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ABSTRACT

This report discusses the methods, techniques, and software applications used in processing the data gathered in a survey of the physical condition and health of students in Guangdong Province, China. The introduction provides background on the survey. Survey grouping, data items, and survey procedures are then described. A discussion of microcomputer data processing covers crude and derived indicators, statistics, hardware and software, data structure, the use of LOTUS 1-2-3 for survey data processing, programming of the data entry module, and programming of the data analysis module. Selected findings are summarized in order to illustrate the capabilities of LOTUS 1-2-3 for data presentation and to demonstrate analyses of the data for comparison of groups and establishment of standards. Some problems encountered with hardware and software and solutions to these problems are considered, and conclusions are drawn regarding applications of microcomputers for survey data processing. The report includes many tables and graphs. A sample of a Chinese student physical condition and health card (in Chinese characters) and the programs written to compare data files for inconsistencies and to calculate common statistics are appended. (MES)

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MICROCOMPUTER PROCESSING AND ANALYSIS OF SAMPLE SURVEY IN EDUCATION

a methodological case study

by GUO SHENG

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CONTENTS

FOREWORD

A salient component of current reforms and restructuring of educational systems in countries of Asia and the Pacific is the modernization of educational planning and management approaches and mechanisms. The introduction of applications of new information technology, such as the computer, is fast becoming a major thrust in the region.

The productive and service sectors have been pioneers in the application of computer technology to management, through the development of what is commonly called (MIS) (Management Information System). This approach is spreading to the education sector.

The education sector remains one of the biggest employer within the national economy. It usually caters to a very large client group: the learners, who comprise easily more than half of the total population, particularly those below 25 years of age. Within the national budget, the education sector also operates huge financial resources which very often are second in size only to defence. The number of physical facilities such as school buildings, furniture, textbooks and other materials acquired, operated, and maintained is not only vast, but also very much dispersed within the national territory.

Also taking into account the rapidly growing non-formal and informal streams of education, it is clear that the entire planning and management tasks would be insurmountable, unless good use is made of modern management approaches and tools. This has given birth to a new area of development, namely that of Educational Management Information System (EMIS), which deals with the introduction of modern information management techniques and applications for the improvement of educational planning and management.

The past few years have witnessed the rapid proliferation in countries of the region of a new generation of computer: the microcomputers. Technological progress in microcomputer hardware and software capabilities has given rise to a wide panoply of user-specific automated applications. There is the the growing need to draw from experiences that have been accumulated thus far to create and adapt similar facilities for the management of education. The Educational

Planning, Management and Statistics Unit of the UNESCO Principal Regional Office for Asia and the Pacific has therefore commissioned the present study as the first in its on-going efforts to contribute to the sharing of expertise, experiences, and ideas in EMIS.

UNESCO owes special thanks to the author: Mr. Guo Sheng of the Education Commission of Guangdong Province of the People's Republic of China, for documenting in this study his valuable experiment and experience in the processing on a survey on the physical condition of students using microcomputers. It is hoped that this study will provide new insights and new impetus to other countries in the development of microcomputer-based applications in EMIS.

Educational Planning, Management
and Statistics Unit, PROAP

Chapter One

INTRODUCTION

The present study summarizes the methodological approaches adopted as well as experiences gained in the course of a sample survey launched in 1985 in Guangdong province, China. The survey was undertaken to assess the level of students' physical condition and health in Guangdong province.

In China, it has long been considered important to monitor and observe the physical development of children and youths and the patho-genesis of common ailments over a long period of time. Through a study of the physical characteristics and health of students from different regions, sexes and minority nationalities, this survey aims at providing a scientific basis and guidance to the expansion and improvement of physical culture and hygiene in schools.

In accordance with the national plan of China, Guangdong province established in 1983 the system of Chinese Student Physical Condition and Health Record Card at every level and in all kinds of schools. Observation points were introduced which regularly monitored and carried out research and studies on changes in the students' physical condition and health, from 1983 to 1986. The present sample survey on the students' physical condition and health was launched to further strengthen the information base for the establishment of better standards of health services.

This survey was characterized by a number of innovative approaches. The first was the use of sampling techniques, instead of the usual full-scale census reporting, for the collection of information within the education sector. The use of microcomputers to handle the entire processing and analysis of data was another major innovation, which proved to be very positive and valuable. There is no doubt that this experience will contribute to the further development and expansion of microcomputer-based data processing in education.

A third innovative aspect encompasses the wide range of original applications developed for data input, verification and analysis, using a common spreadsheet software package, the LOTUS 1-2-3. The brilliant ideas behind these applications have opened up new avenues not only in the current modernization and microcomputerization of educational planning and management, but also survey data processing in general.

As a methodological contribution, this study shall not attempt to summarize and present the survey findings, but rather the methods, techniques and software applications employed during the survey data processing, as well as the experience gained through their application. It is hoped that this experience will lead to other new and better ideas, approaches, methods and techniques, thus generating further developmental work in related applications in other countries.

The present study contains six chapters, beginning with the Introduction which gives the background to the sample survey. The remaining parts are organized in such a way that the scope and coverage of the survey, as well as the sampling techniques adopted are described in Chapter Two. Chapter Three explains in detail the methods used in survey data processing by microcomputer within the LOTUS 1-2-3 software environment. Chapter Four summarizes the findings from the methodological point of view. Chapter Five attempts to highlight some of the problems encountered during this experiment, and some of the solutions adopted to solve them. And the last chapter draws salient conclusions and suggests future directions of development.

A number of tables and charts are included in appropriate places to illustrate the approach and results. In the Annex, a sample of the Chinese Student Physical Condition and Health Card is included, along with listings of two LOTUS 1-2-3 macro programs used.

Chapter Two

SURVEY METHODS

Survey Grouping

Respondents to this survey were drawn from university and college students as well as secondary and primary school pupils aged from 7 to 22. The age-group 7 to 12 corresponds to primary education in China, 13 to 18 to secondary schooling, and 19 to 22 to college and university education.

For primary and secondary levels, an urban and a rural area that were representative in terms of students' physical conditions and health were selected from each prefecture and municipality in Guangdong province. The selection of these areas was also based on economic and geographical factors. About 120 male and female students from every age-group, in both the urban and rural areas, were surveyed. Students in the Hainan Li and Miao Autonomous Prefectures were classified according to Han or Li nationalities, instead of the urban/rural criterion. Three high schools and three primary schools from areas with moderate living standards and sports facilities were randomly sampled in each of the selected areas.

For undergraduates in colleges and universities, three higher educational institutions which could provide data on the state of health of students born in Guangdong province were selected. College students from each specific age-group, numbering 200 each for either sex from the urban areas, and 100 each from rural areas, were surveyed.

The survey respondents were required to be in good health and not to have any physical deformity. Students in special schools or classes, in particular in physical culture or art colleges, were not covered by the survey.

In addition to groupings that separated urban and rural students, information on groups which combine these two sections of data for the same age-group and sex were also collected. The sample data of Guangdong provided data from large cities, mountainous areas, and coastal areas. 102 cards from each segment for each single group were sampled, so there were 306 cards for every group in the provincial sample.

Students included in the survey were classified according to six types: Han and Li nationalities, male and female, urban and rural. About 70,000 valid cards needed to be processed. Considering that 46 data items or indicators were included in each card, more than three million data items were processed. Microcomputers of the IBM-PC/XT type were used for this purpose.

Data Items

Each student was studied according to four types of indicators: size, function, diathesis, and health examination.

In the physical measurement of the body, the size indicators were used to study the relationship among growth, speed and body development. The six size indicators used during the survey were height, weight, chest circumference, sitting height, shoulder breadth, and pelvic breadth.

Functional indicators reflected physical constitution in terms of the functioning of organs. These indicators included pulse, systolic pressure, diastolic pressure, vital capacity and others.

Diathesis indicators were used to evaluate the speed, strength, and flexibility of the students by checking their sportive capabilities. Major diathesis indicators included nine test items, such as the 50 metre sprint, standing long jump, chin-up, inclined-body chin-up, sit-ups, and so on.

Figure 1. *Items examined in the sample survey by level of education*

Items	Primary	Secondary	University
Height	■	■	■
Weight	■	■	■
Chest circum.	■	■	■
Sitting height	■	■	■
Shoulder breadth	■	■	■
Pelvic breadth	■	■	■
Pulse	■	■	■
Systolic pressure	■	■	■
Diastolic pressure	■	■	■
Vital capacity	■	■	■
50 metre sprint	■	■	■
Long jump	■	■	■
Chin-up (M)		■	■
Inclined chin-up(M)	■		
Sit-ups (F)	■	■	■
1000 m run (M)		■	■
800 m run (F)		■	■
50 m x 8 run	■	■	

■ Items examined in the survey.

The health examination sought to identify any pathological changes in the body. Vision, heart, lung, liver and the functionning of other organs were also examined.

Different items were examined in the case of undergraduates, secondary school students, and primary school pupils, due to the different sportive adaptability among groups and sexes (Figure 1). For instance, 1,000–metre run was given as a test item to secondary school male students, 800–metre run for girls, and 50–metre x 8 run for boys and girls in primary schools.

Survey procedure

After the sample was determined and identified, survey interviewers were trained and survey sites and equipment prepared. The survey was formally carried out from April to June 1985 throughout the province of Guangdong.

During the survey, survey personnel filled out the Chinese Student Physical Condition and Health Record Card (see Annex I) for each student covered in the survey, based on designated specifications.

To ensure the accuracy of the data, a random sample of some of the students who had already been surveyed was chosen to repeat the tests. The new results were compared with the original data. When differences surpassed a certain permissible limit, processing of the survey was stopped until the cards were corrected.

Once data collection and verification were completed, the record cards were sorted according to sex, urban/rural, age-group and nationality, and then filed. During the course of card transfer, every item in every card was checked repeatedly. Erroneous cards were corrected and missing cards were added. In this way, reliability of data was improved. The number of valid cards that eventually underwent computerized processing totalled more than 70,000.

Chapter Three

METHODS OF DATA PROCESSING WITH MICROCOMPUTER

Crude and derived indicators

There were two pages to each card : the first contained the size, functional and diathesis indicators: and the second showed results of the physical examination, a list of common ailments and laboratory test results. As the survey covered pupils and students who have no physical abnormalies, only data for the first 22 crude indicators on the first page of the card were entered into the computer for processing.

