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THE PRESENT STATUS OF POLYTECHNIC CURRICULUM AND STUDENT ASSESSMENT APPROACH IN BANGLADESH

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ABSTRACT

Enhancing the quality of Polytechnic graduates is one of the major goals of Bangladesh Technical Education Board. This paper presents the current status of the Diploma-in-Engineering curriculum and student assessment practices at polytechnics in Bangladesh. The qualitative methodology was used to analyze and explain the data. It was found that the curriculum focuses mainly on theoretical matters and does not foster enough the trainees' knowledge transfer capability. In order to optimize the curriculum content, particularly in terms of job market requirements, some recommendations were made based on these findings.

Keywords: Technical and Vocational Education and Training (TVET), Diploma-in-Engineering Curriculum, Student Assessment.

INTRODUCTION

Technical and Vocational Education and Training (TVET) is concerned with the acquisition of knowledge and skills required for the world of work (UNEVOC, 2012). Therefore, the principal objective of TVET curricula is to provide the students with the expertise in a particular group of techniques or technologies (the technical competence) within an occupation including other constituents of occupational competences such as personal competence, learning competence, et cetera (Bader, 2004; Tippelt and Amoros, 2003; Ellström, 1997). This type of curriculum is developed on the basis of the question "Why does someone have to learn this?" and of the answer "Because he or she can use it for ..." The emphasis is on using the material in order to do something else. The learning objective is not remembering or reproducing when assessed (Atherton, 2009). In TVET students experience learning that is more relevant, practical, and useful than general education (Dare, 2006). A TVE curriculum has extra motivational benefits because students gain knowledge and skills through practical learning (Plank, 2001, p2). TVET students become engaged and are motivated to remain engaged both because they are stimulated intellectually and because they can readily see how their learning applies to their lives (Stone & Aliaga, 2003).

However, in case of Bangladesh, there has been a deep consensus that the TVET curriculum, particularly the Polytechnic curriculum for the *Diploma-in-Engineering Programme*, is too theory oriented and it does not provide students with adequate skills, knowledge and attitude. In the same vein, Kashem, Chowdhury and Shears (2011) underlined that the present TVET is unable to fulfill *the demands of industry* because of mismatching between the TVET graduates' competences and the *competences in-use* at workplace. Therefore, polytechnic institutes can hardly produce quality graduates where they find employment in their occupation and are able to earn a considerable level of employers' satisfaction.

Several studies have identified many barriers to quality TVET in Bangladesh that include*: a lack of practical skills and industrial experience of majority of the TVET teachers; ineffective delivery of the practical component of the curriculum; inadequate professional preparation of teachers in both subject matter and teaching methods, lack of academic supervision, inadequate attention to research, lack of teacher and institutional accountability, insufficient and unsuitable textbooks and lab equipment, lack of linkage with industries, lack of government initiative, lack of co-ordination among different levels of education (primary, secondary, tertiary) and also among institutions, lack of teacher-student communication, improper licensing, insufficient student competencies (key or basic competences) at entry-level, lack of self-learning facilities at training institutes (for example using information and communication technology (ICT)), etc.* (ADB, 2008; MinistryOfEducation, 2004; World Bank, 1999b, World Bank, 2000 & 2007; Khanam & Shamsuddoha (2003), Haolader, 2010, p. 7).

The Diploma-in-Engineering Programme

In Bangladesh the *Diploma-in-Engineering* programme is implemented through Polytechnic Institutes and leads to a *Diploma* certificate at National Technical and Vocational Qualification (NTVQ) Level 6 (equivalent to ISCED Level 3B) for middle level technicians/ managers (NTVQ, 2012; BTEB, 2009; ISCED, 1997). Students who pass the Secondary School Certificate (SSC) examination or equivalent (Grade 10) can enroll for this *Diploma* programme. (Note: The total enrolment in TVET sub-sector is 241336 (including female 62562 (25.9%)) and the total enrolment at secondary level is 6389857 (girls 3435695 (53.77%)). The total enrolment at Diploma level at Polytechnic Institutes is 27518 (including a female enrolment of 2926 (10.6%)) (BANBEIS, 2008)).

