Analysis for a Comprehensive Computerized Information System for Schools in Saudi Arabia

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ABSTRACT. Management Information Systems (MIS) are vital tools to the efficient management of organizations, and hence of schools as well. This paper presents the results of system analysis of schools in Saudi Arabia as a necessary first step towards the development of a comprehensive computerised management information system.

The paper follows an input-output system analysis approach. It starts with a description of major school activities, identifies the reports/documents currently generated/used by the schools. The information flow for different activities are analysed by using Data Flow Diagrams. The processing requirements of all the reports and documents have been analysed in terms of volume, complexity, computational needs. The frequency and time constraints for generating the reports also have been analysed. The paper is concluded with a discussion on the drawbacks of the current practice of manual information management and qualitatively recommending the design and development of a comprehensive computerised information system.

1. Introduction

Management information system is a universal tool that helps management run an organization efficiently. A school which is a very important organization for national development is no exception to this.

All schools, like other organizations, do have some kind of information system or subsystems which may or may not be well designed and integrated. Thus, the need to examine the information requirement of schools through formal analysis as a prerequisite to the development of a well designed information system becomes obvious. With

the availability of computer technology at affordable price, the trend decidedly favours development and implementation of comprehensive computerised information system.

Education in Saudi Arabia has been expanding rapidly both in number of schools and enrollment. For example, in the period between 1976/77 and 1985/86, the number of secondary schools increased from 257 to 928, intermediate schools from 824 to 2387 and primary schools from 3878 to 7812[1]. During the same period, the number of students in these levels increased from 59,933 to 180,140 (high school); 177,921 to 402,118 (intermediate) and 726,063 to 1,347,431 (primary). The number of teachers also kept pace with this growth and stood at 12,124; 29,948 and 87,600 for the three levels respectively. These numbers at '93-94 remain at similar levels as the system approaches steady state[2].

Although schools everywhere have similar functions, there can be great variation in terms of information requirement from one country to another due to local practices and regulations. Saudi Arabian schools have their unique requirements, which stem primarily from the following reasons:

1. Language: Since input/output of school MIS need to be in Arabic, off-the-shelf English software cannot be used directly. An arabic interface is needed,

2. Specific Reporting Requirement: Schools in Saudi Arabia are bound by a large number of preformatted periodic, mostly annual, reports which form the basis of statistical reports and planning by the ministry. Furthermore, specific grading policies as well as pass/fail policies require unique system specifications. For example, final exam contributes 35% while class work contributes 65% of the marks obtained by a student in a course. However, when a failed student is given a retake exam, the contribution of class work is changed to 70%.

The schools, have the responsibility of efficiently delivering quality education. This can be ensured only through better school management. One of the important tools to manage a school more efficiently is a well designed information system. Thus, it is obvious that an analysis of the school operations here is necessary to evaluate the need of a comprehensive information system.

The paper starts with the organization of a typical Saudi school followed by the description of the major activities needed for school management. These activities are depicted through data flow diagrams showing the flow of data between various files and entities comprising the school. Next, the paper describes the reports and documents generated in the process of various school activities and subsequently the data processing requirements to generate these reports. The paper concludes by highlighting the need for a computerised information system for efficient management of school activities.

2. Organization of a Typical School

From an information point of view, the school can be viewed as comprising several broad functional units, as illustrated in the schematic diagram in Fig. 1, exchanging *information with one another* and also with the outside world.
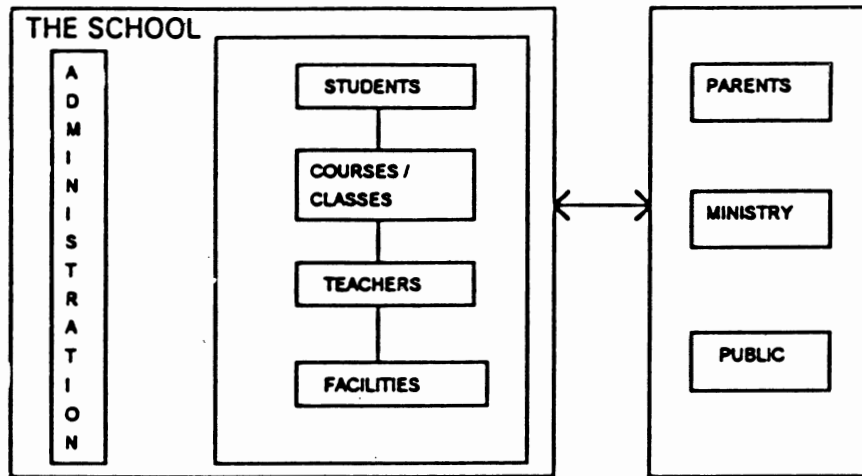
FIG. 1. A typical school showing broad functional units.

In most schools, the administration is run by the headmaster aided by a few clerical staff. However, teachers are assigned different administrative tasks by the headmaster as and when needed. In terms of facilities, schools are designed to have labs, libraries, playground, cafeteria, mosques and other similar amenities.

The functional units in a school serve both as sources as well as destination of information generated by other units in an integrated manner. The school which is the integration of all these units serves in turn as a source of information for outside users such as parents, ministry or public in general.

All the schools under the Ministry of Education follow uniform educational and administrative guidelines set by the Ministry. The educational program at each level is well defined and well structured. For each level, there is a fixed set of subjects to be taught. The contents of each subject are also fixed by the Ministry in the form of specially printed textbooks. The weekly contact hours for each subject, examinations, evaluation procedure and marks distribution for different exams are also fixed by the ministry. However, individual schools are free to schedule courses and exams to suit their individual circumstances. There are two terms in a year with half yearly and yearly exams. There is provision for makeup/retake exam for students failing in the first attempt.

While the state schools are administratively directly under the ministry, the private schools also have to follow certain general guidelines and are academically under the jurisdiction of the ministry.

