THE DEVELOPMENT OF A CURRICULUM FRAMEWORK FOR THE NATIONAL DUAL TRAINING SYSTEM (NDTS) IN MALAYSIA

MOHD YUSOFF BIN ABU BAKAR

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Faculty of Technical and Vocational Education
Universiti Tun Hussein Onn Malaysia

in collaboration with

Institut Technik Und Bildung (ITB)
University of Bremen, Germany

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ABSTRACT

Curriculum is one of the most important elements in the Technical Education and Vocational Training system. Nonetheless, the existing National Occupational Skill Standard (NOSS)-based curriculum was found incapable of playing this role for its approach had created issue of workers being produced not meeting the needs of the industry or mismatch. In addressing the issue, the Malaysian government has decided to implement the National Dual Training System (NDTS) in 2005. The development of the NDTS curriculum was started in 2004, with the help of industry experts and skilled workers and guided by overseas consultants. However, the development of the NDTS curriculums was very time consuming. This has resulted in a serious scarcity in the number of curriculum. Worse still, the completed curriculums have been found inadequate that discouraged industry participation in the training programmes. Study showed that it stemmed from the absence of a good framework for the curriculum development in the country. Thus, it is paramount to make the needed NDTS curriculum framework available. The study adopted the qualitative research approach and the data collection methods were interviews, document reviews and observations. The existing practices of the NDTS curriculum development were investigated and analysed to unveil the actual way of developing the curriculum. The findings were benchmarked against the practices applied by developed countries to evaluate whether the NDTS curriculum development processes were in line with theirs in terms of dual training concept, work process analysis and establishment of working team. Ultimately, the study came up with a curriculum development framework to benefit all parties involved in training especially the curriculum developers to produce good curriculums within a reasonable time frame.

ABSTRAK

Kurukulum merupakan elemen yang paling penting bagi menentukan kejayaan dalam sistem pendidikan teknikal dan latihan vokasional. Kurikulum sedia ada yang berasaskan kepada Standard Kemahiran Pekerjaan Kebangsaan didapati tidak mampu merealisasikan hasrat ini kerana kaedah yang digunakan telah menimbulkan masalah dimana pekerja yang dilatih tidak memenuhi keperluan industri. Bagi menangani isu ini, Kerajaan Malaysia memutuskan untuk melaksanakan Sistem Latihan Dual Negara (SLDN) pada 2005. Pembangunan kurikulum SLDN telah dimulakan pada 2004 dengan bantuan pakar dan pekerja mahir industri serta tunjuk ajar perunding antarabangsa. Bagaimanapun, pembangunan kurikulum SLDN ini mengambil masa yang sangat lama. Ini telah menyebabkan kekurangan jumlah kurikulum yang serius. Lebih teruk lagi, kurikulum yang telah dibangunkan didapati kurang berkualiti yang menyebabkan kurangnya penyertaan industri dalam program SLDN. Kajian menunjukkan bahawa satu *framework* yang sesuai bagi proses pembangunan kurikulum SLDN perlu dibangunkan bagi mangatasi masalah tersebut. Kajian ini menggunakan pendekatan kualitatif dan kaedah utama pengumpulan data adalah temubual, semakan dokumen dan pemerhatian. Amalan proses pembangunan kurikulum SLDN sedia ada dikaji dan dianalisa untuk mendedahkan cara sebenar kurikukum itu dibangunkan. Dapatan kajian dibandingkan dengan amalan yang digunakan oleh negara-negara maju untuk menilai samada amalan tersebut selaras dengan amalan mereka daripada segi konsep latihan dual, orientasi proses-kerja, penubuhan kumpulan kerja serta factor-faktor yang mempengaruhi pembangunan kurikulum. *Framework* ini dijangka akan memberi manafaat kepada semua pihak yang terlibat dalam bidang latihan terutamanya pembangun kurikulum bagi menghasilkan kurikulum yang baik dalam jangkamasa yang berpatutan.