Till today several measures have been taken to improve the quality of the polytechnic graduates. However, the quality and/or the level of competences of polytechnic graduates of Bangladesh is still under question and is required to be improved a lot in order to achieve the international level standards (Haolader, 2010).

The Importance of HRD for Bangladesh

The Human Resources Development (HRD) is one of the key issues in Bangladesh's national development plan, since it has only limited natural resources. But unfortunately a huge number of working age people is un-skilled and semiskilled. For example, more than 15 million labour force below the age of 25 was unemployed in year 2006 (Ray et al., 2007). If quality TVET is provided to these people they can be exportable manpower resources. "The pool of skilled and professional manpower in Bangladesh which has greater per capita remittance potential is very shallow, not even adequate to meet the demand for the growing domestic industries" (ibid, p. 150). Economists have emphasized the increasing importance of human capital as the unique factor in economic development and competition (Brown & Lauder, 1995). Jucius & Irwin (1979, p. 221), noted "*Human Resources are the most powerful propeller of a country's economic growth and development.*" An increasing focus, both in research and in the policy debate, on HRD and work based education and training as instruments for enhancing productivity, competitiveness, and economic growth have been witnessed during the last decade (Pfeffer, 1995); Rubenson & Schütze, 1993). Ray et al. (2007, p. 15) underlined, "*the next phase of globalisation is likely to be marked by an emerging global labour market and societies will* *have to grapple with many thorny problems of labour market integration."* In a report on Technical Education in Bangladesh Oxtoby (1997) commented, "… *perhaps more than any other country, Bangladesh has only human resources on which to base its future development*". Therefore, TVET institutions, particularly polytechnic institutes, can play a key role in developing the human resource in Bangladesh.

SCOPE AND OBJECTIVES OF THE RESEARCH

This empirical study investigates the *Diploma-in-Engineering (Electronics Technology)* curriculum content including the student assessment. Since, the relevance of curriculum content and its implementation process play an important role in developing students' competences (Nickolaus, 2008; Bieg & Mittag, 2009; Geißel, 2008), the objectives of this research work are to:

a. Find the relevance of the curriculum content with the occupation Diploma Engineer (Electronics Technology) based on the current job market requirement;
b. Evaluate the examination questions of BTEB in terms of Bloom's revised (Anderson and Krathwohl's) taxonomy of teaching, learning and assessing; and
c. Provide information about the current curriculum that would be useful to reform/ modernise it, if necessary.

METHODOLOGY

The required data/information was collected through curriculum content analysis, question paper analysis. Furthermore, experts, senior teachers, and some students were interviewed. The qualitative methodology was mainly used to analyze the data. Additionally, students' competence was measured through a test, particularly in case of application oriented tasks in core area of the occupation *Electronics Technician* to support the findings of the qualitative analysis. Based on the presence at the test time, a total of 160 final year students of five selected polytechnic institutes took the test.

Occupational Profile and the Curriculum Content

The Occupational Profile

The fields of activities, duties and responsibilities of a Diploma Engineer (Electronics Technology) may be described as follows: Typical fields of activities are, for example, production automation, process automation, network automation, traffic management systems, building security & automation systems, radio & television production & service industries and other electronic systems. They can also be employed in hospitals, infrastructure facilities and industrial plants. Other fields are ICT devices, medical devices, automotive systems, systems components, sensors, actuators, micro systems, EMS (Electronic Manufacturing Services), measurement and testing technology.

Duties and responsibilities of a *Diploma Engineer (Electronics Technology)* may include: to produce, put into operation and maintain components and devices, integrate, put into operation and monitor and maintain electronic systems and automation solutions. Diploma Engineers also provide technical and organizational services, make conception and install safety, monitoring and surveillance techniques. They install data networks, fire and burglar alarm systems, access control systems, video monitoring systems, telecommunication installation, erect and operate these installations. They install, configure and parameterize software, develop software, test IT-systems. Moreover, they work independently, take economic and environmental concerns into consideration and observe the relevant technical regulations and safety rules and coordinate their work with the preceding and following activities. They often work as part of a team.