3. Major Activities in the School

There are several major activities performed in the normal course of school operation. *These activities are well structured* and fairly unified throughout the Kingdom. Within these activities, data, information and reports are generated at various times by

different functional units and subsequently passed on to other relevant units or external users such as the administration, the parents, the ministry, ... etc. A brief description of these activities is given below.

3.1 Student Admission

- Provide blank application forms to prospective students.
- Receive filled up forms along with past academic records, if any.
- Check applications to accept/reject students.
- If accepted, open a file for student. Add his name to the class list.
- Inform the student.

3.2 Student Assignment to Different Sections of a Class

- Obtain list of promoted students, failed students, new students and class capacities.
- Assign students to different sections and prepare class lists.
- Send the lists to relevant teachers, files and notice board.

3.3 Course Scheduling (Time Tabling)

- Obtain list of teachers, classes, courses, time periods and classrooms.
- Assign classroom and teachers and prepare master schedule.
- From master schedule, obtain individual class schedules and teacher schedules.
- Distribute the teacher schedules to teachers and class schedules to students.
- Keep records of the schedules in relevant files.

3.4 Preparation of Exam Schedules

- Obtain course list and exam dates from academic calendar.
- Prepare the exam schedule.
- Distribute exam schedules to teachers and students.
- Keep the exam schedule in relevant file.

3.5 Grade Processing and Reporting

- Collect course-wise grades of exams for all the classes.
- Enter the grades in master grade sheet for each class.
- Compile the marks, *i.e.,* add marks, rank students, ... etc.
- Prepare list of promoted students, failed students and students to sit in repeat exam.
- Prepare progress reports/promotion cards.
- Distribute progress reports/promotion cards to students.
- Generate aggregate statistical reports about student performance.
- Distribute aggregate reports to relevant parties.
- Keep records of list of promoted, failed and repeat students in relevant files.
- Keep records of grades in class files.
- Keep records of progress reports in students files.

3.6 Acquisition of Equipment

- Prepare requisition list of equipments.
- Send the list to the Ministry.
- Receive material according to list approved by Ministry.
- Update the equipment records in master equipment file.
- Send receipt to the ministry. Save a copy of receipt in the transaction file.

3.7 Transaction of Equipment
- Receive request of transaction, *i.e.*, issue or return of equipments.
- Check equipment records if necessary.
- Effect the transaction.
- Update equipment record in Master equipment file.
- Save the transaction record.

3.8 Preparation of Annual Reports
- Obtain data from all relevant files.
- Prepare the reports in formats predefined by ministry.
- Send the reports to ministry.
- Keep copies of reports in Annual report file.

In addition to the activities detailed above, there are other numerous activities carried out by the school as outlined below.

– Issuing of transfer certificates to students.

– Absence reporting on students.

– Personnel management which includes keeping records of staff, leave, absence, overtime, preparing salary bills, ... etc.

– Library management: This includes acquisition of books, keeping records of transaction and stock of books and other library materials.

– Management of physical facilities: This includes keeping record of physical facilities like buildings, furniture, cars, air conditioners, office equipments, ... etc., and preparing requisition for maintaining these facilities.

4. Data Flow Analysis for Major Activities

One of the widely used tools for structured system analysis and design is the data flow diagrams (DFD), that trace the data flow throughout the system showing the storage of data and data transformation processes.

For various conventions in DFD, one may refer to standard texts on Systems Analysis and Design (see for example, Senn[3], Gore and Stubbe[4], or Davis and Olson[5]). Figures 2-11 show the DFD's related to some of the activities described in the preceding section.

