Some Aspects of Information Technology Education in Schools in Asia

Chandima H. de Silva
Department of Statistics & Computer Science
University of Kelaniya, Sri Lanka
chandima333@yahoo.com

Abstract: Information Technology education in schools in Asia is generally a recent phenomenon. Countries like India and Singapore introduced IT education to schools some time back while countries like Sri Lanka were rather late in the process. Significant differences in modalities, processes and pedagogical issues in IT education in schools in the Asian region could be identified. The reasons for these differences are many. This paper attempts to present a comparative study on IT education in schools in Singapore, India and Sri Lanka especially with reference to curriculum development, pedagogical approach and examinations procedure.

1. Introduction and background

A remarkable growth in the interest among the younger generation in Sri Lanka to embark on information technology related study programs is observed during the last decade or so. However, the introduction of information technology as a subject in the secondary school curriculum is only a very recent development. The pilot project on teaching General Information Technology (GIT) to year 12 and year 13 school children started only in 2002 while teaching GIT as a selective subject in a limited number of schools commenced in 2004. At present there are approximately 10,000 schools in Sri Lanka and approximately 2400 out of these have G.C.E. Advanced Level classes. GIT is presently being offered as a selective subject in approximately 500 schools and the first batch of students took this subject in the G.C.E. Advanced Level examination\(^1\) in June 2005. Plans are afoot to offer Information Technology as a subject in the G.C.E. Ordinary Level Examination from the year 2008. Apart from the above mentioned teaching of IT, there is no other formal teaching in IT at present in the primary and secondary school system in Sri Lanka.

The Ministry of Education, according to its circular 2004/20, has identified four pre-requisites to conduct teaching GIT in a particular school namely,

\(^1\) General Certificate of Education (Advanced Level) Examination also functions as the entrance examination to Sri Lankan universities
(a) a minimum of four computers.
(b) one teacher with sufficient subject knowledge and training.
(c) a secure room (lab) with electricity supply.
(d) sufficient furniture.

The Government of Sri Lanka having recognized teaching GIT as a priority, formulated the National Policy on Information Technology in School Education (NPITSE) in 2001. The vision of NPITSE is “a new generation of Sri Lankans empowered with Information and Communication Technology and to facilitate the planning, implementation and sustenance of Information Technology education in schools to enhance students’ learning and quality of teaching”. Since the formulation of the NPITSE, the Government has initiated several programmes under four strategic themes namely, curriculum development, human resources development, physical infrastructure development and support initiatives development. Approximately 1000 teachers have so far been trained in teaching GIT, syllabuses have been formulated, computers have been provided to many schools and even physical infrastructure has been enhanced. There are plans to propagate teaching IT to even lower forms in schools in the near future.

2. Motivation and usefulness

Given the above developments that have taken place during the recent past and the enormous amount of both financial and human resources invested in the process, a scientific study to evaluate the effectiveness of this whole process is yet to be done. This, in our opinion, is a national need due to several reasons. The wide variation in IT knowledge among teachers and general inadequacies in both knowledge and training, if any, should be identified and need to be remedied sooner than later in order to make the efforts of the Government bear fruit. Secondly, a proper study should be done to examine whether both physical and human resources are being optimally utilized. Thirdly, a proper evaluation of teaching GIT in year 12 and year 13 should be done to enable the authorities to be satisfied before propagating IT into the school curriculum in lower forms. Last but not least, a curriculum evaluation should be made to make sure that what is being presently taught is in line with the requirements of universities to which some of these students will eventually enter, and in general with the requirements of employers. This paper primarily analyses the performance of students at the first GIT Examination conducted in Sri Lanka.

Several research work carried out previously by distinguished academics motivated the author to do a similar study first in the Sri Lankan context and then expand it to cover some other countries in Asia. Valentina Dagiene[1] presents the goals and nature of introducing IT into the school curriculum in Lithuania and Peter Micheuz [5,6] describes how the Austrian school system has responded to the needs of a growing digital economy over many years. Ewa Gurbiel
et al [3] puts forward how ICT was integrated into the curriculum in the Polish Education System while Christian Doringer[2] discusses the importance of educational standards in school informatics in Austria. Standards in the Russian Education System with respect to ICT are discussed by Kuznetsov and Beshenkov [4] and recent tendencies in teaching ICT in Ukraine is given by Oleg Spirin [8]. Markus Schneider [7] discusses strategies to incorporate even abstract concepts in IT into the school curriculum in Bavarian Gymnasiums. Many other researchers have also documented their research on different aspects of teaching and learning ICT in schools and experiences in introducing ICT into the school curriculum.

Introduction of ICT into the Sri Lankan school system is only a recent development and no research has so far been done on any of the above mentioned aspects. It is in this backdrop that the author presents the foregoing analysis on the performance at the first GIT examination in the Sri Lankan school system. In countries like Singapore and India, ICT in schools is not a recent phenomenon. In such countries so much academic discussion has taken place during the past few years in order to make ICT education in schools more meaningful and more productive.