The Curriculum Content – Distribution of Subjects and Lesson Hours

The content of the *Diploma-in-Engineering* curriculum is organised according to subjects. These subjects can be divided into two major categories: the technical (domain specific) subjects and the related subjects. However, for the purpose of analysis, these subjects have been grouped into four different categories, namely (1) domain specific (e.g. electronics, electrical, and information technology; (2) mathematics and natural science; (3) other related subjects (management, book keeping, social science, language, environment, entrepreneurship, etc. and (4) industrial training. Usually, each of the domain specific (technical) subjects consists of two parts: a theoretical part (T) and a practical part (P).

It has been estimated that the total credit points allocated for the *Diploma-in-Engineering (Electronics Technology)* course are 166. About 55.4%, (42.8% for core subjects + 5.4% electrical + 7.2% IT relevant) of the total credit points are allocated for technology based (domain specific) subjects. The next major percentage of credits is occupied by mathematics and natural science (18.7%). The rest are: 7.2% for management, book keeping, etc.; 12% for social science and languages (Bengali and English); 3% for environmental management, physical education and engineering drawing. Only 6 credits (3.6% of the total credits) are allocated to industrial training. Here students spend only 16 weeks out of the whole 4 years of the programme, which is about 13% of the total estimated lesson hours. On the basis of 16 working weeks per semester the sum of the lesson hours allocated for the Programme was calculated to 4800 (including Industrial Attachment). The Bar Diagram in Figure1 shows the lesson hours distribution of different subject categories. It has been found through interview with some students that mostly theory is reviewed during the *Industrial Attachment* period and the time is not used effectively. Considering 5 working days a week and 8 working hours per day, the total lesson hours over seven semesters (excluding *Industrial Attachment*) is 4480. But the total *lesson hours* scheduled for *theory* and *lab* classes over seven semesters is 4160. So there is an unoccupied space of 320 lesson hours, assuming that the scheduled *lessons hours* are utilized effectively.

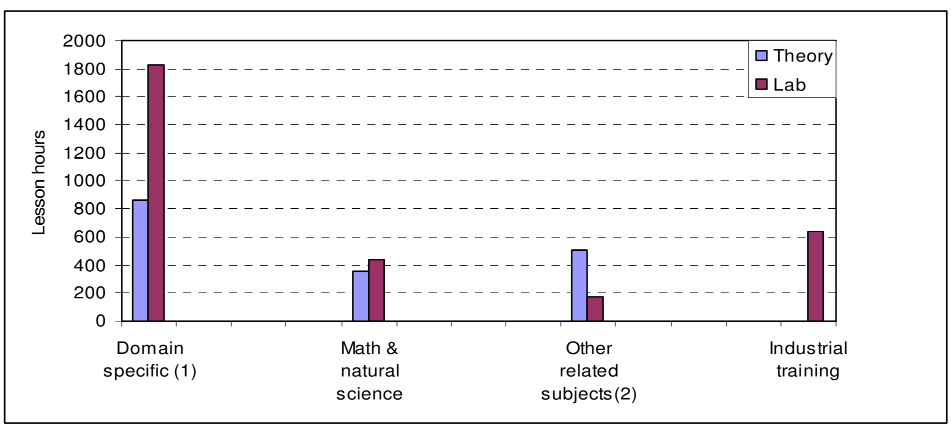

Figure 1. Lesson hour distribution for different subject categories of *Diploma-in-Engineering (Electronic Technology)* programme