5. Reports and Documents Used in School

The analysis presented in the preceding sections does indicate the existence of different types of reports and forms used by internal and external users. These reports and forms were mainly collected from different schools at primary, intermediate and secondary levels. Personal interviews with the headmasters and teaching staff were conducted to gain further understanding about how the data are gathered and processed into information. These interviews also elicited information about frequency of report generation, difficulty of gathering data and complexity and processing them manually. The Directorate of education in the Western region also provided valuable information about different forms and reports received periodically from individual schools. The investigators also benefitted from the views and suggestions obtained through the interviews.
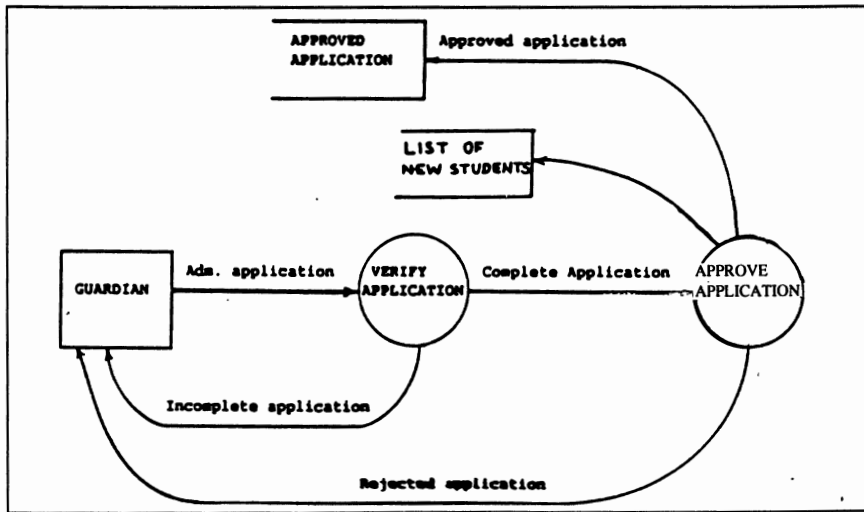
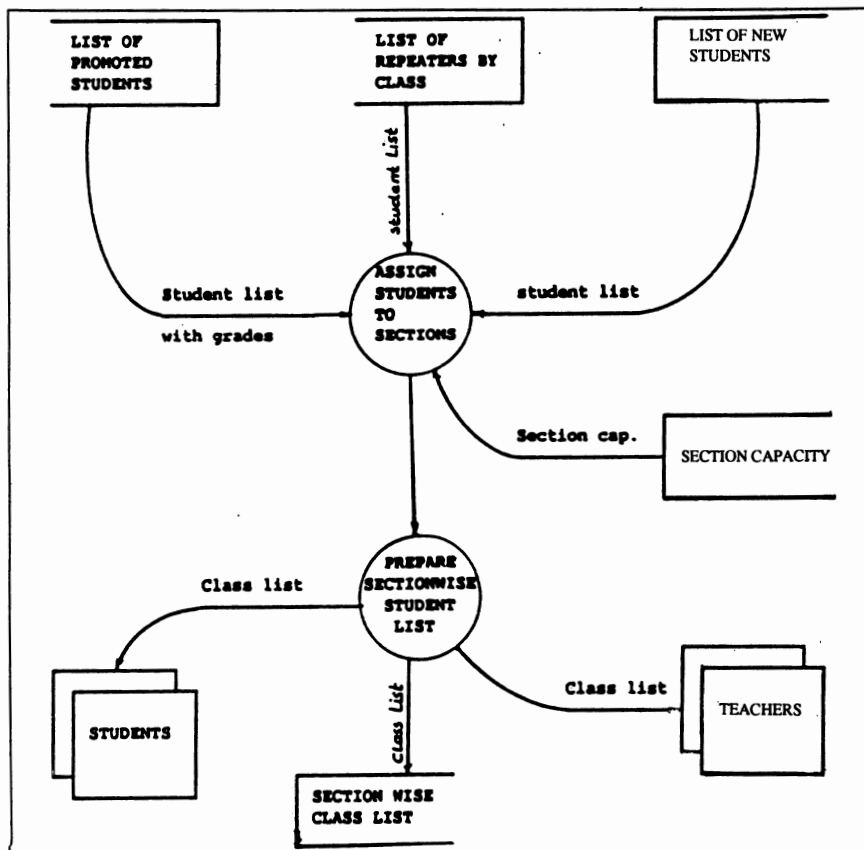FIG. 2. Dataflow diagram for admission process.

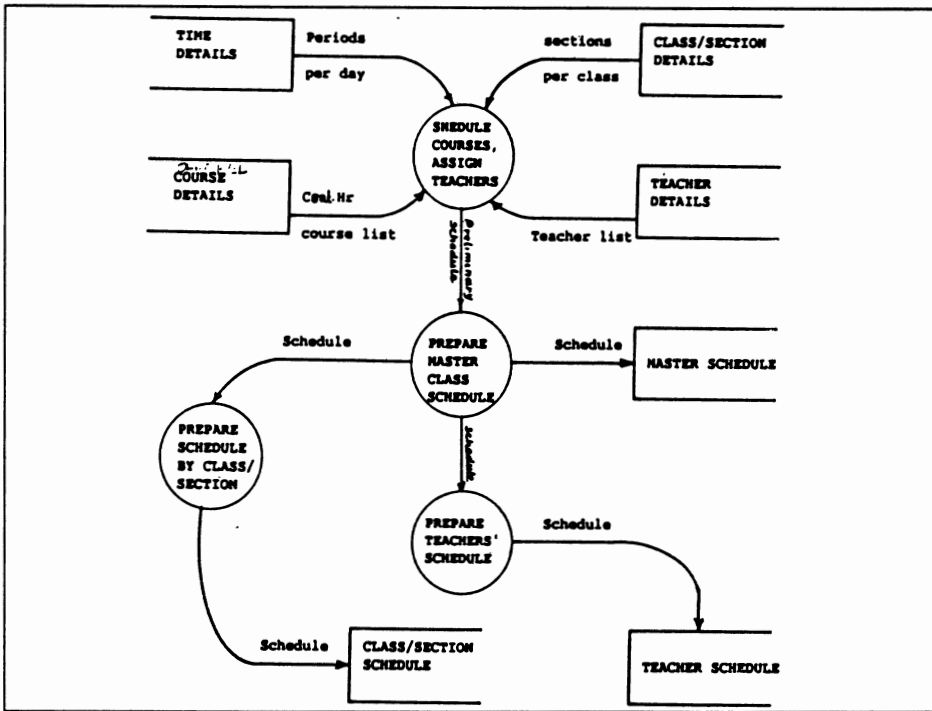FIG. 3. Dataflow diagram for student assignment to different sections.

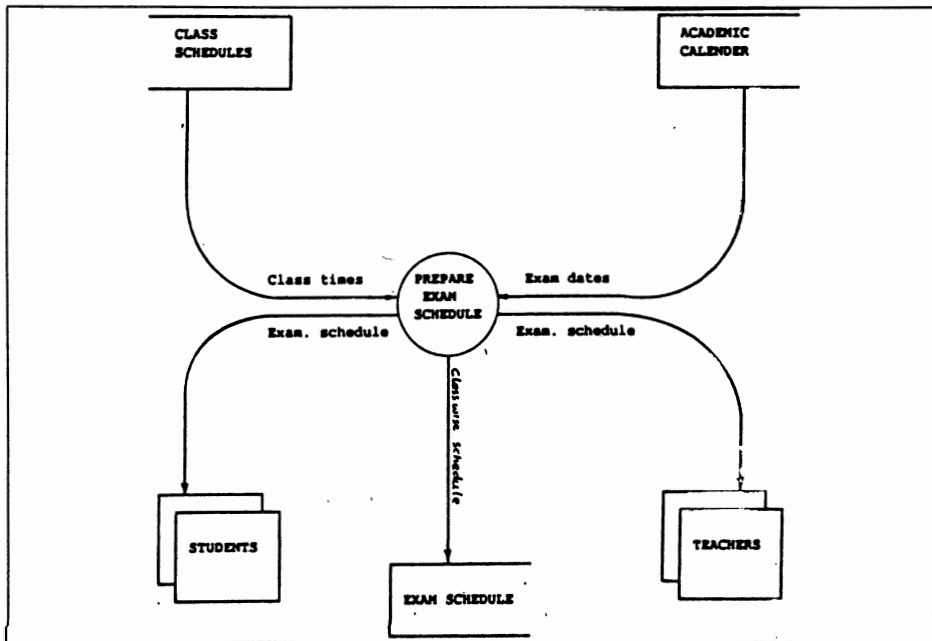FIG. 4. Dataflow diagram for course scheduling processes.