Indicators 1 to 20 were quantitative data used for computational analysis. Indicators 21 and 22 were logical data used for sorting, counting and grouping. Each of them had two possible values: 0 or 1. For item 21, 0 indicated that a girl has not had menstruation yet; 1 for yes. For item 22, 0 signified that the student has normal vision (vision index greater than or equal to 1), and 1 for hypopsia (vision index smaller than 1).

Through various combinations and further computations of different crude indicators, derived indicators were obtained, which reflected ratio relationships between various components of health and physical condition within the human body. For example, the Livi index, calculated by taking the percentage chest circumference divided by height then multiplied by 100, showed the nutritional status of a student. A total of 24 derived indicators were computed in preliminary survey data processing.

Statistics

Basic statistics computed were as follows: maximum and minimum values, average, standard deviation and standard error, variance and percentiles (3%, 5%, 10%, ..., 90%, 95%, 97%) of every crude and derived indicator by group. Each indicator in every group was also checked for normal distribution. Absolute increases, growth rates and adjusted growth rates, as well as standard ratios giving proportions of every age to a specific age of each indicator were also calculated to investigate the development and growth of students as age changes. Some of the differences between rural and urban, male and female, Han and Li Nationalities, were also compared for the same indicator at the same age.

When the data had been sorted and computed, linear regression models with single and multiple variables were built to study the correlation between different indicators. These models enabled the setting up of standards for the evaluation of the students' physical condition and health. This was particularly important for the study of functional and diathetic characteristics among different body configurations.

Data processing hardware and software

Processing of the sample survey on physical condition and health was carried out using two IBM-PC/XT microcomputers at the Computer Center of the Guangdong Province Department of Education. Both microcomputers have a 10MB fixed disk and a 360KB disk drive. One has 640KB random-access-memory(RAM) and the other 512KB. As there were many IBM-PCs and compatible computers in Guangdong province, it was possible to make use of external help from other departments equipped with similar microcomputers to carry out and complete the data entry. In the future, data transfer to and from the mainframe will also be possible.

The LOTUS 1-2-3 software package was used for data processing, owing mainly to its powerful functions which integrate electronic spreadsheet, database management and graphics. Its capabilities for data manipulation, calculations, analysis, tabulation and graphical presentation, as well as the many statistical functions offered, made it the ideal choice for the task at hand. Furthermore, it incorporates macro programming language for automating repetitive procedures through a series of sequential commands. The experiment was therefore made to process and analyze the entire sample survey data through the use of LOTUS 1-2-3.

Data structure

The maximum space in a single LOTUS 1-2-3 worksheet consists of 2,048 rows and 256 columns of data (new versions provide for 8,192 rows). Most PCs have about 512KB of memory. Excluding at least 100KB used by the system, there were approximately 300KB to 400KB of memory left for the worksheet itself. As a result, only a limited quantity of data could be processed at a time.

In view of the more than 3 million crude and derived data in the survey, it was neither possible nor necessary to put all the data in a single data file. In accordance with the set objectives of survey data processing and analysis, the data were classified, inputted and stored separately in a number of LOTUS worksheet files, and processed subsequently by group.

The data file names were determined according to nationalities, urban/rural areas, sex and age. By letting U stand for urban, R for rural, M for male, F for female, H for Han nationality, and L for Li nationality, rules for file names were as follows:

| U/R | M/F | age |

| L/H | M/F | age |

There were consequently eight kinds of file names: UM, UF, RM, RF, HM, HF, LM, F. For instance, UF12 represented the group of 12-year old girls from municipalities or towns.

Cards in every group were numbered in ascending order, starting with 1. This allowed data to be checked or verified conveniently later. Care was also taken to ensure that all the groups had roughly the same number of cards. Programs designed for processing and analysis could then be standardized.

By making use of the database management functions of LOTUS 1-2-3, worksheets were created, with data organized in such a way that rows and columns contained related information. In a typical worksheet, the first row indicated the file name of the group. In the second row were field names in the sequence as described in the survey cards. An additional first column was added to record the card numbers. The field names were labels in the form of numbers corresponding to the data items on the card. Field name 1 therefore stood for the first data item examined, namely "pulse"; field 2 represented the second data item, "systolic pressure"; and so on.

The database records began from the row immediately below the field names. Each record was a row in the worksheet showing the physical condition and health information of a student. Each field was a column that contained data of the same indicator in the group (see Figure 2). Each worksheet was therefore organized as a database. For example, the cell located in position D7 represented the intersection of the fifth record and the second data item - "s,stolic pressure". It indicated that the systolic pressure of the fifth student in the group UF12 was 92.

The data structure of the derived indicators was similar to that of the crude indicators. However, the field names in the second row of the worksheets were given in the form of characters, such as A, B, C, ..., X.

Certain crude indicators were not examined for some specific age-groups. In designing the data entry worksheet, the corresponding fields were protected so that data could not be entered into those cells. This reduced data entry errors. The procedures followed were as follows: firstly, to specify the entire data input range by the /Range Unprotect command; then to use the /Range Protect to mark the

	A	B	C	D	E	F	G	X
1			uf 12					
2	No.		1	2	3	4	5	22
3	1		38	110	60	40	1600	1
4	2		46	128	80	70	2340	1
5	3		43	96	60	50	2330	0
6	4		44	102	72	66	2650	0
7	5		45	92	70	60	1980	0
8	6		39	90	56	50	2180	0
.	.							.
.	.							.
.	.							.
308	306		42	106	70	64	1800	0

Figure 2. *Structure of data files*

columns to prohibit data entry; and finally, use the command /Worksheet Global Protection Enable to turn on the protection facility.

As soon as all the data were organized in the way described above, the powerful statistical and data management functions of LOTUS 1-2-3 were put to use in processing and analyzing the data in a fast and convenient manner.

An overview of survey data processing

A salient feature of this experiment in microcomputer processing of survey data was the use of LOTUS 1-2-3 macro programming facilities for automating data input, processing and analysis. Macros not only reduce repetitive keystrokes and command operations, they have also become the building blocks for programs incorporating advanced features such as loops, subroutines and conditional branching. It is the macros that speed up commands execution, thus improving the efficiency of data processing.

The worksheets were designed to facilitate application of the macro programming technique within LOTUS 1-2-3. A typical worksheet consisted of three ranges: data range, formula range and program range (Figure 3). The data range was used to incorporate data file for processing. The formula range contained mathematical expressions for the calculation of derived indicators and statistics. When the {calc} command in the macro program was encountered, the computer would perform certain specific computations automatically. The program range was generally a column in which a series of cell entries recorded the step-by-step macro operations. Whenever the macro was invoked, the computer would automatically load the data file to be processed into the data range, sort and reorganize the data, as well as compute them. Finally, the results were saved in the diskettes.

As 10MB of hard disk storage was not sufficient to hold all the files, only the relevant series of data files were copied into it for each batch of the processing operations. Once the LOTUS 1-2-3 was started, the computation worksheet was loaded from a diskette into the main memory, and the macro invoked. Data files were then loaded one after another into the data range. The processing subroutine was activated automatically once the data range was filled, so large amount of data could be processed repeatedly. In the computational worksheet demonstrated in Figure 3, once the data file UF7 had been processed, UF8 was loaded and the same processing operations carried out. In a similar manner, subsequent data files such as UF9, Uf10, .., UF18 were processed.

Data processing of the physical condition and health survey could be roughly divided into four modules or phases: data preparation, data entry, data analysis and results output. They are shown in Figure 4.