The Curriculum Content Analysis according to Bloom's Revised Taxonomy

The complete syllabus was studied and found as if the main aim of the course is so that it is enough if a student can recall and understands the content (Bloom's Taxonomy Level Remembering and Understanding). In other words, it seems that the objectives of the course are to deliver the syllabus content at levels *Remembering* and *Understanding* and students are not supposed to learn and practice the content at higher level, Level *Apply* or above. For example, the subject "Microcontroller and PLC" is taught in the 6th semester of the *Electronics Technology* course. It was found that all the statements under the title 'AIMS' in this syllabus begin with "To be able to Understand". Similarly, under the title "*DETAIL DESCRIPTION OF THEORY*:" parts of these particular subject 10 general objectives are specified. All of these *General Objectives* begin with the verb '*Understand'*, as given below (reproduced from the syllabus): "Understand the basics of microcontroller", "Understand the features of the 8051 microcontroller", "Understand programming of the 8051 microcontroller", "Understand the Timer and Counter programming in the 8051", "Understand the interfacing of the 8051 microcontroller" and so on. (BTEB, 2009b, pp.67 - 69)

Usually, TVET curriculum includes content with different levels of learning objectives (Bloom et al., 1956; Anderson & Krathwohl, 2001; Marzano & Kendall, 2007, p.15). Different types of tasks serve different learning objectives at different cognitive process levels. In order to examine how the learning objectives of the Diploma level curriculum in Bangladesh have been constructed, the following text presents a detailed analysis of the curriculum content of a particular subject. For example, in detail description of the theory part of "Microcontroller and PLC" 71 specific learning objectives (learning items) or learning outcomes are given (ibid.). Each specific objective is constructed with one or more action verbs. They are listed in Table 1. The term *Describe* has been used 29 times and the next verb *Explain* occurs 13 time. The others are (in descending order) *Program* (7), *Interface* (7), *Mention* (5), *Input* and run (5), Use (4), *Prepare* (3), *Connect* (3), *Identify* (2) *Code* (2) *Define* (1), *Know* (1), *Distinguish* (1), and *State* (1).

Table 1. The frequency of verbs used in the syllabus for "Microcontroller and PLC"

Verb	*N*	*Verb*	*N*
Describe	29	Explain	13
Program	7	Interface	7
Mention	5	Input and Run	5
Use	4	Prepare	3
Connect	3	Identify	2
Code	2	Define	1
Know	1	Distinguish	1
State	1		

Some examples of frequently used verbs that relate to the function of the cognitive process level of *Apply* of the Bloom are Taxonomy; are: apply, develop, implement, translate, use, operate, interpret, demonstrate, practice, calculate, show, exhibit, etc. (Bloom et al., 1956). Verbs that relate to the function of the cognitive process level "Understand" are: describe, differentiate, distinguish, discuss, explain, express, illustrate, identify, interpret, mention, recognize, review, etc. and the verbs that relate to the cognitive process level of *Remember* are: define, identify, know, list, name, recognize state, repeat, record, et cetera. The verbs listed in Table 1 from the curriculum of a subject show that majority of the learning objectives are of level *Remember* and/or *Understand*. That means, the *Diploma-in-Engineering* curriculum focuses mainly on theory at two lower levels of cognitive process. This observation has been made not only on the basis of the usage of verbs used for a particular subject, but also on the basis of the detailed syllabus content.

It has been found, with some exceptions, that majority of recommended lab assignments under the title 'PRACTICALS' cannot be categorised as application oriented tasks. For example, the subject "Microcontroller and PLC" includes fourteen items for practical tasks. In *Practical numbers 1 to 5* of this subject students are asked *to input and run assembly language programs - to perform arithmetic and logical operation; to compute 1's or 2's complement of binary number; to transfer data between I/O and memory; to implement the branching and looping structures, and to implement the subroutine operation*. (Microcontroller and PLC, p. 70) They tend to be theoretical because no concrete tasks that simulate the real world situations are mentioned explicitly, unless teachers do so. Exactly the same tasks have been recommended for practical tasks in subject "Microprocessor & Interfacing I", except the type of core processor (BTEB, 2009a, p.44]. The *Practical numbers 6* to *7* are just typing the 'source code' and issuing two commands by pressing the correct buttons. However, the *Practical numbers 8* and *9* are workplace relevant examples. But they are incomplete, in the sense that it is not specified clearly whether students should programme the systems and test some functions. The *Practical numbers 10* to *14* are too abstract and incomplete. Nevertheless, some specific objectives mentioned in this subject are found to be workplace relevant.