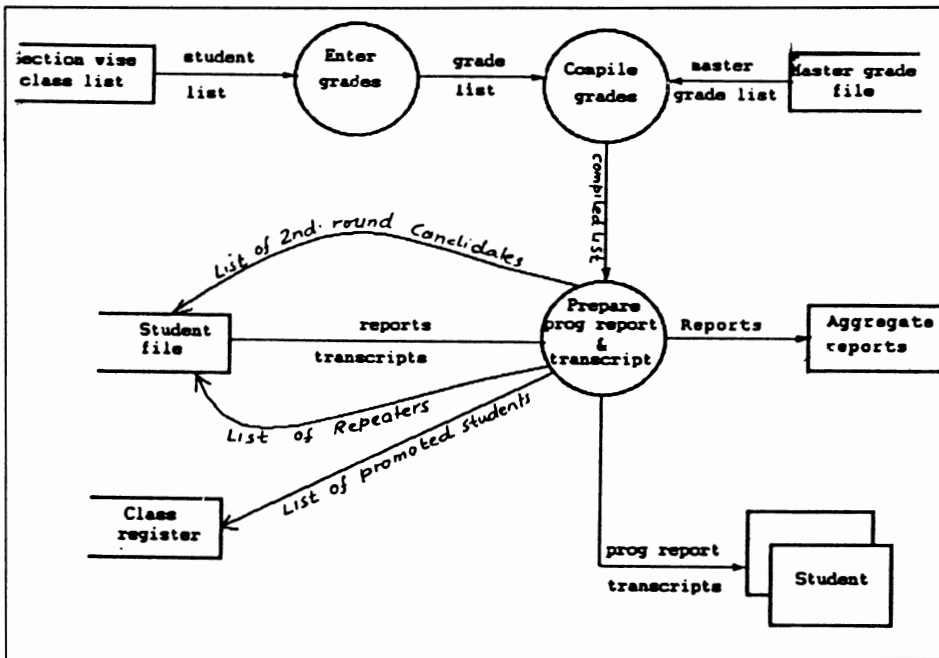FIG. 5. Dataflow diagram for preparation of exam schedule.

FIG. 6. Dataflow diagram for grade processing and reporting.
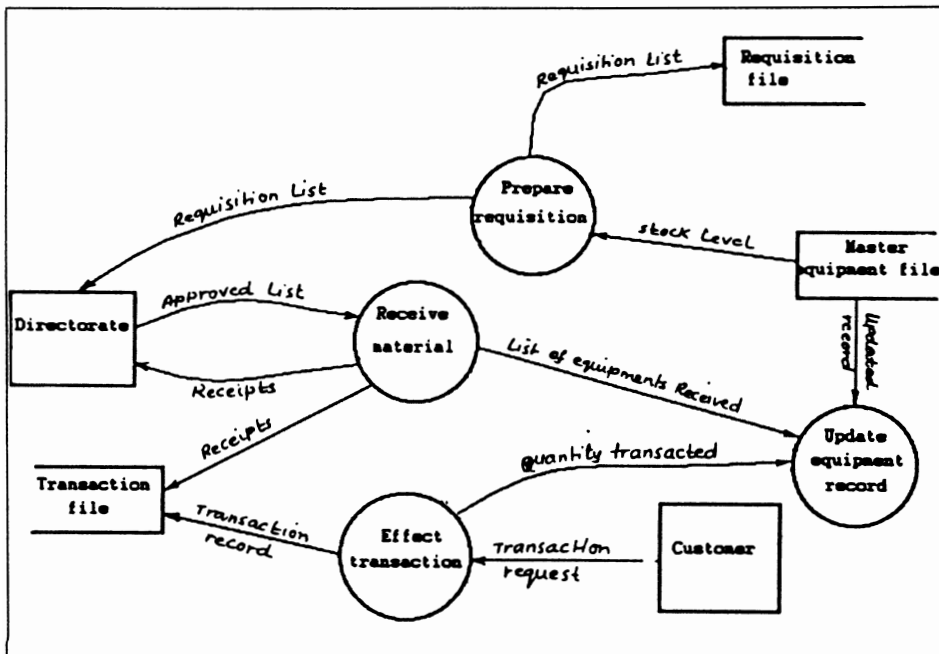
FIG. 7. Dataflow diagram for acquisition of equipments.
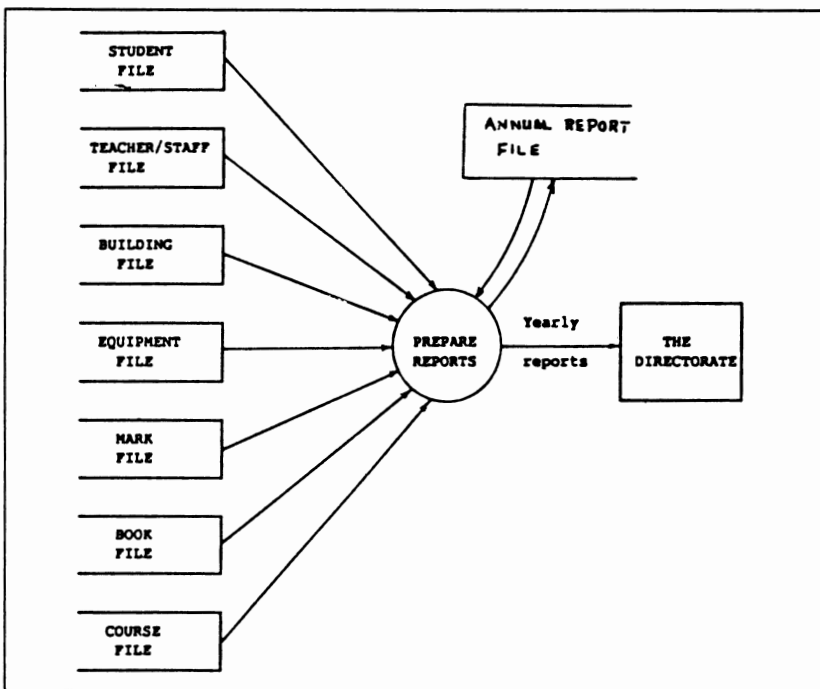
FIG. 8. Dataflow diagram for preparation of annual reports.
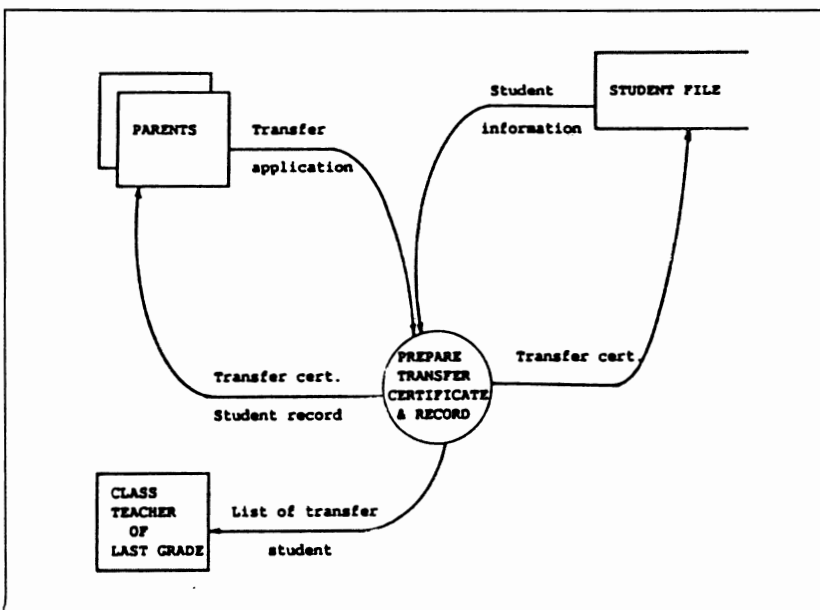

