

## **CHAPTER 5: PRELIMINARY RESEARCH**

### **5.0 WORK LEADING TO PRESENT STUDY**

As mentioned in Chapter 1, I conducted a Research Project on estimation with a group of low-attaining school leavers as part of an MSc taken at the Polytechnic of the South Bank. [Clayton 1983] This project involved the development of an intensive programme to teach various estimation techniques. The pupils were given a pre-test followed by a teaching programme lasting eight weeks. A post-test was given two weeks after the culmination of the teaching programme. A group of O-level pupils was given the pre-test and post-test as a control group. The treatment group showed considerable improvement relative to the control group. I became more interested in the development of estimation in schools and embarked on the present research.

### **5.1 INITIAL STAGE**

I realised very early in my research that interviews would be a vital part of the research and I had serious misgivings of my own interview technique. A group of Hillcroft College students and two male friends, a police constable and a van driver, volunteered to assist in the research and I was able to gain experience interviewing adults who could be critical of my technique and were also able to verbalise their estimation methods quite well - in most cases. Estimation tasks and questions were gathered in the early stages of the literature search. The adult interviews allowed me the opportunity of exploring some of these tasks with the volunteers with the purpose of eventually developing a bank of questions/tasks to present to the pupils.

Questions which were deemed to be unsuitable by the interviewees were discarded and new questions posed. Some questions were dismissed as too similar to "Trivial Pursuit" questions while others were dismissed because the interviewees were not interested in them or thought them to be uninteresting to pupils. A detailed discussion of the development of questions is presented in the next chapter. This initial period was very unstructured and speculative in nature and allowed me to have first hand contact with people while they performed estimation tasks. The prime

reason for interviewing adults was their willingness and interest in the project.

The initial interviews of five Hillcroft volunteers were conducted in a group to establish a friendly working atmosphere during the Autumn of 1984. The course they were following is roughly equivalent to the first year of a degree course for 'second chance' female students. I was able to determine that, although the group was of varied background and ability, they were generally 'maths-phobic'. They expressed a willingness to assist in the research due primarily to their own poor experiences in mathematics. Their expressed desire was to help anyone who would attempt to change the way mathematics is taught. A second interview of each volunteer was conducted in private while they attempted estimation tasks. To attempt to get the interviewee to 'think aloud', they were asked to read the question aloud and try to explain their thinking.

During the interviews, I discovered that the five female volunteers were unable to estimate anything in metric units except metres which they interpreted as yards. However, both of the male volunteers answered a question about the length of his foot in cm. with confidence. One said his foot was "about 12 inches long, 25 mm. to the inch, giving  $25 \times 12 = 300$  mm., which is 30 cm.". I found this rather amazing as that individual considers himself to be very weak in any academic abilities. The other male said that it must be about 30 cm. since his foot was about a ft. long and there are 30 cm. per ft. I decided, on the basis of the above comments, to have all estimates for the adults in Imperial units. The problems associated with the two systems of units being used concurrently recur and will be mentioned in future chapters.

During this set of interviews, I was attempting to confirm that strategies (predicted by Siegel, et al [1982] and described in Chapter 4) were used by adult subjects and to develop methods of observation to identify these strategies. In one instance, a female volunteer, stated her own height in feet and then "imagined standing on my own shoulders" to estimate the height of the room. In this case, she was using the Benchmark strategy. She was able to realise that some problems could be broken into sub-problems but she was not always able to finish the problem. At those times, she was using a Pseudo-Decomposition strategy. She and the two

male volunteers were much more adept at correctly rounding numbers and their estimates were slightly more accurate than other volunteers. The male volunteers had greater confidence in approaching each task (reinforcing the reference in the literature to the importance of self-confidence) and the answer given by one of the male volunteers to a question about the length of one's foot, cited earlier, showed that Decomposition/Recomposition was used. At the other extreme, one female volunteer's answers were primarily of the nature of "only a guess" or "not a clue". Her reactions to these questions showed that her strategies were almost non-existent. The interviews were useful as a means of verifying that subjects used some of the strategies mentioned in the literature and I found that these strategies were easily identified. The interviews also gave the first indications of potential gender issues involved in estimating.

## 5.2 INTERVIEWS OF PRIMARY PUPILS

I became interested in determining whether pupils use the same techniques as adults and whether they were able to estimate without the experience that adults had gained after leaving school. After the series of interviews with the adults was completed, an opportunity to interview pupils in a primary school presented itself to me. The catchment area for the school is entirely private housing and decidedly middle class. These interviews were intended to extend my experience with pupils in this age range and to test the interest value of previously developed questions. Each of four class teachers released four individuals. These were the 'top' and 'bottom' boy and girl for each year group in overall ability as judged by their teacher.

Individual pupils were taken into a playground and asked "How high is the goal post?"(2m.) This question was preceded by the metre stick being presented to them and a short discussion of whether they were taller/shorter or the same height as a metre stick. The 'Guess' was then checked by a measurement and the pupils were then asked to guess the height of a fence(3m.). I was interested to see if they adjusted their guess to the fence after having 'failed'/'succeeded' (in their minds) on the goal post question. The problem of a 'right' answer became apparent as

several were disappointed at guessing "2 and a bit m." for the goal post and, therefore, 'wrong'. They were praised but I detected their strong desire to get the 'right' answer.

The five and six-year old pupils appeared to have very little ability to cope with the work. This would agree with the study by Immers [1983] previously mentioned and it was decided that seven would be the minimum age pupil to involve in the testing programme. I decided to test the value of two of the questions used with the adults. The pupils were shown a pattern of 100 dots with a winding red line encircling some of them and asked "How many dots are inside the red line? There are 100 dots in all." They were also asked if they could explain any strategy. Generally, the older the pupil, the closer the guess. However, none of the pupils could explain their methods. Another question, (How many 10p pieces stacked up will be as high as a 10p piece on end?), was raised. They were asked the question first and then showed the coins and asked the question again. The pupils were quite close, at least, on their second estimate. This showed that they could alter their predictions confirming that they can use the 'Guess and Check' strategy at a very young age. The Benchmark strategy was the most common one used and this was determined by observing the eye movement of the pupil and confirmed through questioning them.

The pupils found it difficult to explain their thinking but were keen to do the work. Other questions were asked and their opinions were used to modify the questions to be of greater interest to pupils of their age range. Finally, they were asked to supply questions or areas of interest where they believed estimation would be useful. They were not forthcoming with questions but did show an interest in guessing the heights of various objects. This was possibly due to the fun that they had experienced in estimating the heights of various objects while I assisted them.

### 5.3 DIRECTION INDICATED BY PRELIMINARY RESEARCH

This preliminary research produced a number of questions which appeared to be of interest to a wide age range and also addressed a variety of estimation skills. At this stage, it became apparent that a test of estimation skills across a wide age and ability range could be developed

and, provided the questions were of interest to the pupils, they would endeavour to answer them in a serious manner. I decided to continue to develop questions which could be used in such a test. I received funding from the Schools Curriculum Development Committee for this work and permission from the London Borough of Sutton to conduct the tests once completed.