Similarly, the recommended practical tasks in "Microprocessor & Interfacing II, are: *(1) Study the hardware of microprocessor based single board computer (16 bit/ 32 bit/ 64 bit); (2) Make simple program by using MC68000 microprocessor instruction set and test them on MC68000 trainer; (3) Make simple program by using Intel 80286/80386/80486 / Pentium microprocessor instruction set and test them on respective trainer; (4) Study the interfacing system of different peripheral devices to the Intel Microprocessor;* and so on. The aims for delivering this subject, as described in the syllabus, are: "*to provide the students with an opportunity to acquire knowledge, skills and attitude in the area of microprocessor and interfacing with special emphasis on: features of 16, 32 & 64 bit microprocessors; memory interface, I/O interface; DMA controller; coprocessor and bus interface; Pentium processo*r" (BTEB, 2009, pp.19-21). The time allocated to this subject is as follows: 32 lessons hours for the theory part and 48 lesson hours for the practical tasks. The authors are in doubt how students can complete this content within this given time. It may only be possible theoretically, but not in practice. Moreover, the practical tasks listed above are by no means workplace relevant. It is not common that *Electronics Technicians (Diploma Engineer)* write programmes for such type of microprocessors as MC 68000, Intel 80286/ 80386/ 80486/ Pentium at his workplace. Today an *Electronics Technician* usually programs 16/32-bit micro-controllers, not microprocessors, excluding some exceptional cases. The syllabuses of other subjects of the electronics technology course were reviewed and found more or less the same pictures everywhere. In summary, *the Diploma-in-*

Engineering (Electronic Technology) curriculum focuses mainly on theoretical knowledge at the cognitive level '*reproduction*' and 're-*organization*', and not on the practical relevant skills at the '*transfer*' level. Unless teachers practice tasks that are real world relevant, students will learn mainly the basic theories and principles. The *Industrial Attachment* training is not effective enough for developing students' practical competencies.

STUDENT ASSESSMENT APPROACH - ANALYSIS OF QUESTION PAPERS

The acceptance of a qualification in a job market is depends in large part on how appropriate and justified the assessment is (test goodness).

Besides continuous assessments Polytechnic students are assessed through semester final examinations (summative assessment). In this study the question papers of the semester final examinations over the last three years have been analyzed and classified according to Anderson & Krathwohl Taxonomy. Usually the duration of each final exam is 3 hours and the allocated full marks are 50. The test-items are organised into three groups: Group A, B & C. *Group A* contains 20% of the total marks. It includes ten very short objective type questions. Each question carries 1 (one) mark. This type of questions measures mainly students' knowledge (factual information) at the cognitive process level *Remember* ('*Reproduction*'). *Group B* contains 40% of the total marks and includes ten short (objective) type questions. Each question carries 2 marks. Items in this group are mainly used, as the authors found, to measure students' knowledge at the cognitive process level *Remember* and to some extent at level *Understand* ('*Re-organisation*'). *Group C* contains 40% of the total marks. In this group each question carries 5 (five) marks and students have the options to choose any four out of five essay type questions. This group also measures mainly the theoretical knowledge at the level 'Reproduction' and 'Re-organisation'. For example, none of the essay type items in *Group C* of the examination question paper for 'Microcontroller and PLC' (6th semester final examination, 2009) requires '*Knowledge generation*' for solving the task. That means they do not assess students' competences at cognitive process level *Apply* ('Transfer'). Similarly, no item from other two groups could be classified in the category *Apply*. In other words, items in these groups assess students' competences at level *Remember* (reproduction) and *Understand* (re-organisation) at the highest, not at level *Apply*. A core area of the Diploma syllabus for electronics technology consists of 1) Microprocessors and Interfacing (MI), 2) Microcontroller and PLC (MC & PLC), 3) Computer Control System and Robotics (CCSR). The typical student assessment items found in the examination questions were: describing the block diagram of a robot system, a Fuzzy logic controller, a PID controller (Final Exam 2009a, CCSR, Q25; Final Exam 2009b, CCSR, Q21; Final Exam 2007, CCSR, Q23; Final Exam 2009a, CCSR, Q22; Final Exam 2009a, CCSR, Q23; Final Exam 2009b, CCSR, Q24) ; the working process of a PLC, (Final Exam 2009a, CCSR, Q21; Final Exam 2009b, CCSR, Q23); the architecture of a PLC, the internal architecture of a MC-6800 microprocessor, an arithmetic co-processor (Final Exam 2007, MI-1, Q21; Final Exam 2009a, MI-2, Q22; Final Exam 2009b, MI-2, Q22 ; Final Exam 2008, MI-2, Q22 ; Final Exam 2007, MI-2, Q23); the pin diagram of a Z-80 microprocessor and the functions of the pins, a MC-68000 microprocessor and the functions of the pins, a 80486 microprocessor and the functions of the pins (Final Exam 2007, MI-1, Q21; (Final Exam 2009a, MI-2, Q24; Final Exam 2008, MI-2, Q21; Final Exam 2009b, MI-2, Q24).