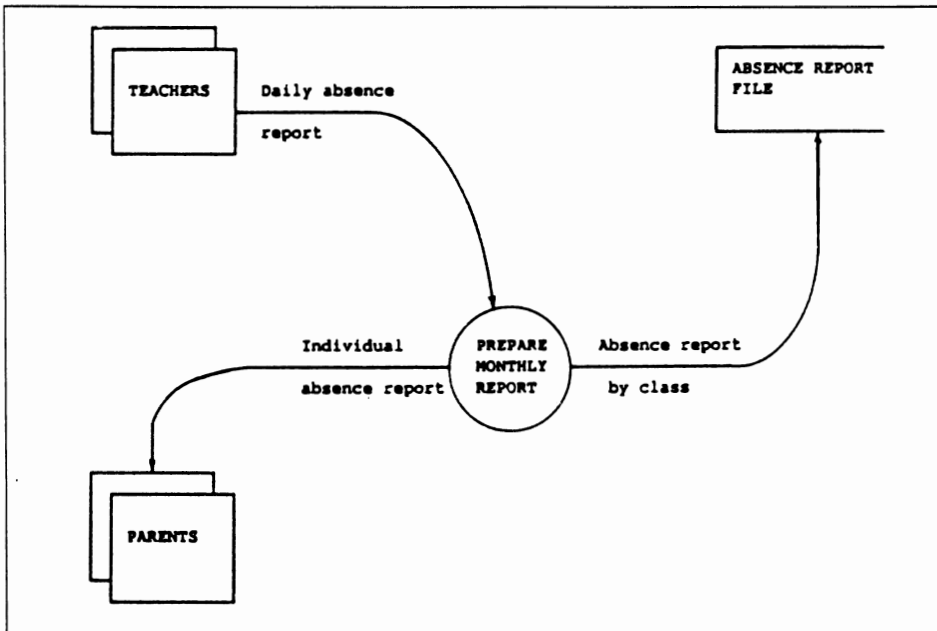FIG. 9. Dataflow diagram for preparing transfer certificate.

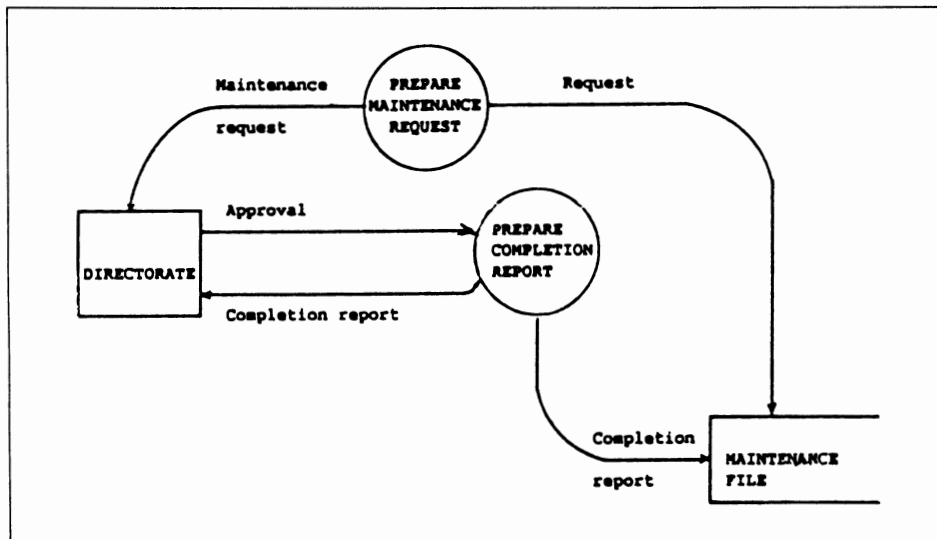Fig. 10. Dataflow diagram for absence reporting.