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LIST OF ABBREVIATIONS

CBET	-	Competency-Based Education and Training
CEDEFOP	-	European Centre for the Development of Vocational Training
CTE	-	Career and Technical Education
CURRENT	-	Curriculum Revision and Entwicklung (Development)
DACUM	-	Developing A Curriculum
DSD	-	Department of Skills Development
DSP	-	Dual System Project
EPU	-	Economic Planning Unit
GMI	-	German Malaysian Institute
GTZ	-	Deutsche Gesellschaft fur Technische Zusammenarbeit (German Agency for Technical Cooperation)
JPK	-	Jabatan Pembangunan Kemahiran (Malay word for the DSD)
LWA	-	Learn and Work Assignment
MLVK	-	Majlis Latihan Vokasional Kebangsaan (Malay word for the NVTC)
MOHR	-	Ministry Of Human Resources, Malaysia
MSC	-	Malaysian Skills Certificate
NDTS	-	National Dual Training System
NOSS	-	National Occupational Skill Standard
NVTC	-	National Vocational Training Council
SDAC	-	Skill Development Advisory Committee
SME	-	Small and Medium scale Enterprise
TEVT	-	Technical Education and Vocational Training

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CHAPTER 1

INTRODUCTION

1.1 Background

Technological application has been widely utilised in developed and developing countries to enhance and expedite their economic development by exploiting the modern and advanced techniques especially in industrial sectors. In this regard, carefully well-moulded development of human resources is vital in fulfilling the manpower requirements of the industries. As a result, a proper design of vocational training is indispensable to serve this purpose that is to make full utilization of the available modern and advanced technology in order to enhance and expedite the country's economic development.

In relation to this, Malaysia as a developing country must not be left behind but to keep on thriving in this industrial development to achieve its vision of becoming a developed industrialised country by 2020; it should work smarter and harder. In making this aspiration a reality, several relevant ministries have been appointed to look into this matter. The Ministry of Human Resources (MOHR) is one of the key ministries, which has been actively involved in developing the national industry workforce. It takes care of workers' welfares, training affairs and labour laws, inclusive of foreign workers. In May 1989, the ministry established the National Vocational Training Council (NVTC) or better known as MLVK to focus on administering the training affairs. The functions of

this department among others were to formulate, promote and co-ordinate vocational skills training to further spur the national economic development of the country.

The NVTC was not only coordinating the training institutions under the purview of the MOHR such as the Advanced Technology Training Centres, Industrial Training Institutes and Japan Malaysia Technical Institute, but also those under the administration of other various ministries and state governments as well as private training institutions which totalled up to about 1000 centres (cf. DSD, 2010c). The main role of the NVTC was to bridge up the gap between training institution and workplace requirements or in other words - between the world of training and the world of employment. In order to make it a success, the council was given responsibility to develop a training standard according to the requirement of relevant industries. In December 1992, the National Occupational Skill Standard has been introduced (cf. MLVK, 1994; MLVK, 2001) or popularly known as the NOSS. The NOSS-based training system has been developed using the DACUM (acronym for 'Developing A Curriculum') process approach (cf. Ahmad, 1993; Pang, 1986). Then this NOSS was distributed to the training institutions to be used as training guides. In the training institutions, training syllabus was then derived from the relevant NOSS. In terms of certification, at present, the NOSS consists of five levels of competency (see Appendix A for level descriptor). Apart from being used as the standards for skills training, it also could be applied in working environment such as; the standard for workers' performance valuation, the reference for job modification, job description, career development and/or planning and as the basis for wages and/or compensation.

The NOSS development basically based on job titles and the number of the job title developed so far is 1098 and it covers about 5,765 skills training programs throughout the country (cf. DSD, 2010c). The NOSS-based training system has experienced impressive growth and established itself as the dominant system for pre-employment training in the country. Its progress continues to be driven by the government through the efforts of the department (cf. MLVK, 2005a).

However, there has been a mismatch between the training programme and the industry requirements that results in low productivity (cf. Yogeesvaran, 2005, pp. 6-12). There are many kinds of mismatch as suggested by the European Centre for the

Development of Vocational Training as showed in Figure 1.1. From the researcher's observation, most of those listed in the figure could be rampantly found happening in the country in which need to be duly rectified in order to maintain and sustain the country's economic growth.