In the IT field the test items were, for example, writing programs to: compute the real and non-real roots of a quadratic equation (Final Exam 2009, Visual programming, Q12; Final Exam

2007, Visual programming, Q22; Final Exam 2006, Visual programming, Q23); compute the factorial of any positive number (Final Exam 2007, Visual programming, Q25; Final Exam 2007, Programming in C, Q22); compute the first 10 Fibonacci numbers (Final Exam 2007, Programming in C, Q23); to arrange ten numbers in ascending order (Final Exam 2009, Programming in C, Q25). These tasks are not workplace relevant for an occupation in electronics field.

The Pie-Chart in Figure 2 shows different categories of the test-items used in the question papers over the last three years. The percentages of items in the category *Remember*, *Understand* and *Apply* are 51, 43.9 and 5.1, respectively. That means the test-items assess mainly students' theoretical knowledge ('reproduction'). They rarely demand 'transfer' level skills.

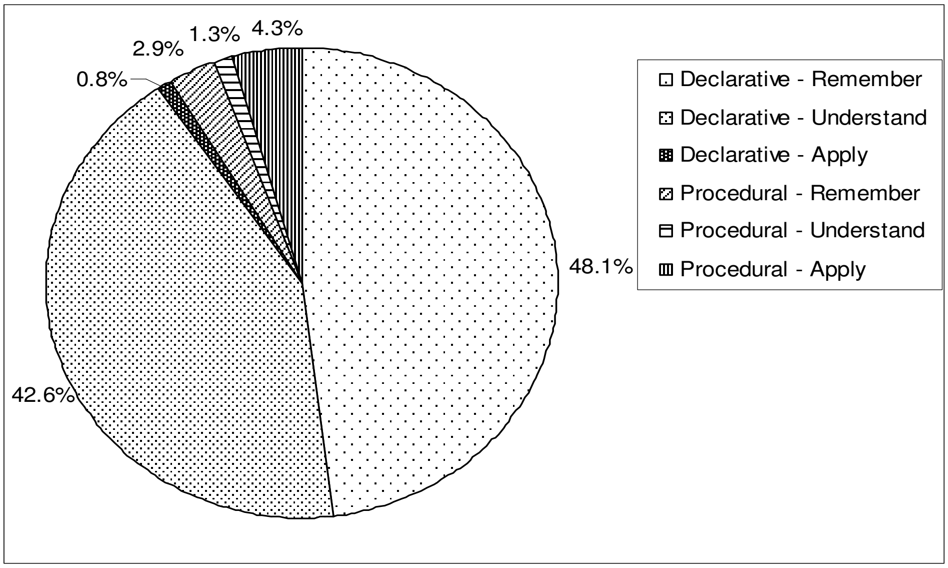

Figure 2. The percentage of items in final examination question papers (according to Anderson & Krathwohl taxonomy)

In brief, the analysis of the examination question papers of the *Diploma-in-Engineering* programme shows that the question papers are constructed to assess mainly theoretical knowledge in the category *Remember* and in the category *Understand*. Assessment of student performance in the category *Apply* is only undertaken in a few cases.