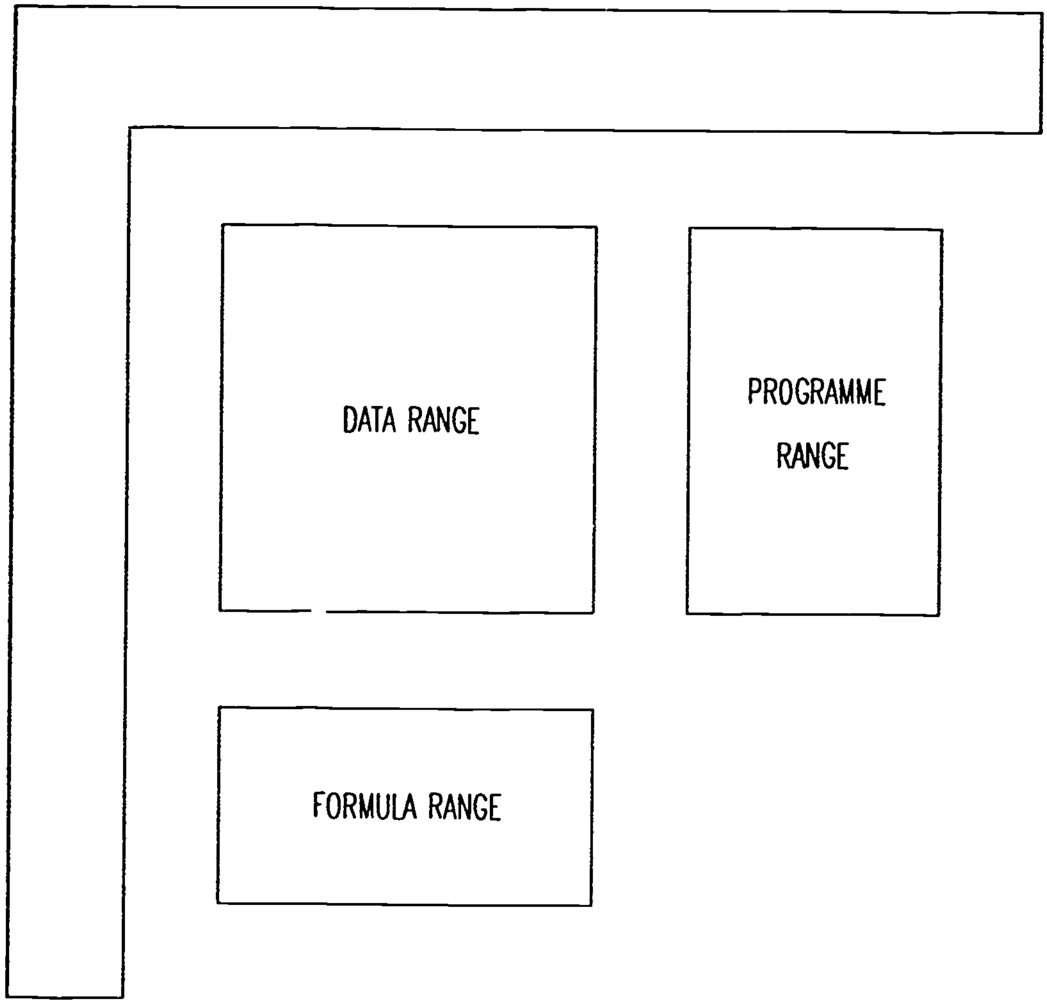

Figure 3. *Structure of computation worksheet*

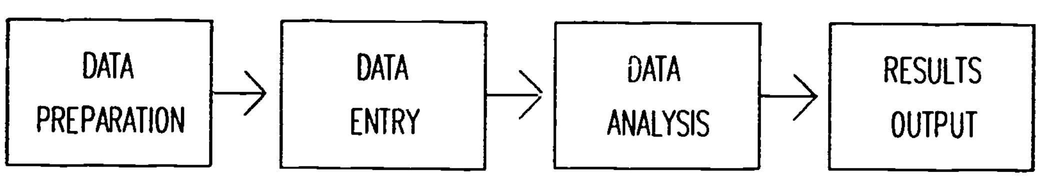

Figure 4. *Data processing on physical condition and health*

The task of the data preparation module was to provide quality crude data for microcomputerized processing. During this stage, sample points were selected and data items examined by trained personnel. The cards were completed and repeatedly checked; then sorted and bound into volumes. File names and card numbers were then assigned.

At the stage of data entry, data were entered into computer storage following fixed formats and procedures. A duplex data entry system was employed in which data from the same card were entered twice into separate data files for cross-checking. Data entry errors were located and eliminated. This was followed by logical checks which, according to the age and sex of individual pupils, identified data values that either fell short of or exceeded the normally accepted value ranges, for example in body height or size. Logical checks based on the correlation between crude indicators were also performed to locate erroneous records which were then rectified or replaced.

The data analysis module was used to sort, calculate and analyze the survey data. The first step was to compute derived indicators based on the crude indicators, in order to generate data files of derived indicators. At different stages of the calculation, patterns of student physical development were identified and norms for the evaluation of students' health determined. The appropriate reference curve graphs were also plotted.

The results output module was used when analytical results were transferred to the printer for hard-copy output of tables and graphs for further study and interpretation.

These modules will be described in detail in the following sections, beginning with data entry and data analysis.

Programming of data entry module

Before data could be entered into computer storage, worksheets such as the one illustrated in Figure 2 were prepared. Data entry personnel filled out the worksheet cells row by row, from left to right, and from top to bottom. With the duplex data entry procedure, the same group of data was entered twice and saved on diskettes under different file names.

The COMPARE program was then used to compare duplex data files and locate inconsistencies. When these inconsistencies had been checked and corrected, the LOGICAL program was executed to make logical checks through the data. Illogical records were extracted and either corrected by special personnel or replaced with new logical cards with correct and logical data. The design and functions of the COMPARE and LOGICAL programs are described below.

Assuming that A and B are the duplex data files of the same group with n cards in each group. The data are arranged under LOTUS 1-2-3 as a database in the form of a matrix with n rows and 22 columns (as there are 22 data items in a card). By designating A as the matrix $\{a_{ij}\}$ and B as $\{b_{ij}\}$, where i can vary from 1 to n and j from 1 to 22, according to the law of probability, it is rare that exactly the same data item is entered twice with error during the duplex data entry. There is even lesser probability that the two erroneous entries are identical. Therefore, if one can ensure that $a_{ij}=b_{ij}$ for all i's from 1 to n and all j's from 1 to 22, the data entries for the specific batch of n cards can be considered as complete and free from error.

The condition of $a_{ij} = b_{ij}$ is equivalent to $a_{ij} - b_{ij} = 0$.

$$a_{ij} = b_{ij} \iff a_{ij} - b_{ij} = 0$$

With the /File Combine Subtract command in LOTUS 1-2-3, we can incorporate the data file B into A in the COMPARE worksheet and subtract every datum in A from the corresponding datum in B, to give:

$$c_{ij} = a_{ij} - b_{ij}$$

To locate the errors, the absolute values of c_{ij} are horizontally summed up to act as a tag for judging whether there is any error in the data entry for each record, where:

$$Tag_i = \sum_{j=1}^{22} |c_{ij}| = \sum_{j=1}^{22} |a_{ij}-b_{ij}|$$

When $Tag_i = 0$, the ith record is correct. By being different from zero, it indicates error.

The purpose of taking the sum of the absolute values of c_{ij} is to eliminate the possibility that certain positive and negative values obtained by calculating the simple differences between a_{ij} and b_{ij} may cancel each other if the the horizontal sum of c_{ij}'s are taken. As a result, one may not be able to detect the existence of error in certain records, if the horizontal sums of the c_{ij}'s for those records are equal to zero due to the cancelling effect.

In the COMPARE program, the flow of which is illustrated in Figure 5, through the use of macros (please see macro program in Annex II), data file A is loaded into the worksheet and used to check against data on the survey cards at a later stage. The matrix A is also duplicated through the /Copy command into another area in the worksheet, so that one can subtract B from it with the /File Combine Subtract command. As described earlier, the field names and card numbers are recorded in the border ranges, so only the data parts of B need to be combined into the corresponding range by selecting the /FCS Named-range commands.

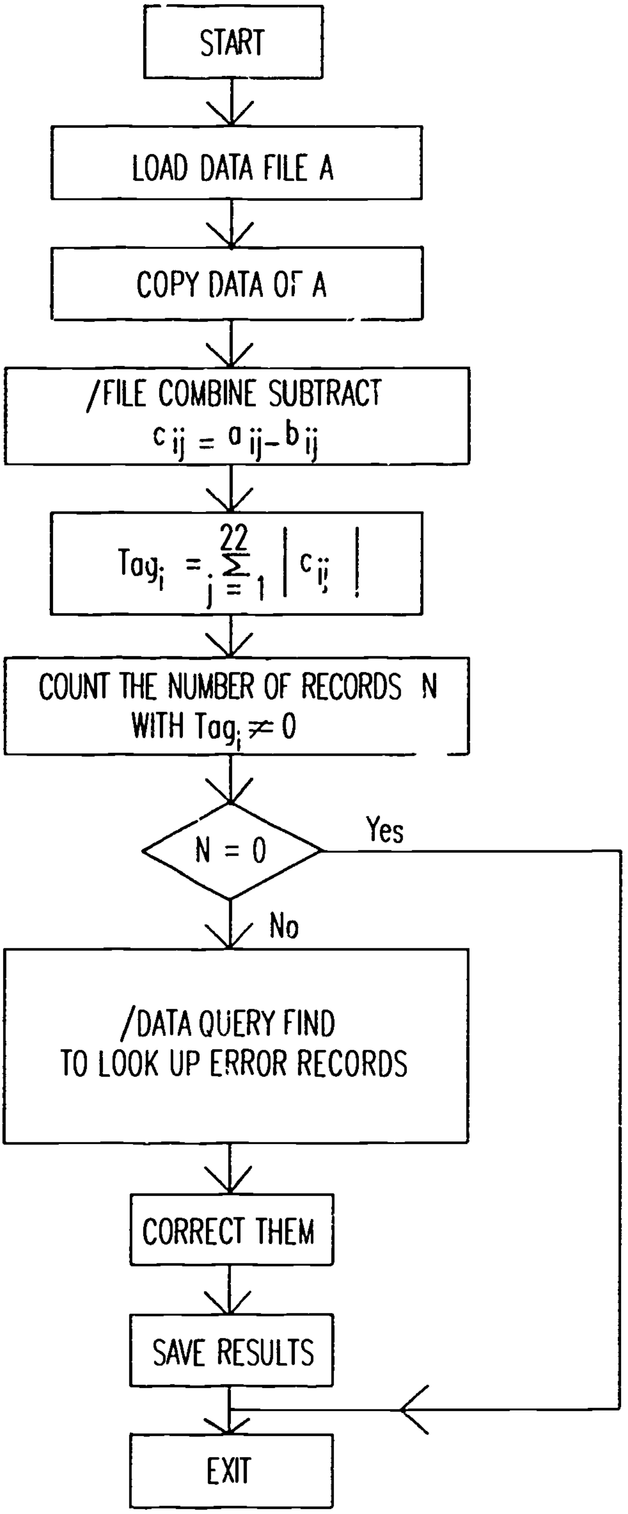

Figure 5. *Flow chart of Compare*

After calculations of individual c_{ij}'s (= $a_{ij} - b_{ij}$) are completed, their horizontal sums are obtained and another database with a single field tag is set up. Records with tags which are non-zero are identified by using the command /Data Query Find.

The "window" command in LOTUS 1-2-3 is used to split the screen into two windows for showing two sets of data at the same time. The upper window provides a view on the original data of file A. The lower window shows the results of $a_{ij} - b_{ij}$ and the tags. Once a non-zero value is detected for the tag, the corresponding value in A is checked against the card records to locate the error. Three types of errors may arise when $c_{ij} = 0$: (a) only entries in B are wrong; (b) only entries in A are wrong; or (c) both entries in A and B are wrong. For the first case, nothing needs to be done. For the second and last cases, modifications are made in the appropriate entry and data item.