Fig. 11. Dataflow diagram for maintenance activity.

The scope of this paper preclude individual discussion of these documents. However, a detailed study and analysis of these documents is reported elsewhere[6], the result of which is presented as a detailed list in Table 1.

TABLE 1. Analysis of processing requirements for school reports.

FORM CODE	REPORT NAME	FREQ/YEAR	TIME OF GENERATION	DATA ORIGIN	VOL. DATA PROCESSED	TIME CONSTRAINT	DIFFICULTIES ENCOUNTERED	COMPUT. NEEDS
	ANNUAL STATISTICAL YEARBOOK REPORTS:							
Y1	GENERAL SCHOOL INFORMATION	.	YEAR END	STUDENT RECORDS,SCHOOL RECORD CLASS RECORDS	MEDIUM		GETTING ACCURATE INFORMATION	MEDIUM
Y3	NO OF SECTIONS AND STUDENTS BY CLASS	1	YEAR END	CLASS RECORDS	LOW			LOW
Y4	# OF STUDENTS JOINING/PROMOTED BY CLASS	1	YEAR END	GRADE RECORDS, STUDENT RECORDS	MEDIUM		TEDIOUS MANUAL COMPILATION	MEDIUM
Y5	DISTRIB. OF SAUDI STUDENTS BY AGE	1	YEAR END	STUDENT RECORDS	HIGH		TEDIOUS MANUAL COMPILATION	HIGH
Y6	DISTRIB. OF NON-SAUDI STUDENTS BY AGE	1	YEAR END	STUDENT RECORDS	MEDIUM		TEDIOUS MANUAL COMPILATION	HIGH
Y7	RESULTS OF PREVIOUS YEAR 'SHAHADA' EXAM	1	YEAR END	STUDENT REC., GRADE RECORDS	MEDIUM		MANUAL CROSS CHECKING	MEDIUM
Y8	DISTRIB OF STUDENT ATTRITION BY REASON	1	YEAR END	TEACHERS, STUDENT RECORDS	HIGH		MANUAL COMPILATION, MULTIPLE SOURCES	MEDIUM
Y9	DISTRIB OF STUDENT ADMISSION BY SOURCE	1	YEAR END	STUDENT RECORDS,ADM. REGISTER	LOW		MANUAL COMPILATION, MULTIPLE SOURCES	LOW
Y16	DISTRIBUTION OF STUDENTS BY NATIONALITY	1	YEAR END	STUDENT RECORDS	HIGH		LENGTHY MANUAL COMPILATION	MEDIUM
Y17	LIST OF FURNITURE	1	YEAR END	EQUIP. RECORDS, INVENTORY	MEDIUM			LOW
Y18	LIST OF TEACHING AIDS	1	YEAR END	EQUIP. RECORDS, INVENTORY	MEDIUM			LOW
Y19	LIST OF AVAILABLE UTILITIES	1	YEAR END	ADMINITRATION	LOW			LOW
Y20	GENERAL INFORMATION ON SCHOOL BUILDINGS	1	YEAR END	ADMINISTRATION	LOW			LOW
Y21	DISTRIB OF BUILDINGS BY STRUCTURE TYPE	1	YEAR END	BUILDING RECORDS,ADMIN.	LOW			LOW
Y22	DISTRIBUTION OF ROOMS BY USAGE	1	YEAR END	PHYS. CHECK, BUILDING RECORDS	LOW		MIGHT REQUIRE PHYSICAL CHECK	LOW
Y23	ROOMS ASSIGNED TO EXTERNAL USERS	1	YEAR END	PHYSICAL CHECK	LOW		MIGHT REQUIRE PHYSICAL CHECK	LOW
Y24	DISTRIB OF STAFF BY NATIONALITY	1	YEAR END	STAFF RECORDS	LOW			LOW
Y25	DISTRIB OF STAFF BY ACADEMIC QUALIFIC.	1	YEAR END	STAFF RECORDS	LOW		ITEMS IN FORM NOT WELL DEFINED	MEDIUM
Y26	DISTRIB OF STAFF BY JOB CATEGORY	1	YEAR END	STAFF RECORDS	LOW			LOW
Y27	DISTRIB OF PART-TIME STAFF BY CATEGORY	1	YEAR END	STAFF RECORDS	LOW			LOW
Y28	DISTRIB OF STAFF ON LEAVE BY REASON	1	YEAR END	STAFF RECORDS	LOW			LOW
Y29	DISTRIB OF NEWLY JOINING STAFF	1	YEAR END	STAFF RECORDS	LOW			LOW
Y30	DISTRIB OF STAFF BY SPECIALIZATION	1	YEAR END	STAFF RECORDS	LOW			LOW
Y31	EXPENDITURES ON STAFF BY NATIONALITY	1	YEAR END	SALARY RECORDS	LOW			LOW
Y32	DISTRIB BY SAUDI BY JOBGRADE & CATEGORY	1	YEAR END	STAFF RECORDS	LOW			LOW
Y33	PERSONAL INFORMATION ON STAFF	1	YEAR END	STAFF RECORDS	HIGH		MANUAL COMPILATION, LONG FORM	HIGH
Y34	PERSONAL INFORMATION ON SUPPORT STAFF	1	YEAR END	STAFF & SALARY RECORDS	MEDIUM			MEDIUM
Y35	PERSONAL INFORMATION ON STAFF DEPARTED	1	YEAR END	STAFF & SALARY RECORDS	LOW			LOW
Y36	DISTRIB OF STAFF DEPARTED BY REASON	1	YEAR END	STAFF RECORDS	LOW			LOW
	ADMINISTRATIVE REPORTS:							
A1	MASTER LIST OF STUDENTS	1	YEAR END	STUDENT RECORD	HIGH		MANUAL UPDATING	LOW
A2	MONTHLY REPORT ON STUDENTS ABSENTEEISM	12	MONTH END	ATTENDANCE RECORD	HIGH		LONG AND TEDIOUS	LOW
A3	DAILY LIST OF ABSENT STUDENTS	--	DAILY	STAFF RECORDS	HIGH		TEDIOUS	LOW
A4	EMPLOYEE INFORMATION	1	YEAR END	STAFF RECORDS	LOW			LOW
A5	EMPLOYEE ABSENTEEISM AND PUNCTUALITY	1	YEAR END	STAFF ATTENDANCE RECORDS	MEDIUM		TEDIOUS	MEDIUM
A7	LIBRARY ACQUISITION JOURNAL	1		BOOK TRANSACTION RECORDS	LOW			LOW
A8	FURNITURE & EQUIPMENT JOURNAL	1		FURNITURE/EQUIP TRANS. RECORDS	LOW			LOW