RESULTS OF COMPETENCE TEST

The above findings from the curriculum content and examination papers analysis can be supported by the results of a competence test designed by the authors. In this test the final year students of the Diploma-in-Engineering Programme obtained only 9.27 marks out of total 100 with a standard deviation of 4.71. The performances of the students in the cognitive process categories of *Remember*, *Understand* and *Apply* were found 18.2, 10.0 and 2.6 in percent, respectively. This test result support the findings presented in the previous two sections and also support the private sector employers' negative assessment about the skills of polytechnic graduates (Oxtoby, 1997). Experts and teachers working in TVET sectors told the authors in an interview that private sector employers' prefer graduates from non-government organisation (NGO)-run technical institutes. These technical institutes offer training courses at Certificate level. Some students of polytechnic institutes also told the authors that immediately after completing the *Diploma-in-Engineering* course they go to some NGO-run technical institutes, situated in Dhaka, in order to achieve the practically oriented knowledge and skills demanded by job market. The test included 16 tasks and 37 test-items covering the core area of electronics technology. The items were mainly application oriented. More about this competence test can be found in (Haolader, 2010, pp. 95-114).

The Strengths of the Curriculum

The content of the curriculum covers a wide range of areas including domain specific subjects; cross-occupational subjects (e.g. information technology, biomedical engineering, communication technology, engineering drafts); and related subjects (higher mathematics, natural science, social science, business studies, entrepreneurship, environmental engineering, etc.). The curriculum is detailed and well documented. This facilitates all polytechnic institutes to follow the same curriculum content and, therefore, the competence levels of all polytechnic graduates are expected to be, more or less, the same or comparable, given other factors that influence the student competence are the same.

Weaknesses of the Curriculum

An occupational profile and/or occupational standards for the occupation *Electronics Technicians*, which are the basis for a systematic curriculum content determination, are missing. The credit hours allocated for domain specific, related subject and *Industrial Attachment* are: ca. 55%, 41%, and 4% respectively. This data shows that the weights for technical and general education are almost the same. Other weaknesses are:

Lack of practical relevance

The focus of the curriculum is not placed upon the practical requirements, but rather on theoretical matters. For example, polytechnic students are taught the working principle and functions of operational amplifiers, working principles of Wheatstone bridge and sensors discretely. But they cannot solve a task that requires the knowledge and skills of these basic elements together. Similarly, polytechnic students are taught the working principals of diodes, transistors, relays, etc. But they do not acquire the competence of how to control (on/off) a relay based output of an electronic device. Teaching PLC at polytechnics means only description and memory architecture of it. In a competence test no students could solve a task relevant to driving an elevator using a PLC (Haolader, 2010, pp.100-151).

Lack of harmonisation between technical and related subjects

For example, five mathematics courses are taught. Out of these five courses, three are general mathematics, namely Mathematics *I, II and III*, the other two are called *Applied Mathematics I* and *Applied Mathematics II*. Most of the content found in the syllabuses titled "Applied Mathematics" is "not applied" at all. Because, *firstly*, the same content of *Applied Mathematics I* is taught in *Architecture*, *Civil* and also in *Electronics Technology*. Students of these technologies are assessed using the same examination question paper. *Secondly*, most of the content of applied mathematics has no applications in the field of electronics technology. For example, in *Applied Mathematics II*, one of the defined four aims (general objectives) is: *"to be able to use the knowledge of differential equation to solve the problems of hydrodynamics and velocity of a particle in space"* (ibid.). The authors do not think that this objective is in line with electronics technology at Diploma level. Curriculum content such as De Moiver's theorem, Green's theorem, Stokes's theorem, Beta function, Gamma function, etc., has no application in the area of electronics technology at Diploma level.