Figure 6. *Limits for logical check*

Error Code	Limits / Indexes \ Ages	7–12	13–18	19–22
E01	Pulse (times/semi-sec)	30–60	25–55	25–55
E02	Systolic pressure	70–160	70–160	70–160
			(13–14)	
E03	Diastolic Pressure	40–90	50–95	
			(15–18)	
E04	Vital capacity		0–95	0–95
E05	Sitting H/H*100	600–5000	1000–7000	1700–7000
E06		46.32–59.6	46.06–59.0	47.28–58.3
.				
.				
.				
.				
.	(M)			
E15	Chin-up		0–50	0–50
E16	Inclined chin-up	0–66	0–66	0–66
E17	50m*8 (sec)	200–60		
	(F)			
E18	800m (sec)		400–160	400–160
E19	1000m (sec)		370–150	370–150

15 *Methods of data processing*

Certain logical relationships existed among the indicators for specific age groups. Some of the maximum and minimum values of measurement are given in Figure 6. Any datum that exceeds the maximum value or falls short of the minimum value was checked again for logical errors. For example, the pulse range for children of the 7 to 12 age-group usually varied from 30 to 60 times per half-minute. If the pulse of a 10-year old child was found to be less than 30 or greater than 60 times per half-minute, the record of this student was checked again. Nineteen types of error were coded: as E01, E02, ... , E19.

For each type of error, a criterion range was set up to specify the error conditions. For the 7 to 12 age-group, the condition for E06 was that (sitting height/ height X 100) should be less than 46.32 and greater than 59.6. As mentioned earlier the field names of height and sitting height were in cells H2 and I2. Therefore, the cell address of standing height in the first record was H3, and sitting height I3. By entering the two conditions in the two rows below the field name E06 in the criterion range, the /Data Query Extract command was used to specify the criterion range and the whole database as input range, and to copy all records matching either of the conditions to an output range.

6	Range name
+I3/H3*100<46.32	1st condition
+I3/H3*100>59.6	2nd condition

The flow chart of LOGICAL can be seen in Figure 7. When the macro was invoked, the data range was cleared and the specified data file was incorporated in the current worksheet. The database range, output range and criterion ranges were automatically specified by the macro. The computer would check the nineteen logical errors one after another. If logical inconsistencies were found, they were checked against the cards and rectified accordingly. The main portion of the program would re-execute until no more error was found. When the entire data file had been checked for logical errors, it was saved replacing the original file.

Programming of data analysis module

The data analysis module forms the centre-piece of the complete methodology of microcomputer processing of the sample survey of the students' physical condition and health.

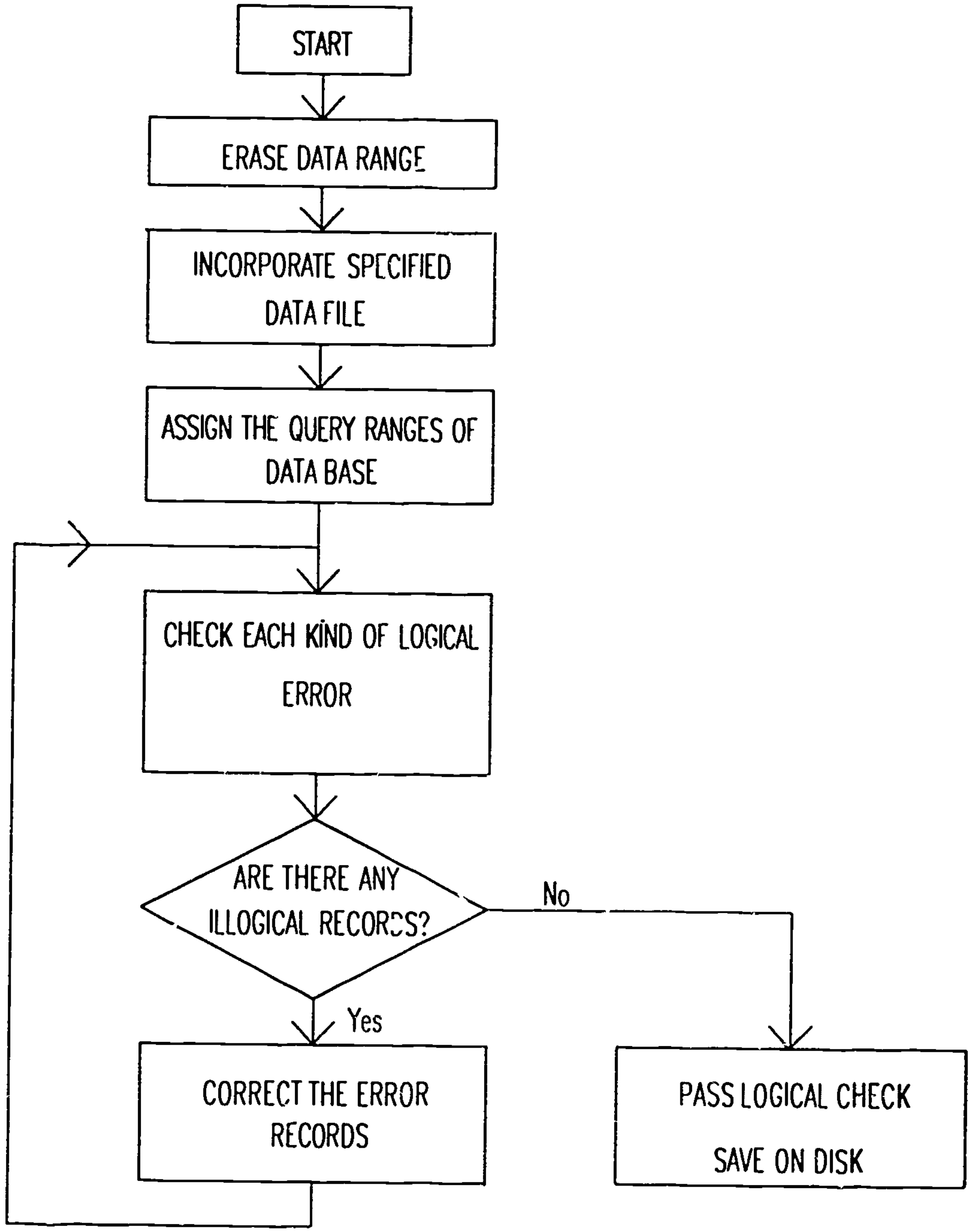

Figure 7. *Flow chart of Logical*

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17 *Methods of data processing*

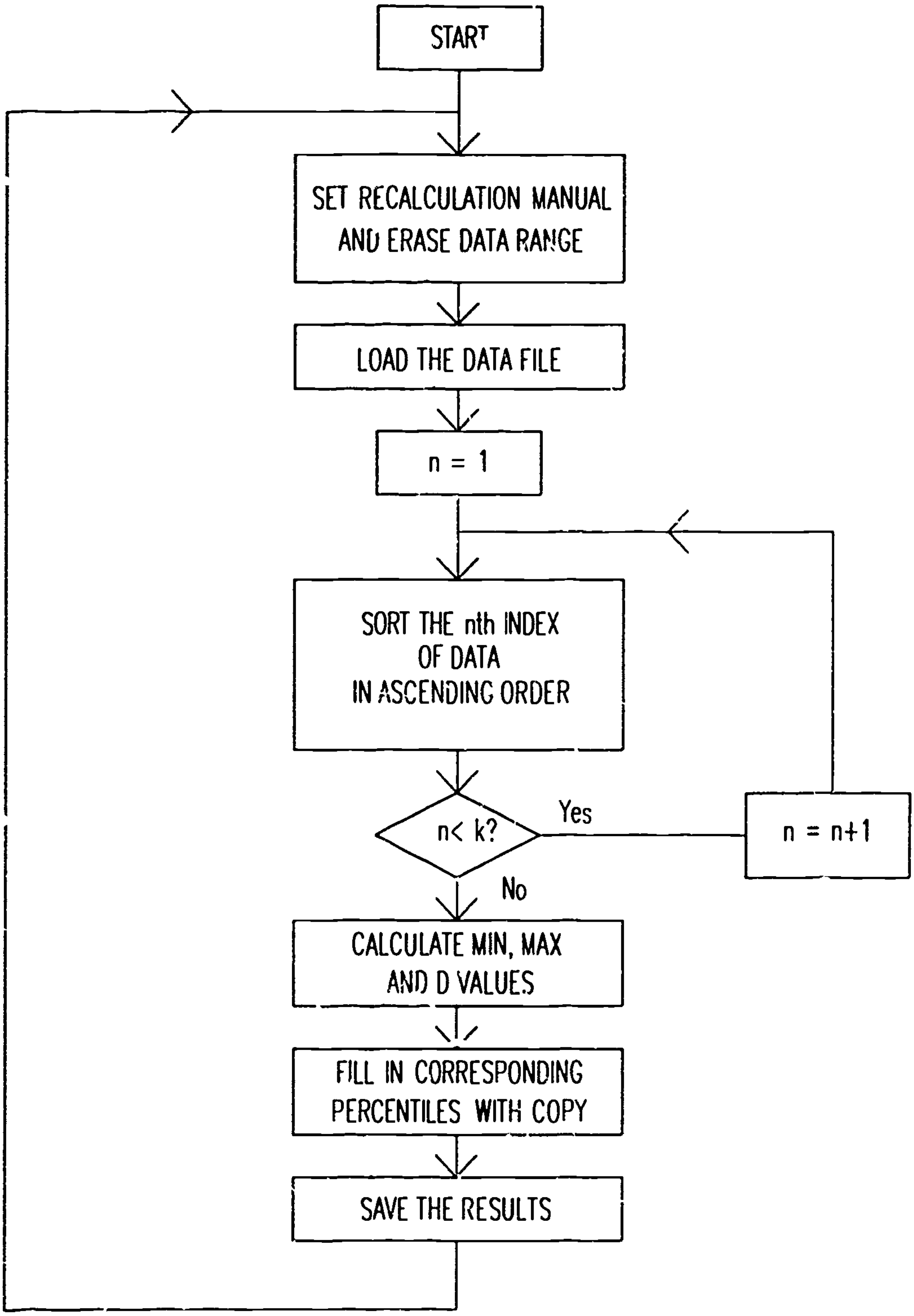

Figure 8. *Flow chart of General*

This module first calculated the derived indicators from the crude indicators. Through further computations based on both types of indicators, many statistical tables and charts were generated for use in analysis and interpretation. Several programs were designed and incorporated into this module: for data re-organization, regression analysis, as well as comparison among different groups. Of these programs, GENERAL was used in calculating common statistics; and another program known as TABLE was mainly used in making body development evaluation tables.

The purpose of GENERAL was to compute the following statistics by group: maximum, minimum, mean, standard deviation, standard error, variance and percentiles. This program also checked for normal distribution.