3. Structure, syllabus and assessment of the GIT Examination

According to the official document prepared by the National Institute of Education, Sri Lanka [11], setting out the syllabus of GIT examination, the objectives of the GIT examination are for the student to understand the basic concepts of IT, understand the potential of IT tools and apply them appropriately, identify the further study paths in IT based on his/her ability, gain knowledge in selecting the directions towards employment opportunities in IT and associated fields, adapt IT to enhance learning, demonstrate an awareness of social, ethical and safety issues related to IT and appreciate the importance of IT in national development. It is debatable as to how many of these objectives are in fact practically measurable.

Subject contents of the GIT examination and recommended time allocation are summarized below. One period is defined to be forty minutes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Proposed no. of periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IT Fundamentals</td>
<td>12 (Theory 11, Practical 1)</td>
</tr>
</tbody>
</table>
2. Mathematics for Computing 10

3. Information Systems and IT 14

4. Computer Programming 20 (Theory 10, Practical 10)

5. Use of Computer Software 14 (Theory 4, Practical 10)

6. IT and National Development 02

Total 72 (Theory 51, Practical 21)


A more detailed version of the syllabus is given at the end of the paper.

Assessment of the GIT examination is carried out as follows. School based assessment is done through a written examination administered by teachers under the guidance of the National Institute of Education. The National Level Examination (GIT Examination) is conducted by the Examinations Department of Sri Lanka. This examination comprises two papers namely, objective type multiple choice paper of one hour duration (number of questions 40) and structured paper of two hours duration (number of questions 6 and students have to answer 4). The medium of both these papers is English and the distribution of marks is 40 and 60 respectively.

3. Analysis of Performance of Students in the GIT Examination

This is an attempt to analyse the students’ performance in paper 2 of the GIT examination. The analysis of paper 1 has not been conducted as marks were not available at the time of writing this paper. The author extends his appreciation to the R & D Branch of the Examinations Department of Sri Lanka for providing the data.

The examinations consisted of six structured questions out of which students had to answer four. Each question carried 15 marks. The lowest mark obtained was 00 while the highest was 60. The mean of marks was 8.9 and the standard deviation was 14.48. The Facility Index of almost all items is below 0.5, which is an indication of poor performance. Furthermore, the facility index in many parts is less than 0.1, which indicates that many students have scored low marks. This implies that the majority of students had found it difficult to answer the questions. Reasons of this poor performance could be many and needs investigation.
The overall performance of paper 2 is clearly positively skewed and the majority has obtained low scores. The very fact that the mean of scores is 8.9 implies very poor performance by students.

4. Case of Singapore

To prepare Singapore for its next phase of development, the Republic’s government embarked on a plan in the early 1990s, called IT2000, to use information technology resources throughout the country (Kuo, Loh and Raman [10]). One of the linchpins in the plan was education, specifically, the need for computer literacy. The IT Masterplan was developed in April 1997 by the Ministry of Education to revolutionise the learning environment. This Masterplan was ambitious: it aimed not only to teach computer literacy and information technology but also to use the capabilities first, to enhance linkages between the school and the world around it, and then to encourage creative thinking, generate innovative processes in education and promote administrative and management excellence in the education system.

There are different types of schools in Singapore, ranging from the government schools to the independent schools. Independent schools are given autonomy in staff deployment and curriculum development, whereas the government schools have to adhere closely to the curricula and syllabus. In the Singapore education system, schools are ranked based on the students’ academic performance.

According to Pui See Tang[11], three major themes were identified in the philosophy of IT usage. First was the concept that IT was to be seen as a tool, specifically to enhance teaching and learning. Second, IT should be integrated into the existing government initiatives such as national education and thinking program. In the United States, the OTA (Office of Technology Assessment) identified integration as the important component in ensuring effective technology implementation (OTA, 1995). Third, IT should prepare students for the workforce. At the primary school level, the message communicated to teachers was essentially concerned with mere usage of IT lessons. At the secondary school and junior college level, the message revolved around convincing teachers of the necessity and importance of IT. The emphasis of message is ‘value-addedness’ – how IT can add value to their lessons.
References