Overeducation	**To have completed more years of education than the current job requires.**
Undereducation	To have completed fewer years of education than the current job requires.
Overqualification	To hold a higher qualification than the current job requires.
Underqualification	To hold a lower qualification than the current job requires.
Overskilling	To be unable to fully use one's skills and abilities in the current job.
Underskilling	To lack the skills and abilities necessary to perform the current job to acceptable standards.
Skill shortage	Demand for a particular type of skill exceeds the supply of available people with that skill.
Skill surplus	The supply of people with a particular skill exceeds the demand for it.
Skill gap	The level of skills of the person employed is less than that required to perform the job adequately or the type of skill does not match the requirements of the job.
Economic skills obsolescence	Skills previously used in a job are no longer required or are less important.
Physical (technical) obsolescence	Physical or mental skills and abilities deteriorate due to atrophy or wear and tear.
Vertical mismatch	The level of education or skills is less or more than the required level of education or skills.
Horizontal mismatch	The level of education or skills matches job requirements, but the type of education or skills is inappropriate for the current job.
Crowding out/ bumping down	Better qualified workers are hired to do jobs that less qualified workers could also do, thus replacing (crowding out) less qualified workers from traditional employment possibilities for their level of skill. Bumping down refers to this process working from top to bottom, pushing less qualified workers to even lower level jobs. At the extreme some lower level workers may become unemployed.

Figure 1.1: Types of skills mismatch
(The European Centre for the Development of Vocational Training, 2010)

Over time, rapid changes in technology and increasing complexity of work processes in Malaysian industries have created new demands on the skilled workforce or better known as a knowledge-worker or k-worker, where in Malaysia, k-worker is generally defined as a skilled worker who possesses at least Level 3 of the Malaysia Skills Certificate as described in Appendix A. According to Drucker (1959), a knowledge worker is anyone who works for a living at the tasks of developing or using knowledge. For example, a knowledge worker might be someone who works at any of the tasks of planning, acquiring, searching, analysing, organizing, storing, programming, distributing, marketing, or otherwise contributing to the transformation and commerce of information and those (often the same people) who work at using the knowledge so produced. Realising the essential of training for developing k-workers, the Government of Malaysia decided on 19 May 2004 to implement the National Dual Training System (NDTS) commencing in the year 2005 (cf. MLVK, 2005a). The NDTS has evolved from the Dual Training System Project (DSP) i.e. a project came up from negotiations between the Governments of Germany and Malaysia, 17-18 September 1986, as outlined in official NDTS documents, which was formulated with the purpose of strengthening technical education and vocational training in Malaysia by incorporating the dual training system as practiced in Germany.

The NDTS involves a two-year training programme carried out at two learning environments where 70% to 80% at workplaces and the remaining 20% to 30% at selected training institutions. In terms of training delivery, self-reliant learning, action-oriented teaching as well as the Learn and Work Assignments (LWA*)* have been adopted as the fundamental teaching and learning approaches (cf. MLVK, 2005a). The notion of Training Occupation was also introduced for the first time in Malaysia to designate the training programme to be selected for the NDTS implementation. With regard to the curriculum design and development, the National Occupational Core Curriculum (NOCC) was introduced as the basis for training and assessment (ibid). The NOCC is a new form of training documentation that has never been used before in the country's skills training system, and it differs from any of the curricula used in the existing NOSS-based training.

Within the DSP, the NOCC is put under the Component 2 (see Appendix B for component description) which emphasises the enhancement of quality and capacity of the curricula and teaching aids (cf. DSP, 2004a, p. 4). The development of the NOCC as the curricular framework for the NDTS, and self-reliant learning and action-oriented teaching as its didactical approaches has brought yet another new dimension that is work process orientation into the Malaysian skills training landscape. The work process approach builds upon the business process orientation of a modern and innovative company in which its core work activities become the collective responsibility of all its members rather than specific functional units only (cf. Spöttl, 2004). The use of work process knowledge as the conceptual underpinning for vocational education and training represents a paradigm shift, or regarded by Rauner (2005, p. 9) as the 'turning point for curriculum design', away from the narrow Tayloristic concept of jobs. Work process knowledge requires a holistic understanding of the overall work and business process; involves 'active' knowledge, that is essential for quality performance of work; is contextualised and a synthesis of theoretical and practical knowledge, as well as explicit and tacit knowledge (ibid, pp. 9-10). Clearly, the work process orientation differs sharply from the traditional skills training approach. Therefore, it is hoped that the mismatch issues would be alleviated with the implementation of the NDTS in the country.