The LOTUS 1-2-3 statistical functions can simplify considerably the computation of common statistics. When the range of an argument is given, such as c3..c308, one can calculate directly with functions like @count(c3..c308), @min(c3..c308), @max(c3..c308), @avg(c3..c308), @std(c3..c308), and so on.

As soon as a formula for calculating basic statistics of the group was set up, all other formulas were filled in the formula range to obtain other statistics in the same way, with the /Copy command.

To calculate the Xth percentile in a list of data with n examined values, the method adopted in the survey was to sort these data in ascending order first,

$$X1 < X2 < X3 < \ldots < Xn$$

The Xth percentile required was determined by the sorted value located by the formula:

$$P_x = x\% * (n + 1) \qquad (1)$$

For instance, if n=306, $P_5 = 5\% * (306 + 1) = 15$, that is, the 15th value in the sorted list was the 5th percentile of the indicator.

As the processing methods for various indicators in the same group were identical, loops were used in the program GENERAL to repeatedly sort, one by one, the columns of data. As soon as all the data had been sorted, the corresponding rows of data were copied into the result ranges for percentiles.

During the execution of a /Data Sort command, the data range to be sorted was defined in the first place, and then one of the indicators was designated as the primary sort key. When asked to determine the sort order, A specifies the ascend-

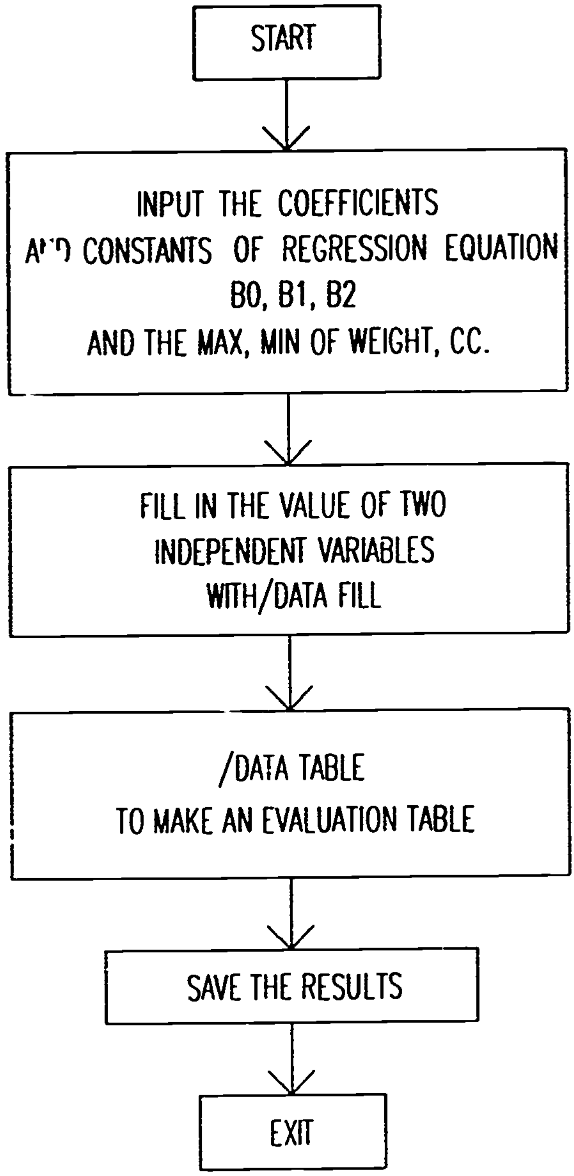

Figure 9. *Flow chart of Table*

ing order and D the descending order. The GENERAL program calculated each indicator independently. By issuing the Go command, the computer immediately sorted the data in the assigned order.

Once the data of each indicator had been sorted, the value of D was derived using the following formula:

$$D = \frac{\sum_i \left(i - \frac{1}{2}(n+1)\right) x_i}{n^2 S} = \frac{\sum_i \left(i - \frac{1}{2}(n+1)\right) x_i}{\sqrt{n^3 \sum_i (x_i - \bar{x})^2}}$$

By looking up the table, the p value was obtained. Based on this, it was verified whether the observed data for the particular indicator followed the normal distribution.

The flow chart of GENERAL is illustrated in Figure 8. As the first step, the recalculation mode was set to manual so that LOTUS 1-2-3 would recalculate the formulae only when the {CALC} key was pressed. The data file was then loaded into the data range and the columns of data by indicator were sorted one by one, from left to right. A loop was incorporated to control the number of fields to be sorted. With the execution of command {CALC}, all formulae were recalculated and statistics, such as min and max, as well as D values were obtained. The macro then copied the values of each percentile. Finally, the computed results were saved onto diskette.

The function of program TABLE was to produce standard summary tables for the evaluation of body development through the application of multiple regression methods. Standard physical proportions were determined by fitting regression equations, using height as the dependent variable and weight and chest circumference as independent variables: $H = b_0 + b_1 * W + b_2 * CC$.

Before the program TABLE was executed, the data group names, the coefficients and constant of the regression equation, as well as the minimum and maximum values of weight and chest circumference for that group, were entered into specific cells.

The formula for computing height was located on the upper left of the table. As the macro was invoked, the values of the two independent variables were filled with weight increments of 1 kg and chest circumference increments of 1 cm by the /Data Fill command. The starting value was the minimum, the steps 1 and the stop value was the maximum. The evaluation table, showing height on the basis of weight and chest circumference, was then created by the command /Data Table (see Figure 9).

Chapter Four

FINDINGS

Statistical analysis by means of microcomputer-processing of the survey data on physical condition and health, as described above, resulted in many graphs and tables. Tables like the one illustrated in Figure 10 for group UF12 were obtained by running the program GENERAL. According to the average values of different indicators by age, the annual increments as well as rates of growth were also derived.

A salient survey finding can be summarized in the table showing changes in height as children grow up year by year. Figure 11 shows that 13-year old boys have the fastest growth in height; and the physical development of urban girls occurs two years earlier as compared to urban boys and rural girls. The LOTUS 1-2-3 graphical features provide many possibilities for drawing graphs with the /Graph command, and for eventual plotting on hard-copy using the printer. The height increase and increase rate curves can therefore be illustrated as in Figures 12 and 13. These enabled the comparison of differences between male and female, mountainous and coastal areas, Han and Li Nationalities, Guangdong and other provinces and even with other countries.

Many evaluation standards were determined during the survey data processing. For instance, the 80th percentile of weight was taken for the same height as the standard weight for that specific height. If one's weight was under 75 per cent of the standard, the child was severely under-nourished. When it was between 75 per cent and 85 per cent, there was moderate malnutrition. For levels between 85 per cent and 90 per cent, only light malnutrition was detected. Normal nutrition level would be situated between 90 per cent and 110 per cent. Between 110 per cent and 120 per cent, the person was overweight. When it was above 120 per cent, obesity was the diagnosis.

The body development evaluation table for the group UF12, created by executing the program TABLE, is shown in Figure 14. From the differences between the height calculated based on weight and chest circumference and the actual height of a student, the physical proportion and development level of a student were determined. Evaluation standards were also established on the sports indicators by age and sex, which were used to grade students according to their sportive results. By means of standards established based on percentiles, students' sportive capacities could be evaluated in a more scientific manner.

UF12

NO	1	2	3	4	5	6	7	8	9	10	11
N	306	306	306	306	306	306	306	306	306	306	306
MIN	33	88	46	0	1280	124.6	68.8	22.3	58.9	26	18.7
MAX	54	128	84	80	3120	160	87.9	54.2	81.3	35.5	27.5
AVG	43.34	104.16	66.04	53.90	2066.34	146.91	78.61	35.10	68.82	31.10	23.17
S	4.34	9.11	7.34	14.59	322.18	6.34	3.58	5.10	4.32	1.69	1.53
S-x	0.25	0.52	0.42	0.83	18.42	0.36	0.20	0.29	0.25	0.10	0.09
C.V	10.02	8.74	11.11	27.07	15.59	4.31	4.55	14.53	6.28	5.45	6.59
D	0.29	0.28	0.28	0.25	0.28	0.28	0.28	0.28	0.28	0.28	0.28
P3	35	90	52	0	1500	134	71.3	26.2	60.8	27.5	20.5
P5	37	90	54	30	1540	135.5	72.1	27.2	61.7	28.5	20.6
P10	37	92	56	40	1640	138	73.6	28.7	62.8	29	21
P15	38	94	58	42	1700	139.8	74.7	29.5	64.3	29.5	21.5
P25	40	96	60	50	1850	143.1	76.3	31.2	66.2	30	22.1
P50	43	104	66	58	2080	147.4	78.8	35	68.5	31	23.2
P75	47	110	70	62	2260	151.1	81.1	38.3	71.5	32.2	24.3
P85	48	112	72	64	2310	152.3	81.9	39.3	72.1	32.5	24.5
P90	49	116	76	70	2500	154.7	83.2	41.5	74.6	33.2	25.1
P95	50	122	78	70	2590	157	84.2	42.7	76.5	34	25.6
P97	51	122	80	72	2700	158.3	85	47.6	78.1	34.5	26

NO	12	13	14	15	16	17	18	19	20	21	22
N	306	306	3	4	306	306	306	2	0	306	306
MIN	7.7	92	0	0	5	-4.3	90	0	ERR	0	0
MAX	11.1	209	0	0	51	22.8	134.4	0	ERR	1	1
AVG	9.22	167.43	0.00	0.00	32.23	7.10	106.93	0.00	ERR	0.29	0.28
S	0.59	15.42	0.00	0.00	7.93	1.54	7.37	0.00	ERR	0.45	0.45
S-x	0.03	0.88	0.00	0.00	0.45	0.26	0.42	0.00	ERR	0.03	0.03
C.V	6.42	9.21	ERR	ERR	24.60	63.92	6.89	ERR	ERR	157.65	161.51
D	0.28	0.28	ERR	ERR	0.28	0.28	0.28	ERR	ERR		
P3	8.2	140			15	-0.7	94.9			0	0
P5	8.3	143			18	0.2	95.6			0	0
P10	8.5	148			22	1.7	98.6			0	1
P15	8.6	151			24	2.1	100.3			0	1
P25	8.8	159			27	3.6	101.9			0	0
P50	9.2	168			33	7	106.2			0	1
P75	9.6	178			38	9.9	110.9			1	0
P85	9.7	180			39	11	112.7			1	1
P90	10	186			42	13	116.1			1	0
P95	10.2	192			44	14.5	121.2			1	0
P97	10.4	195			45	16.1	123.5			1	0

Figure 10. *Results generated by GENERAL*

UM age	AVG	AINC*	INC**	UF AVG	AINC	INC
7	121.14			120.76		
8	124.24	3.11	2.56	124.92	4.16	3.45
9	129.92	5.68	4.57	130.59	5.67	4.54
10	134.71	4.79	3.68	135.24	4.65	3.56
11	139.46	4.75	3.53	142.49	7.25	5.36
12	144.83	5.37	3.85	146.91	4.41	3.10
13	154.60	9.77	6.75	152.95	6.04	4.11
14	160.07	5.46	3.53	154.66	1.71	1.12
15	163.96	3.89	2.43	155.69	1.03	0.67
16	167.01	3.05	1.86	157.13	1.44	0.93
17	168.57	1.56	0.93	157.50	0.36	0.23
18	168.65	0.08	0.05	157.69	0.19	0.12
19	168.44	-0.21	-0.12	158.23	0.54	0.34
20	168.83	0.39	0.23	158.12	-0.12	-0.07
21	169.19	0.37	0.22	158.20	0.08	0.05
22	168.81	-0.39	-0.23	158.21	0.02	0.01

RM age	AVG	AINC	INC	RF AVG	AINC	INC
7	116.91			115.22		
8	121.10	4.19	3.58	119.86	4.64	4.03
9	125.46	4.36	3.60	125.31	5.45	4.55
10	130.63	5.17	4.12	129.83	4.52	3.61
11	135.48	4.85	3.71	135.77	5.94	4.58
12	139.87	4.39	3.24	140.49	4.71	3.47
13	147.95	8.08	5.78	148.29	7.80	5.55
14	154.17	6.22	4.20	151.50	3.21	2.16
15	159.47	5.31	3.44	152.79	1.30	0.86
16	162.86	3.39	2.13	153.65	0.85	0.56
17	164.44	1.58	0.97	154.49	0.84	0.55
18	165.32	0.88	0.53	155.04	0.55	0.36
19	166.41	1.09	0.66	155.64	0.60	0.38
20	166.59	0.18	0.11	154.96	-0.68	-0.44
21	167.22	0.63	0.38	155.16	0.20	0.13
22	165.78	-1.44	-0.86	155.67	0.51	0.33

* Absolute Increase
** Increase Rate

Figure11. *Height Development Table*

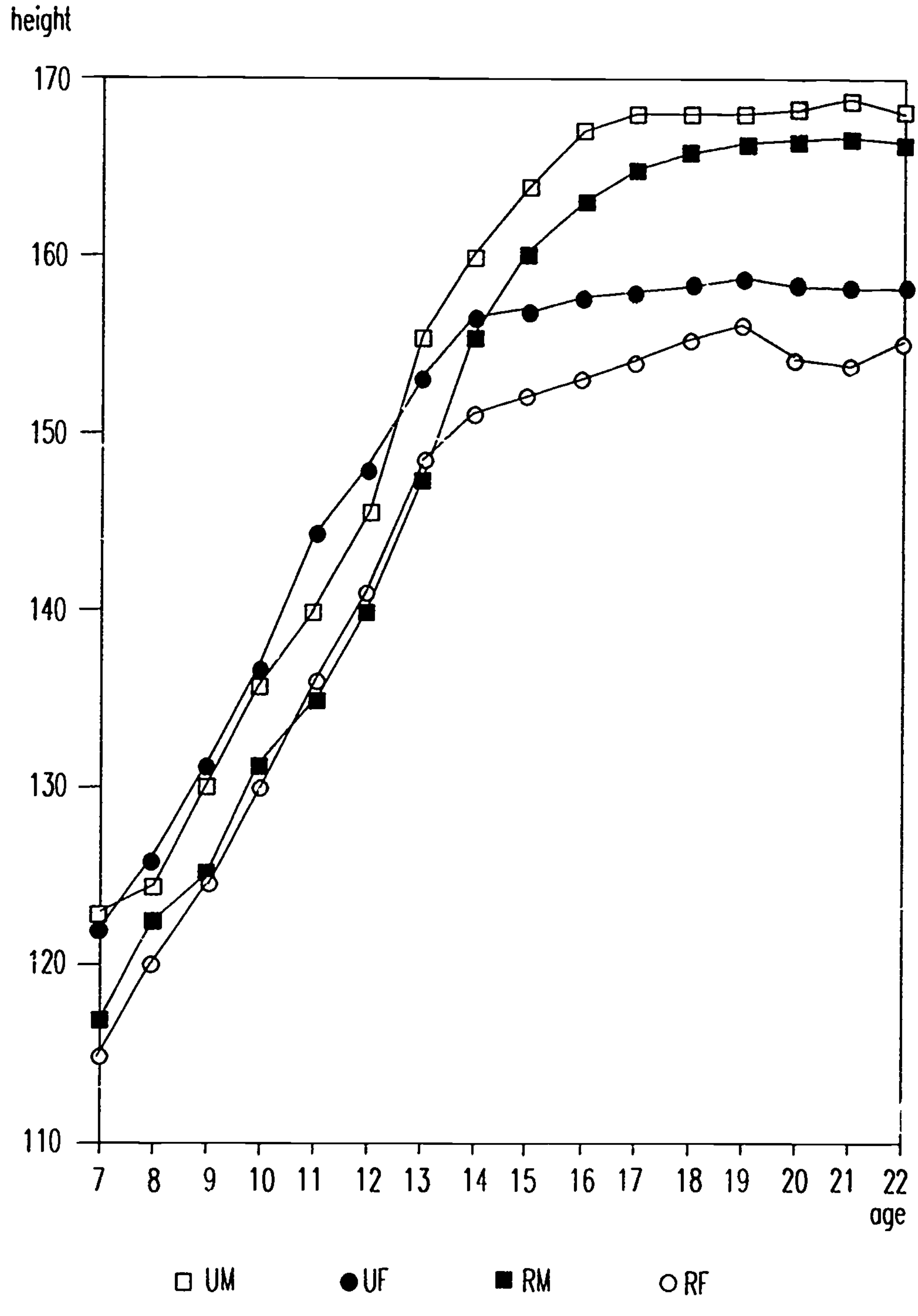

Figure 12. *Height Development Curves as age changes*

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2 5 *Methods of data processing*