Inefficient Enterprise attachment/training

Polytechnic students are placed with companies for a period of 16 weeks for gaining work experience. This is very short indeed. Moreover, it is neither well managed nor efficient. The authors experienced this when interviewing students and teachers. For example, during the six month period of the 7th semester students undergo 12 weeks training at enterprises, and 4 weeks at their respective polytechnic institutes' laboratories. Students are kept waiting for a period of two months' time, until the 8^{th} semester begins. That means, 38.46% time is unused in this semester. Furthermore, some students have to pay fees for getting places at enterprises and they are allowed to practice only 2 to 4 hours a day. That means students cannot work full-time at enterprises.

CONCLUSION AND RECOMMENDATIONS

The *Diploma-in-Engineering* programme intends to prepare Diploma Engineers with a qualification that corresponds to NTVQ Level6. At this level a Diploma Engineer should *"be in possession of a very broad range of specialised, cognitive and practical skill and comprehensive actual and theoretical knowledge, and be able to develop creative solutions to problems within an occupational activity"* (Moore, 2009, p.11).

The curriculum of *Diploma-in-Engineering (Electronics Technology)* together with the examination question paper*s* was analysed and investigated. This curriculum covers a broad spectrum of curriculum content. It puts less emphasis on practical tasks and, rather, focuses mainly on theoretical matters.

Hence the need for a reform of the curriculum is more than obvious. A transition from current subject based to learning field based curriculum, as in Germany for example, or to Competency Based Training and Assessment (CBT&A) approach at Diploma level will require requires feasibility studies, as Xaymountry (2009) carried out for countries in the Mekong region (Cambodia, Laos, Thailand Vietnam). Therefore, the following recommends are made based on the findings and consultation with experts/teachers and students:

1. Participation of industry in determining the curriculum content of a training course and also in preparing the question papers should be ensured so that the qualification is job market relevant at the expected NTVQ level.
2. The authors think that the polytechnic students are overburdened. In order to bring the main focus on the practical relevant matter and to include some new content the inert content may be discarded so that students are not (further) overburdened.
3. More priority should be given on the core area of the electronics technology, particularly on application oriented tasks.
4. More weights on (structured) essay type questions may be given. Questions should asses practical relevant (not hypothetical) skills and be constructed in such a way that they demand '*Knowledge generation*' for solving tasks/problems. The required information could be supplied through *data-sheet*. That means they should assess students' competences at cognitive process level *Apply*.

5. It was found, in some cases, that the same question paper is used to assess students studying different technologies. For example, the same examination paper for *Programming in C* was used to assess students of Civil, Electronics, Mechanical, Survey, Garments Design and Patter Making Technology. This practice should be changed, because students of electronics technology should be assessed to measure if they can use *C Programming Language* to program a microcontroller, for example. The assessment tasks in the examination should be relevant to the respective technology and application oriented.
6. Using Handbooks/engineers' reference books/data-sheets in the examination may facilitate the students to use information of the category *Remember/Retrieval*. This should be practiced in the classroom and laboratories as well. Thus, students will get used to transferring technical data/ information and applying them to solve tasks. These practices will improve students' competency particularly in designing, developing, installing and configuring new devices and systems.
7. In each examination at least one or more questions may be in English. Students must answer these questions in English. These questions will not only assess students' technical knowledge but also their competencies in professional English. This strategy will motivate students to read English text/ books. This practice will contribute to improving students' fluency in professional English.
8. A close distributed monitoring system is required to ensure that *the practical component of the curriculum is taught effectively and Industrial Attachment* is used efficiently, which will ultimately improve students' competence level, particularly in the case of practical relevant tasks.

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