The NDTS aims to produce k-workers which needs for a fundamental shift in approach, considering that the occupational competences of k-workers encompassed human and social competence as well as learning and methodological competence, apart from technical competence. Thus, training must be geared to produce skilled workers who 'must have the willingness for lifelong learning and be able to work in networks and teams, always anticipating tomorrow's needs at the workplace' (Hoepfner and Koch, 2004, p. 17). In addition, the fact that 70% to 80% of training in the NDTS will be undertaken at the workplace itself lends weight to the constructivist nature of training and learning activities that must take place (cf. Kerka, 1997).

The NDTS that exposes the apprentices to the actual practice in the industries was introduced to produce knowledge workers under a comprehensive and advanced training system, to meet the industries prevailing requirements. The NDTS is expected

to resolve the major issue of skilled workers being produced but not meeting the needs of the industries. As such, more trained people will be getting employed with a competitive income and significantly reduce the unemployment rate in the country. In fact, the development of skilled workforce through the system will definitely facilitate in achieving the nation's vision of becoming a developed country by 2020.

The mode of training program under the NDTS will be determined by the participating companies with the collaborating training institutes, whether it is to be day-release or block-release, to the convenience of the industries. In the day-release program, students are trained in the industry four to five days a week and the remaining one to two days at the training institute. In the block release program, apprentices undergo training for four to five months in the industries and one to two months at the training institutes. The training period is about two years of four semesters (cf. MLVK, 2005b). The NDTS implementation of training and its assessment in the industry and training institute is based on the NOCC that has been developed by the helps of industry experts and skilled workers. The NOCC is applied in teaching and coaching process, used as a basis in preparing teaching materials, as a standard for levels of achievement and skills quality of the apprentices and as a reference for the preparation of the LWA (cf. MLVK, 2005c).

The dual training system has attracted many parties in the country. During the Eight Malaysian Plan (Malaysia, 2001a) that outlines the country's planning for the five-year term of 2001 to 2005; 20.6% of the development budget was allocated to education and training, reflecting the priority given by the government to human capital development. Nevertheless it was found that the increased investment in the human resource development by the government was not sufficient in creating a responsive and effective education and training delivery system to meeting the market requirements (cf. Zaharaton, 2003). For that reason, the development of skilled human resource as required by the country has been reinforced in the Ninth Malaysian Plan (cf. Malaysia, 2006).

1.2 Statement of the problem

Curriculum is the heart in any education system. It guides the teaching and training personnel on what to teach, how to teach, what to test, how to test and how to structure the progress of trainees. The design and development of the Technical Education and Vocational Training (TEVT) curriculum is a dynamic process which requires on-going revision and on-the-spot customising (cf. Adam et al., 1999). Consequentially, it is inevitable to develop a curriculum that comply with the requirement of training at workplace and training institution for each and every training program needed in the country.

Currently in Malaysia, curriculum development has been very time consuming. For example, the development of the first generation NDTS curriculum since its inception in Malaysia was initiated in April 2004 which based on the 'Outline of the Dual System Project for the Reform of TEVT in Malaysia, 2004' and the 'Curriculum Development for Highly Skilled Work National Occupational Core Curricula' documents. Unfortunately, after about two years later (in 2006) only four NOCCs have been completed which has resulted in a serious shortage of curriculum in the market albeit the NDTS was officially launched in 2005 (cf. DSD, 2010b). The development process generally, had been heavily relying on the industry experts and skilled workers but without sufficient guides from the facilitators. There was no proper curriculum guideline or framework made available that could serve as a standard reference during the development process. Consequently, different facilitators led to different ways of development processes. This situation has caused uncertainties and created arguments among the development panels that triggered disruption and ultimately delayed the development progress.

These concerns have spurred a number of suggestions including by the former Director General of the NVTC. He even has suggested in a departmental Management Meeting in 2005 to making use of available resources particularly the existing NOSS to be converted into the NOCC. He supposed that by doing so, the issue of scarcity of the NOCC would be duly addressed. So far however, no attempts have been made as to what extent this suggestion could be implemented. A careful study on the NDTS

curriculum development must be carried out and a clear framework for the NDTS curriculum development must be made available before considering any proposition of adopting and adapting the existing NOSS into the NOCC.