TABLE 1. Contd.

FORM CODE	REPORT NAME	FREQ/ YEAR	TIME OF GENERATION	DATA ORIGIN	VOL. DATA PROCESSED	TIME CON- STRAINT	DIFFICULTIES ENCOUNTERED	COMPUT. NEEDS
	GRADE REPORTS:							
C1	PROMOTION CARD	1	YEAR END	GRADE AND CLASS RECORDS	VERY HIGH	2-3 WEEKS	VOLUMINOUS AND TEDIOUS	HIGH
C2	PROGRESS REPORT	2	TERM END	GRADE AND CLASS RECORDS	VERY HIGH	2-3 WEEKS	VOLUMINOUS AND TEDIOUS	HIGH
G1	SUMMARY STATISTICS ON FINAL EXAMS	1	YEAR END	GRADE RECORDS	LOW	2-3 WEEKS	MANUAL COMPILATION IS TEDIOUS	
G2	SUMMARY STATISTICS ON EXAM PERFORMANCE	1	YEAR END	GRADE RECORDS AND CLASS LIST	VERY HIGH	2-3 WEEKS	MANUAL COMPILATION & VERIFICATION	HIGH
G3	DETAILED COURSE-WISE STUDENT GRADES	1	YEAR END	GRADE RECORDS	VERY HIGH	2-3 WEEKS	SEARCH, SELECTION OF DATA & COPYING	HIGH
G4	SUMMARY STAT ON 1ST ROUND EXAM RESULTS	1	YEAR END	GRADE RECORDS	LOW	2-3 WEEKS	SEARCH & SELECT DATA FROM REPORT G5	HIGH
G5	DETAILED GRADE SHEET AFTER 1ST ROUND EXAM	1	YEAR END	GRADE RECORDS	VERY HIGH	2-3 WEEKS	SEARCH, SELECTION OF DATA FROM MANY SOURCES, LARGE FORM, ERROR CHECKING, MANUAL COMPILATION	VERY HIGH
G6	SUMMARY STAT ON 2ND ROUND EXAM RESULTS	1	YEAR END	GRADE RECORDS	LOW	2-3 WEEKS	SEARCH & SELECT DATA FROM REPORT G7	MEDIUM
G7	DETAILED GRADE SHEET AFTER 2ND ROUND EXAM	1	YEAR END	2ND. ROUND EXAM GRADE	MEDIUM	2-3 WEEKS	SEARCH, SELECTION OF DATA & COPYING DATA FROM G5	MEDIUM
	REPORTS ON STUDENTS:							
T1	STUDENTS PROGRESS REPORTS, MONTHLY	12	MONTH END	STUDENT RECORDS & CLASS MARKS	MEDIUM	1 WEEK	INF. COLLECTION+ MANUAL COMPILATION	HIGH
T2	STUDENT PERFORMANCE BY CLASS	2	TERM END	CLASS MARKS	HIGH	1-2 WEEKS	INF. COLLECTION+ MANUAL COMPILATION	HIGH
T3	DAILY LOG OF STUDENT ABSENTEEISM	--	DAILY	CLASS RECORD (FROM TEACHER)	LOW	1 DAY	MONOTONOUS DAILY ROUTINE	LOW
T4	LIST OF ABSENT STUDENTS	12	MONTH END	DAILY ABSENCE RECORD	HIGH	1 WEEK	LARGE DATA VOLUME+MANUAL COMPILING	HIGH
T5	STUDENT ADDRESSES	2	TERM END	STUDENT RECORDS	HIGH	1 MONTH	LARGE DATA VOLUME+MANUAL COMPILING	VERY HIGH
T6	UNDERTAKING FORM BY GUARDIAN	-						
S1	COMPREHENSIVE STUDENT INFORMATION*	1	AT ADMISSION	STUDENT RECORDS	LOW		DETAILED FORM DIFFICULT TO FILL	

* FORM S1 COMPRISES 14 FILES THAT ARE TOO DETAILED AND ARE FILLED UP GRADUALLY OVER THE YEARS AS THE STUDENT PROGRESSES THROUGH THE SCHOOL. IT SEEMS THAT THERE ARE MANY PIECES OF INFORMATION IN THEM THAT HAVE MARGINAL UTILITY.

It has been found that most of the internal forms are not standard or well structured. The format of these forms/documents vary from one school to another and sometimes within the same school. It is also possible that some of these forms are not actively used in some schools. However, certain documents such as yearly reports, grade reports, ... etc., sent to the ministry are very well defined and highly structured, although occasionally do contain information of doubtful relevance.

It should be noted that a large number of the reports[2] such as yearly reports, grade reports, promotion cards, ... etc., are event oriented, voluminous and need to be produced in a limited time frame. This results in great strain on the resources, especially teachers who have to work extra hours to meet the deadline.

6. Data Processing Requirements

Analysis of processing requirements gives an idea about the nature and quantity of work required to generate all the needed information. The analysis is based mainly on the volume of data, the frequency of generation, the complexity of calculation involved, and computational requirement. Other attributes of information such as timelines, accuracy, ... etc., also influence the total work load. Table 1 shows a global analysis of data processing requirements of a typical school.

6.1 Volume of Data

The exact volume of data involved is difficult to estimate since it may vary from school to school depending on the number of students, teachers, classes, ... etc. Also, it depends on the amount of data handled to produce individual reports. From Table 1, it can be seen that the volume of data involved in most of the reports is quite high, particularly those related to individual students, student grades, books and equipment.

6.2 Frequency/Time Constraint of Report Generation

Generally, most of the reports are generated on a periodic basis, mostly every term or every year. Even though this is not a high frequency, a number of these reports have stringent time constraints. For example; promotion cards, progress reports, annual reports, ... etc., need to be generated within a short time following the examinations. Additionally, some reports (for example; transcript of a student) may be required on a random basis when requested by a user. In such cases, speedy preparation of the report is desirable although the frequency is not high. A summary of the frequency of the report generation is also presented in Table 1.

6.3 Complexity of Calculation and Computational Needs

Generally, the calculation involved in preparing these reports are rather simple. Basic arithmetic is enough for the purpose. However, a good number of these reports involve simple but lengthy computations. For example summary statistical reports of different kinds, the annual reports, ... etc., require multiple scanning of entire files to produce the necessary statistics. Manually, this is a tedious and time consuming task.

7. Conclusion

The analysis of the school information system brings out certain important features which may be summarized as follows:

a) The volume of data handled in the course of report generation is quite large for most of the reports. For some reports, it can be extremely large. The number of reports and documents is also quite large. Although, the computational complexity for preparing these are generally low, the computational requirements for some of them (for example; yearly reports) is very high. The manual preparation of most of these reports is thus tedious, time consuming and error prone.

b) It is difficult to produce some of the reports on a timely basis because of short time available to the school. For example; the manual preparation of yearly report is difficult and teachers have to work overtime to prepare them. This increases the temptation to compromise on the quality of reports.

c) Not all the documents, particularly the ones used internally, are standardized or well structured. This discourages (or sometimes inhibits) storing of many information in an organized and accessible manner.

d) Evaluation of student performance and its trend is important in judging the standard of a school. Although the grade report prepared by schools for the ministry does show the students performance, it mainly contains the pass/fail statistics or the raw grade obtained by students. It does not contain meaningful performance analysis. Also, trend analysis of different performance parameters (such as average standing of the graduates) over the years are not done at the school level. On the other hand, some of the reports contain unfiltered raw data of doubtful use to the Ministry.

e) The schools, as a part of normal operation, keep a large number of records on students, grades, teachers, ... etc. Manual record keeping and retrieval of such a large amount of data can be at best cumbersome and at worst incomplete and inaccurate.

Looking at the deficiencies in the system, tremendous scope for improvement exists. The following possible improvements can be visualized.

a) Adoption of standardized and well structured reports and forms for internal and external users.

b) Introduction of new reports for performance evaluation and trend analysis of important parameters.

c) Removal of redundant reports.

d) Removal of redundant and duplicate data from selected reports sent to the Ministry.

In conclusion, it can be said that the introduction of a comprehensive computerized information system will enable generation of accurate reports on a timely basis. In addition, it will no doubt relieve the school administration from the tedious task of manually preparing the reports and allow generation of more meaningful reports. Such a system can be introduced in all schools in the Kingdom and can form the basis of higher information system at national level. The design and development of such a computer-based information system will be presented by the authors in a subsequent paper.

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تحليل نظام معلومات متكامل للمدارس في المملكة العربية السعودية

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جــــدة – المملكة العربية السعودية

المستخلص .   تؤدي نظم المعلومـات الإدارية دورًا هامًا في عـمليـة إدارة المؤسسات بشكل عـام ، والتي تمثل المدارس جزءًا منهـا . وتعرض هذه الورقة نتائج تحليل نظام المعلومات في المدارس الحكومية في المملكة ، وذلك كمدخل لتصميم نظام معلومات متكامل على الحاسب الآلي .

تعتمد الورقة أسلوب تحليل المدخلات والمخرجات لتحديد الخط العام للنظام واحتياجاته وتصميمه ، ويبدأ التحليل بوصف دقيق للأنشطة الرئيسة ، التي تتضمن إصدار أو رصد أو نقل المعلومـات . ثم يتم تحليل خط انتقـال هذه المعلومات باستخدام الرسوم البيانية لتدفق البيانات data flow diagrams . كما يشمل التحليل تقييم المتطلبات المعلوماتية للتقارير ، من حيث حجم المعلومات وتعقيدها ومتطلباتها الحسابية . كما أن التحليل يعرض لوتيرة إصدار التقارير والمدة الزمنية المتاحة تحت ظروف العام الدراسي لإصدار كل منها .

وتُختم الورقة بعرض لأبرز سلبيـات نظام المعلومـات اليـدوي الحـالي ، وأسلوب إدارته ، كما تُختم بتوصيات كيفية نحو تصميم نظام معلومات متكامل على الحاسب الآلي .