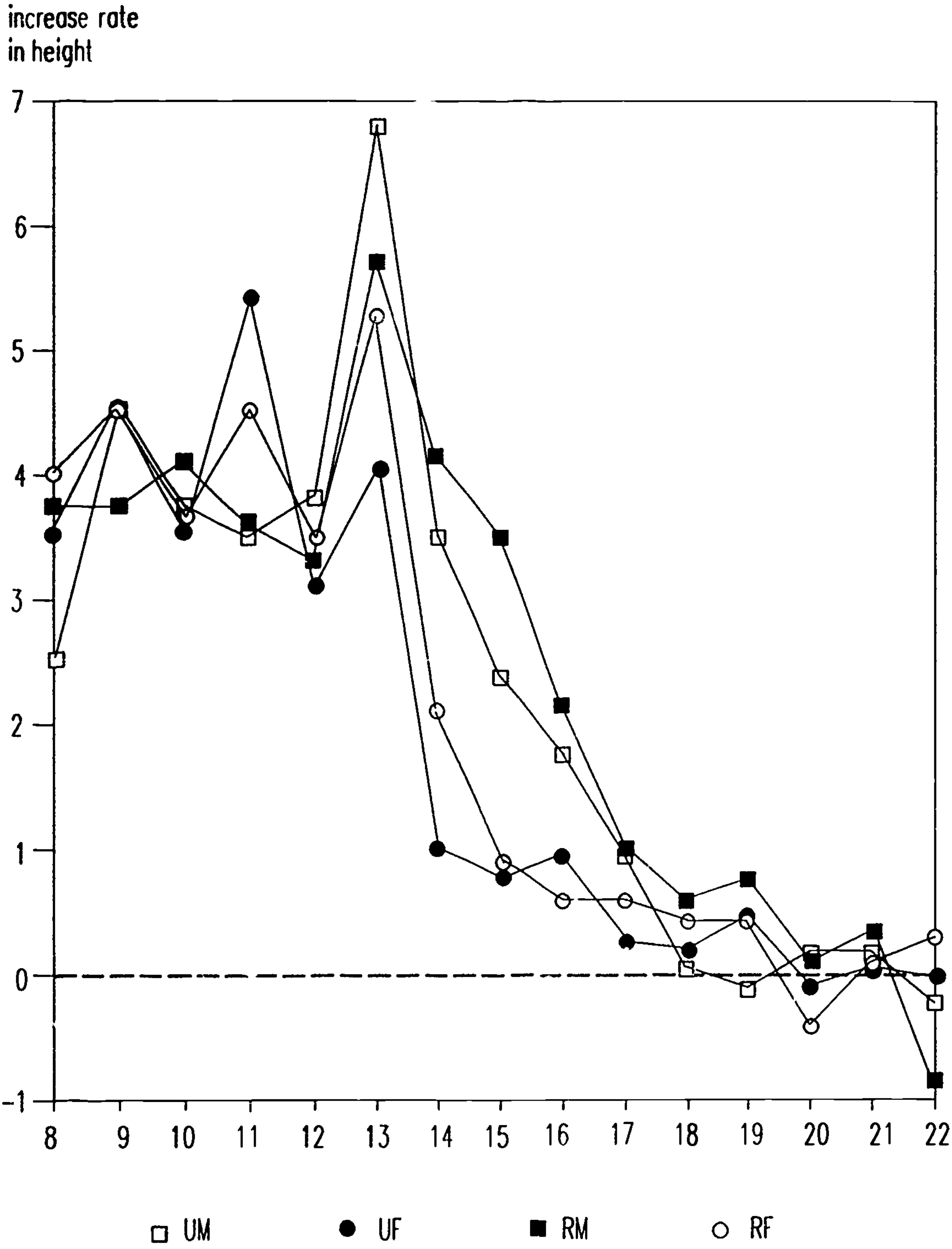


Figure 13. *The Height Increase Rate Curves*

	b1	b2	a
UF12	1.6835	-1.051	159.7

height=a+b1*weight+b2*CC

CC/weight	22	23	24	25	26	27	28	29	30	31
59	134.2	135.8	137.5	139.2	140.9	142.6	144.3	145.9	147.6	149.3
60	133.1	134.8	136.5	138.2	139.8	141.5	143.2	144.9	146.6	148.3
61	132.1	133.7	135.4	137.1	138.8	140.5	142.2	143.8	145.5	147.2
62	131.0	132.7	134.4	136.1	137.7	139.4	141.1	142.8	144.5	146.2
63	130.0	131.6	133.3	135.0	136.7	138.4	140.1	141.7	143.4	145.1
64	128.9	130.6	132.3	134.0	135.6	137.3	139.0	140.7	142.4	144.1
65	127.9	129.5	131.2	132.9	134.6	136.3	138.0	139.6	141.3	143.0
66	126.8	128.5	130.2	131.9	133.5	135.2	136.9	138.6	140.3	142.0
67	125.7	127.4	129.1	130.8	132.5	134.2	135.9	137.5	139.2	140.9
68	124.7	126.4	128.1	129.7	131.4	133.1	134.8	136.5	138.2	139.8
69	123.6	125.3	127.0	128.7	130.4	132.1	133.7	135.4	137.1	138.8
70	122.6	124.3	126.0	127.6	129.3	131.0	132.7	134.4	136.1	137.7
71	121.5	123.2	124.9	126.6	128.3	130.0	131.6	133.3	135.0	136.7
72	120.5	122.2	123.9	125.5	127.2	128.9	130.6	132.3	134.0	135.6
73	119.4	121.1	122.8	124.5	126.2	127.9	129.5	131.2	132.9	134.6
74	118.4	120.1	121.8	123.4	125.1	126.8	128.5	130.2	131.9	133.5
75	117.3	119.0	120.7	122.4	124.1	125.8	127.4	129.1	130.8	132.5
76	116.3	118.0	119.7	121.3	123.0	124.7	126.4	128.1	129.8	131.4
77	115.2	116.9	118.6	120.3	122.0	123.7	125.3	127.0	128.7	130.4
78	114.2	115.9	117.5	119.2	120.9	122.6	124.3	126.0	127.6	129.3
79	113.1	114.8	116.5	118.2	119.9	121.5	123.2	124.9	126.6	128.3
80	112.1	113.8	115.4	117.1	118.8	120.5	122.2	123.9	125.5	127.2

CC/weight	32	33	34	35	36	37	38	39	40	41
59	151.0	152.7	154.4	156.0	157.7	159.4	161.1	162.8	164.5	166.2
60	149.9	151.6	153.3	155.0	156.7	158.4	160.0	161.7	163.4	165.1
61	148.9	150.6	152.3	153.9	155.6	157.3	159.0	160.7	162.4	164.0
62	147.8	149.5	151.2	152.9	154.6	156.3	157.9	159.6	161.3	163.0
63	146.8	148.5	150.2	151.8	153.5	155.2	156.9	158.6	160.3	161.9
64	145.7	147.4	149.1	150.8	152.5	154.2	155.8	157.5	159.2	160.9
65	144.7	146.4	148.1	149.7	151.4	153.1	154.8	156.5	158.2	159.8
66	143.6	145.3	147.0	148.7	150.4	152.1	153.7	155.4	157.1	158.8
67	142.6	144.3	146.0	147.6	149.3	151.0	152.7	154.4	156.1	157.7
68	141.5	143.2	144.9	146.6	148.3	150.0	151.6	153.3	155.0	156.7
69	140.5	142.2	143.8	145.5	147.2	148.9	150.6	152.3	154.0	155.6
70	139.4	141.1	142.8	144.5	146.2	147.8	149.5	151.2	152.9	154.6
71	138.4	140.1	141.7	143.4	145.1	146.8	148.5	150.2	151.8	153.5
72	137.3	139.0	140.7	142.4	144.1	145.7	147.4	149.1	150.8	152.5
73	136.3	138.0	139.6	141.3	143.0	144.7	146.4	148.1	149.7	151.4
74	135.2	136.9	138.6	140.3	142.0	143.6	145.3	147.0	148.7	150.4
75	134.2	135.9	137.5	139.2	140.9	142.6	144.3	145.0	147.6	149.3
76	133.1	134.8	136.5	138.2	139.9	141.5	143.2	144.9	146.6	148.3
77	132.1	133.8	135.4	137.1	138.8	140.5	142.2	143.9	145.5	147.2
78	131.0	132.7	134.4	136.1	137.8	139.4	141.1	142.8	144.5	146.2
79	130.0	131.6	133.3	135.0	136.7	138.4	140.1	141.7	143.4	145.1
80	128.9	130.6	132.3	134.0	135.6	137.3	139.0	140.7	142.4	144.1

Figure 14. *Development Evaluation Table*

CC/weight	42	43	44	45	46	47	48	49
59	167.8	169.5	171.2	172.9	174.6	176.3	177.9	179.6
60	166.8	168.5	170.1	171.8	173.5	175.2	176.9	178.6
61	165.7	167.4	169.1	170.8	172.5	174.1	175.8	177.5
62	164.7	166.4	168.0	169.7	171.4	173.1	174.8	176.5
63	163.6	165.3	167.0	168.7	170.4	172.0	173.7	175.4
64	162.6	164.3	165.9	167	169.3	171.0	172.7	174.4
65	161.5	163.2	164.9	166.6	168.3	169.9	171.6	173.3
66	160.5	162.2	163.8	165.5	167.2	168.9	170.6	172.3
67	159.4	161.1	162.8	164.5	166.2	167.8	169.5	171.2
68	158.4	160.1	161.7	163.4	165.1	166.8	168.5	170.2
69	157.3	159.0	160.7	162.4	164.1	165.7	167.4	169.1
70	156.3	157.9	159.6	161.3	163.0	164.7	166.4	168.1
71	155.2	156.9	158.6	160.3	161.9	163.6	165.3	167.0
72	154.2	155.8	157.5	159.2	160.9	162.6	164.3	165.9
73	153.1	154.8	156.5	158.2	159.8	161.5	163.2	164.9
74	152.1	153.7	155.4	157.1	158.8	160.5	162.2	163.8
75	151.0	152.7	154.4	156.1	157.7	159.4	161.1	162.8
76	150.0	151.6	153.3	155.0	156.7	158.4	160.1	161.7
77	148.9	150.6	152.3	154.0	155.6	157.3	159.0	160.7
78	147.9	149.5	151.2	152.9	154.6	156.3	158.0	159.6
79	146.8	148.5	150.2	151.9	153.5	155.2	156.9	158.6
80	145.7	147.4	149.1	150.8	152.5	154.2	155.8	157.5

Figure 14. *Development Evaluation Table (cont'd)*

Correlation analysis were carried out to help to understand which size indicators were too high relative to the sports indicators. The study results had been useful for choosing athletes by taking into consideration a multiplicity of factors. Statistical results obtained for students with normal vision were also compared with those for students with poor vision. Some interesting results and conclusion were obtained.

In short, through the sample survey and the ensuing microcomputer data processing, a large amount of salient information was obtained on the physical condition and health situation of students in the Guangdong Province. The results provided a scientific basis for the general improvement of the students' health and their capacity for sports.

PROBLEMS ENCOUNTERED AND SOLUTION ADOPTED

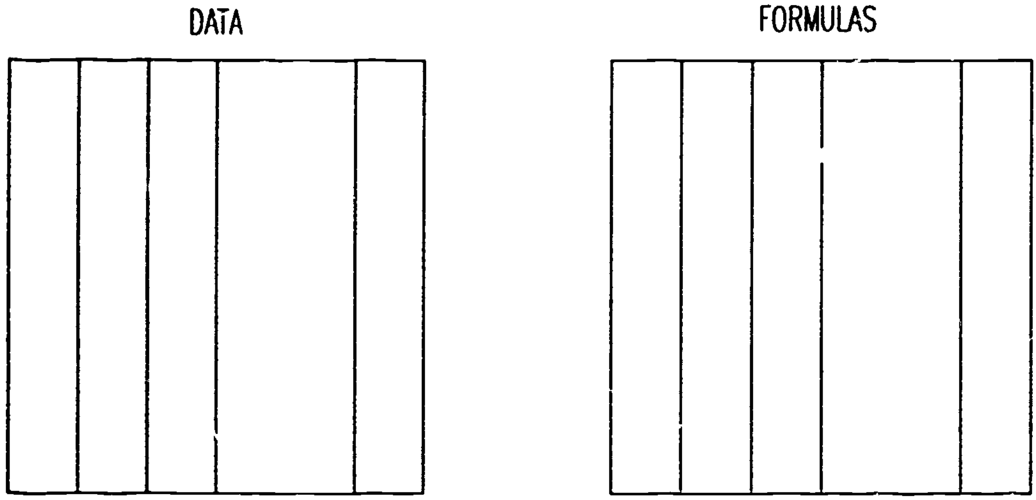
As this was the first major experiment in the use of microcomputer to process large amounts of survey data within the education sector, a variety of problems were encountered at different stages.

The first problem was related to difficulties in conciliating the hardware capabilities of the microcomputer used and the statistical requirements of the survey. As described in Chapter Two, constraints of limited main memory and hard disk storage were solved by storing data in worksheet files on diskettes and processing them by group.

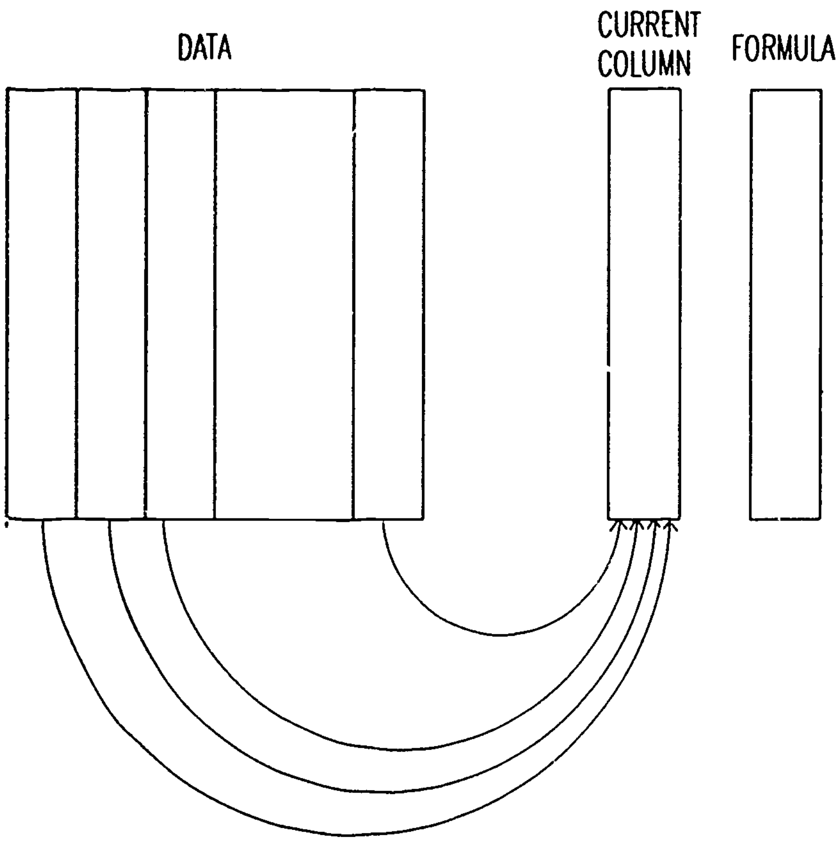
If a group with 1,000 cards is in the current worksheet and every data cell corresponds to a formula, there will be at least 20,000 (=1,000 X 20) formulae to be calculated. If one tried to fill all the cells with formulae using the /Copy command, the "Memory Full" error message in LOTUS 1-2-3 would appear, because formulae take up much more memory space. Therefore, a solution was to set up only one column of formulae, instead of 20 columns, and to copy each column of data into the formula range one at a time, for performing the calculations. This reduced the total number of formulae to about 1,000, thus making 512KB of memory sufficient (see Figure 15).

Sometimes there was the need to combine several indicators of many groups to organize a new worksheet for analysis. In order to work out the height-weight standards, data of height and weight had to be extracted from each age groups for the same sex and then combined.

At first, each of the data files was combined into the current worksheet through the command /File Combine Copy Entire. It was soon found out that the data range was too big, resulting in the "Memory Full" error. Consequently, a range name was given to every field in the database with the /Range Name Create command, followed by loading any indicator of a group into the worksheet. This resulted in greatly reduced memory requirements and the speed of data processing increased considerably.



(1) All data are computed simultaneously



(2) Processing data column by column

Figure 15. *Two methods used in calculating formulas*

Problems were also encountered when moving the cell pointer to or from an address which were determined by formula calculation. For example, a percentile was a datum from a sorted list. The position of the datum was determined by formula (1) on page 19. If a program was designed to calculate percentiles for different sample sizes, different addresses would have to be referred to when copying rows of appropriate locations to the percentiles range. It was difficult, if not impossible, to prepare a macro program within LOTUS 1-2-3 to go to the different addresses on the basis of the number of cards in a sample, because cell address was a label rather than a number. Every time the sample size changed, some addresses in the macro program GENERAL had to be changed accordingly.

Chapter Six

CONCLUSION

This paper introduced some typical applications of microcomputers in survey data processing. The experience confirmed that if planned and designed properly, microcomputers can be used very effectively in the processing of large amounts of data.

Different possibilities and approaches are available on the microcomputer. Some people may prefer to write routines, programs or entire software packages in one of the microcomputer languages such as BASIC or PASCAL for the processing of specific data. Others may opt for the use of some of the ready-made software packages for database management or spreadsheet operations.

Current trend shows that database management software systems tend to dominate. The experience described in this paper on the use of LOTUS 1-2-3, a typical spreadsheet software package, therefore added another dimension to microcomputer applications in educational management information. In many ways, the decision to use LOTUS 1-2-3 could be attributed to the varied analytical features offered by this software, such as functions for the calculation of basic statistics and regression analysis. A first attempt has been made to make use of these features, through the macro programming language within LOTUS 1-2-3. The results have proved to be very positive and satisfactory.

There is a growing tendency for most software packages to make extensive use of user-friendly menu-driven type of operational features. Many packages also have expanded features for customizing data processing procedures, by incorporating programming facilities, such as the macro programming language within LOTUS 1-2-3 or the command files under DBASE III. It is expected that such facilities will further develop in the future. As microcomputers are becoming more accessible and easier to use, efforts on the part of statisticians, managers and planners of education to participate in the development of more powerful and multi-function programs for the entry, checking, storage, processing, search, retrieval, analysis and dissemination of education management information, will be required.

It was noticed during the data entry stage of this survey that as the more data were being handled, the more frequently errors occurred. Consequently, more intensive data checking and corrections were required. The design of the survey questionnaire was found to play an essential role in facilitating data verification and entry. In some countries, optical-marker readers (OMR) have been used for inputting data directly from the questionnaires into computerized storage. Although this method is still relatively costly, it is seen as one of the means by which the effectiveness and efficiency of data processing can be enhanced.

3.3 *Conclusion*

城女

中国学生体质、健康检测卡片（一）

学校____ 班级____ 姓名____ 性别____ 城乡____ 民族____

出生日期____年__月__日 年龄____ 未/已婚 民族 父____ 母____

重要病史____________ 检测日期____年____月____日

1. 脉搏____次/30″×2=____次 分
2. 收缩压________mmHg
3. 舒张压（变音）________mmHg
4. 舒张压（消音）________mmHg
5. 肺活量 1____ 2____ 3____ 最大值________ml
6. 身高____________cm
7. 坐高____________cm
8. 体重____________kg
9. 胸围____________cm
10. 肩宽____________cm
11. 骨盆宽____________cm
12. 50米跑____________秒
13. 立定跳远____________cm
14. 引体向上____________次
15. 斜身引体____________次
16. 仰卧起坐____________次 分
17. 立位体前屈____________cm
18. 50米×8往返跑____分____秒、________秒
19. 800米跑____分____秒、________秒
20. 1000米跑____分____秒、________秒
21. 月经来潮 已 未
22.
23.

中国学生体质、健康检测卡片（二）

	项目	正常	阳性体征							
体格检查	心		左界大	右位心	心动过速（次/分）	心动过缓（次/分）	频发早搏 安静（次/分）	频发早搏 运动后（次/分）	其它心律异常	其它
	脏		病理杂音	部位	收缩期 性质	收缩期 响度	舒张期 性质	舒张期 响度	传导方向	
	肺脏									
	肝脏		肋缘下____cm 剑突下____cm 软硬度____触痛____							
	脾脏		肋缘下____cm 剑突下____cm 软硬度____触痛____							
	其它部分异常									
部分常见病	视力 远 左			印象						
	视力 远 右									
	视力 近 左									
	视力 近 右									
	沙眼									
	脊柱侧弯									
	神经衰弱									
其它检查化验	胸透			建议						
	心电图									
	肝功									
	结素试验 OT		mm直径							
	结素试验 PPD		mm直径							
	其它									
备注				医师签名____ 日期____						
可、否	参加素质测试									

A SAMPLE OF THE CHINESE STUDENT PHYSICAL CONDITION AND HEALTH CARD

Annex I

Annex II

COMPARE PROGRAMME

```
     AB    AC    AD    AE
1
2    REM: COMPARE PROGRAM
3
4    /real.z640~
5    /wwc
6    {goto{al~
7    /fcc{?}~{esc{ {esc{
8    /wgpd
9    }goto{c3~
10   /wtb
11   /cal.x309~a321~
12   {goto{c323~
13   /fcsncaa~{?}~
14   {goto}y323~
15   @abs(c323)+@abs(d323)+...+@abs(m323)~
16   {right}
17   @abs(n323)+@abs(o323)+...+@abs(x323)~
18   {right}
19   +Y323+Z323~
20   /cy323.aa323~y324.y630~
21   {up}
22   "tag~
23   {down} {down} {down} {down} {down{ {down} {down} {down} {down}
24   /wwh{home{
25   /wgrm
26   {window}
27   }up{ }up} }up} {up} {up} {up} {up} {up} {up{ {down}
28   /wt~}goto{aa323~
29   /xi@dcount (aa322.aa630,0,criteria)=0~}home{OK~/xq
30   /dqiaa322.aa630~cab35.ab36~f
```

GENERAL PROGRAMME

	AC	AD	AE	AF
1	counter 1	6		
2	counter	21		
3	\a	/wgrm		
4		{goto}a320~/fccecompute~		
5		/real.x310~/rec322.x339~/caa3~aa3.aa308~		
6		{goto}a310~a~/ca310~a310.x310~{goto}a1~/fcce{?}~		
7		{goto}counter~0~		
8		{goto}c3~/dsdb3.b308~pb3.b308~a~q		
9	loop	/dfcounter~counter+1~1~~		
10		/xicounter<21~/xgad12~		
11		/xgad14~		
12		/dsd{esc} {right}.{end} {down}~p {esc} {right}.{end} {down}		
13		/xgloop~		
14		/rncvalue~c321~		
15		/rncdata~c3~/recounter1~		
16	loop1	/dfcounter1~counter1+1~1~~		
17		{goto}data~/c{end} {down}~z3~		
18		/rncdata~{right}~		
19		{calc}		
20		/fxvqaz~ab3.ab10~r		
21		{goto}value~/fcceqaz~		
22		/rncvalue~{right}~		
23		/xicounter1<21~/xgloop1~		
24		/cc11.x11~c329~		
25		/cc17.x17~c330~		
26		/cc33.x33~c331~		
27		/cc48.x48~c332~		
28		/cc79.x79~c333~		
29		/cc156.x156~c334~		
30		/cc232.x232~c335~		
31		/cc248.x248~c336~		
32		/cc278.x278~c337~		
33		/cc294.x294~c338~		
34		/cc300.x300~c339~		
35		/fxvv{?}~a321.z343~		