In addition to that issue, it was found that those completed curriculums (NOCCs) have been not holistically developed to cater the requirements of industry. It could clearly be seen as not many companies were interested to use them. In 2005 alone, a total of 1200 companies throughout the country attended a series of dialog sessions organised by the MOHR. Out of it, only 159 companies have agreed to participate in the implementation of the NDTS as based on the written feedback returns. It was a sad fact that only three automotive companies (NAZA Motors, Daimler Chrysler and Tractors Malaysia) had been utilizing the NOCC for Automotive Mechatronics. The poor participation of the potential companies has generated puzzlement of the reasons behind it. From the initial responses of the expected-to-participate industries showed that, in their perspectives, the available curriculums would not be able to fulfil their training requirements and ultimately would not be capable of addressing their workforce development issues.

After a thoughtful consideration, the researcher decided that the best possible solution to those issues is to develop a holistic and comprehensive curriculum framework for the NDTS curriculum development. The to-be-developed framework will be very significant especially to enable the curriculum developers to produce an emergent curriculum in an acceptable time line which subsequently shapes the right training programmes. Accordingly, trainee will be trained in more systematic and comprehensive manner with up-to-date advanced curriculum in which ultimately in turn, becomes high quality skilled workforce upon the training completion that fulfils the requirements of the industry. Undoubtedly, training providers as well will benefit in terms of offering new training programs at relatively earlier time. Consequently, in due course, stake holders and policy makers would be able to come up with more efficient, effective and productive planning and policies concerning the training matters for the future.

1.3 Purpose and scope of the study

The purpose of the study is to develop a new curriculum framework for the NDTS in Malaysia. The framework in turn would help improve and optimise the current NDTS curriculum development process while shortening the required time. Ultimately, the new improved and optimised version of the NDTS curriculum is expected to benefit all training providers involved and relevant industries which are associated with the dual training programme to develop competent skilled knowledge workers in the country. There are five objectives to be achieved by the researcher in this study. The objectives are set as follows:

i. To unveil the existing NDTS curriculum development process by exploring and investigating the current development practice of the said curriculum.
ii. To verify whether the process of the NDTS curriculum development was in accordance with the approach used by developed countries in relation to dual training system by benchmarking the NDTS curriculum development process against the developed countries' practices.
iii. To find out to what extent the existing NDTS curriculum was structured based on the theory on human learning and development of competence as applied globally.
iv. To propose prospective improvements for the purpose of enhancing and optimising the NDTS curriculum development by exploring and searching for them during investigation processes and data analyses.
v. To develop a new curriculum development framework for the NDTS by incorporating all the essential improvements.

In order to ensure that the development of the proposed framework is more manageable, the scope of this research has been constricted as follows:

i. The proposed framework of the NDTS curriculum development is specially developed for use in Malaysia. This is in line with the suggestion that curriculum development and innovation is shaped by the requirements of the

country which depends on the socioeconomic, technical, organisational, political and cultural factors (cf. Adam et al., 1999, p. 11; Richard, 2001). Therefore, the research setting will be based on issues, conditions and environment of this country. Furthermore, the purposive research inquiries will focus on addressing the curriculum development and optimisation in an effort to meet the needs of the TEVT programmes for the purpose of developing skilled workforce for the country.

ii. For illustration purposes, only one specific industry sector will be selected, namely the Automotive Mechatronics. This is to ensure that the investigation can be undertaken with sufficient depth and breadth. The selection of the automotive industry for this study is made based on the following justifications.

a) The automotive industry-based training has been one the earliest training occupation to be implemented in the NDTS programme since 2005;

b) The first group of three companies taking part in the NDTS are all automotive-related organisations that is the NAZA Motors, Daimler Chrysler and Tractors Malaysia;

c) The pioneer groups of 71 apprentices (NDTS, 2005) for the NDTS training programme are doing Automotive Mechatronics; and

d) The automotive industry is in the limelight owing to the recent introduction of the National Automotive Policy in 2006 which aims to transform and integrate the Malaysian national automotive industry into regional and global industry networks (cf. Malaysia, 2006a).

iii. There are three main occupational competences in the NDTS namely the technical competence, learning and methodological competence as well as the human and social competence (cf. DSP, 2004a, p. 30). However, for the researching purposes, only the technical competence will be the central focal

point of the study which constitutes the key elements of the NDTS curriculum as described in the NOCC.

1.4 Significance of the study

The expected outcome of the study is an advanced NDTS curriculum framework for the development of the NDTS curriculum. So far, there is no one has ever done this study in Malaysia. Since the implementation of the NDTS is still new, it could be regarded as still at the experimental stage and therefore the process of enhancement and optimisation is essential. Thus, the proposed study is very significant to ensure the NDTS will continue to thrive. As discussed in Section 1.2, the problem to be addressed in the study is on the curriculum development issues. Accordingly, the expected study outcome will enable the curriculum developers in the country to come up with the desired curriculum that is timely, potential and promising to materialise the national aspiration that is to produce highly competent workforce or knowledge workers of which the industries are in dire need for the sustainability of national development and in tandem with the country's effort to achieving its vision to become a developed nation. More importantly, the continuous supply of workforce with updated skills and knowledge is pivotal in maintaining the momentum of the country's progress particularly in the industrial sectors.

As a matter of fact, human capital development is today's national priority as evidenced from the emphasis given to it in the Ninth Malaysia Plan, 2006-2010 (cf. Malaysia, 2006b). In this regard, the country's national education and training delivery system is expected to play a leading role. Therefore, it becomes vital to make the said curriculum development framework for the national training system available with regard to meeting the country's competent workforce requirements. The study outcome can certainly offer better efficiency and effectiveness on the country's skills delivery system. Obviously, such a curriculum framework impacts greatly on the implementation of training throughout the country considering that it involves a large network of existing training providers totalling about 350 public training institutions and 650-odd or so private training centres (cf. DSD, 2010c), whilst the NDTS itself has targeted to

double up its intake every year. Hence, the study is very significant and in a great need to ensure that the curriculum for the NDTS programs is developed accordingly in fulfilling the needs of all relevant beneficiaries. Without its presence, the dual training system in the country remains hanging in the balance and filled with uncertainties. Therefore, it is the right time for the country to have the NDTS curriculum development framework in the National TEVT arena which would elevate it position to a greater height. Having justified the above situation, it is evident that Malaysia is in dire need of a new curriculum development framework for the NDTS in the country.

1.5 Summary

This chapter enlightens the overall introduction of the study that includes the background, problem statement, purpose and scope and significance of the study. The background highlights the brief account of the vocational training system in Malaysia and the key players in the skills training programmes for the development of skilled workforce for the country.

The problem statement highlights main issues that plague the TEVT implementation in the country that is the severe shortage of the NDTS curriculum in various sectors of industry. In addition to that, the currently completed curriculums were found somewhat not meeting the industry requirements. It was depicted by poor participations of potential companies and unpromising feedbacks despite aggressive promotional activities being made nationwide to encourage their participation in the NDTS programmes. Following the companies response, the NVTC has taken steps to rectify the situation and one of them is to review the NDTS curriculum development. So, based on the above scenario, the proposed study will be investigating the existing NDTS curriculum development process in order to identify the issues that led to the above problems and search for measures in order to undertake necessary actions for improving and optimising the existing curriculum development practice.

The study is irrefutably significant since the current NDTS implementation is still new and at the experimental stage. As far as the curriculum is concerned, it plays the main role in the implementation programme. Hence, the proposed study is

paramount and essential to ensure that the NDTS curriculum development is duly enhanced and optimised which will, in turn, warrants a better and far-reaching implementation of the NDTS programmes in future with more encouraging participation of companies and their collaborating training institutions. In this way, the TEVT will continue to thrive in an effort to train more skilled workforce for the country development.

CHAPTER 2

SCIENTIFIC RELEVANCE, RESEARCH QUESTIONS AND RESEARCH THEORETICAL FRAMEWORK

2.1 Introduction

This chapter focuses on scientific orientation of curriculum development, research questions and research framework for the study. The scientific orientation of the work process-based curriculum development in vocational educational sciences helps to identify the competencies for the coping and shaping of occupational work tasks and to access the most important coherences for competency development as well as to determine the work process knowledge for the shaping of business and work processes.

The research questions are constructed based on the objectives to be achieved from the study. