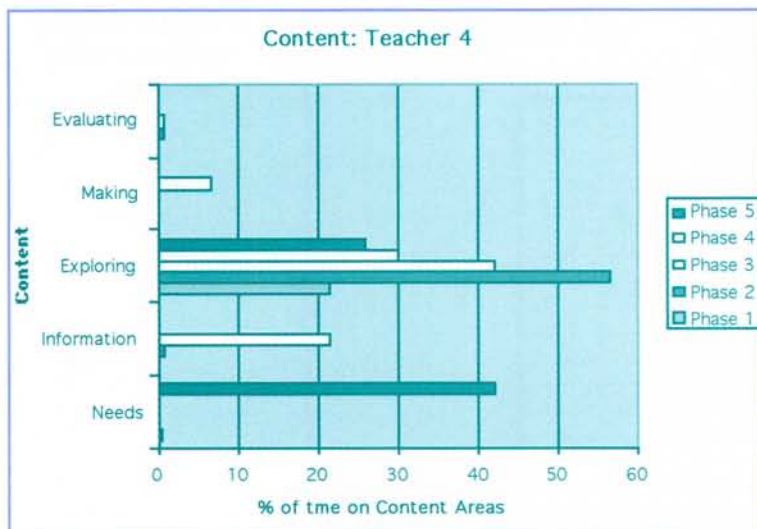


Figure 9: Teacher 4 teaching priority over the five phases of the project.

was more directive to the whole class while in Phases 3, 4 and 5 the teacher was interacting mostly with the whole class in a fairly supporting mode. Hence a highly whole class focused teacher because most of the teacher concentration is on the top right quadrant. In time samples 2 the teacher gave in teacher control and became supportive to individual students.

Another teacher trajectory is shown below demonstrating teacher interactions and the level of student's engagement on the task for teacher 2.

Analysing teachers' content areas

Another way to analyse teachers' content area would be to use the bar charts as illustrated below for teacher 4. In this case the five content areas identifiable from the three-year design and technology programme are needs, gathering information, exploring and developing ideas, making and evaluating. The chart below demonstrates that teacher 4 spent most of their time in 'exploring and developing ideas' in all five phases of the project.

Conclusions

In creating teachers' categories, the teachers' teaching styles or pedagogy, interactions and approaches to content areas were used. And it emerged that there were three groups in each category, one emerging as trends in trajectories, and the second as trends in teachers' approaches. These two main groups or trends (trajectories and approaches to content) were used to select teachers for the Phase 2 fieldwork. It is also explicit as suggested by the Phase 1 data, that teachers are whole class performers and directive in their teaching with more focus on the content area of 'exploring'.

To further triangulate and confirm the groupings and categorisation of teachers for Phase 2 fieldwork, transcribed interviews were used and these will be further analysed using software which is used to analyse qualitative data. By so doing I will be validating and checking the reliability of the study.

This paper has therefore demonstrated how massive amounts of data collected using different data sets and forms could be interpreted, analysed and managed.

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