Appendix

**Subject Contents of GIT Syllabus**

<table>
<thead>
<tr>
<th>1.1 Introduction to IT</th>
<th>1.1.1 Usage and Importance of IT</th>
<th>1.1.2 Present Role of IT in Society</th>
<th>1.1.3 Data and Information</th>
<th>1.1.4 Process of Conversion</th>
<th>1.1.5 Characteristics of Information</th>
<th>1.1.6 IT Tools (Associated components of IT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Introduction to computers (basic components)</td>
<td>1.2.1 Computer Hardware</td>
<td>1.2.2 History (From ABACUS to PC, From Vacuum Tubes to VLSI..)</td>
<td>1.2.3 The Microprocessor development</td>
<td>1.2.4 Computer organization and Architecture</td>
<td>1.2.5 Components (Processor, Memory, I/O Devices)</td>
<td></td>
</tr>
<tr>
<td>1.3 Software</td>
<td>1.3.1 System Software</td>
<td>1.3.2 Application Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Communication and Computer Networks</td>
<td>1.4.1 Introduction to Communication</td>
<td>1.4.2 Components of Data Communication systems</td>
<td>1.4.3 Introduction to Computer Networks</td>
<td>1.4.4 Classification of Computer Networks</td>
<td>1.4.5 Application of Data Communication and Computer Networks</td>
<td>1.4.6 Advantages and Disadvantages of Computer Networks</td>
</tr>
<tr>
<td>2.1 Number Systems</td>
<td>2.1.1 Decimal System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.1.2 Binary System
2.1.3 Octal System
2.1.4 Hexadecimal System

2.2 Data Representation
2.2.1 Bit, Byte & Word length
2.2.2 ASCII, BCD and EBCDIC codes

2.3 Boolean Algebra
2.3.1 Basic Laws and Axioms of Boolean Algebra
2.3.2 Truth Tables
2.3.3 AND, OR, NOT Operation
2.3.4 Boolean Expressions

2.4 Logic gates and circuits
2.4.1 Switching circuits
2.4.2 Gates and simple circuits

3.1 What is a System/Introduction to a System
3.1.1 Elements of a system
3.1.2 Closed and open system
3.1.3 Viewing organizations as a system
t (E.g. college, medical centre, business firm)

3.2 What is an information system / Introduction to an Information System
3.2.1 Data versus information
3.2.2 Decision making

3.3 Types of information system

3.4 Information system development
3.4.1 The system life cycle
3.4.2 System development life cycle
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.4.3 Problem in system development</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.1 Introduction to Programming</strong> Classifications, Generations, compilers/interpreters</td>
<td></td>
</tr>
<tr>
<td><strong>4.2 Algorithms</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.3 Data types &amp; Operators</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.4 Program Structure</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.5 Data Input/output</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.6 Decision</strong></td>
<td></td>
</tr>
<tr>
<td>4.6.1 Condition</td>
<td></td>
</tr>
<tr>
<td>4.6.2 Case</td>
<td></td>
</tr>
<tr>
<td><strong>4.7 Repetition</strong></td>
<td></td>
</tr>
<tr>
<td>4.7.1 For Do</td>
<td></td>
</tr>
<tr>
<td>4.7.2 Do While/Do Until</td>
<td></td>
</tr>
<tr>
<td><strong>4.8 Arrays</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4.9 Sub Routines – (Functions/Procedures)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>5.1 Operating System Software</strong></td>
<td></td>
</tr>
<tr>
<td>5.1.1 GUI Interface and Program Execution</td>
<td></td>
</tr>
<tr>
<td>5.1.2 Directories and Files</td>
<td></td>
</tr>
<tr>
<td><strong>5.2 Use of Presentation Software package</strong></td>
<td></td>
</tr>
<tr>
<td>5.2.1 Introduction to Presentation Software</td>
<td></td>
</tr>
<tr>
<td>5.2.2 Creating a slide show</td>
<td></td>
</tr>
<tr>
<td><strong>5.3 Use of Word processing Software package</strong></td>
<td></td>
</tr>
<tr>
<td>5.3.1 Introduction to Word processing package</td>
<td></td>
</tr>
<tr>
<td>5.3.2 Creation, opening and closing (saving or discarding changes) documents</td>
<td></td>
</tr>
<tr>
<td>5.3.3 Formatting a document creation of a simple table</td>
<td></td>
</tr>
<tr>
<td>5.3.4 Creation of a simple table</td>
<td></td>
</tr>
<tr>
<td>5.3.5 Editing a document (copying, moving and deleting of text)</td>
<td></td>
</tr>
<tr>
<td>5.3.6 Printing documents</td>
<td></td>
</tr>
<tr>
<td><strong>5.4 Use of Spreadsheet Software package</strong></td>
<td></td>
</tr>
<tr>
<td>5.4.1 Introduction to Spreadsheet package</td>
<td></td>
</tr>
<tr>
<td>5.4.2 Moving around a worksheet</td>
<td></td>
</tr>
<tr>
<td>5.4.3 Editing a worksheet</td>
<td></td>
</tr>
</tbody>
</table>
5.4.4 Saving a worksheet  
5.4.5 Graphing  
5.4.6 Printing worksheets and graphs

5.5 Use of Database Management Software package  
5.5.1 Introduction to DBMS Software  
5.5.2 Component of a database  
5.5.3 Searching records  
5.5.4 Creation of a report  
5.5.5 Printing

5.6 Communication Software  
5.6.1 Introduction to Internet & E-mail

6.1 Ethics, Safety, Health hazards & Laws  
6.2 Counseling for career development  
6.3 Evaluation of IT equipment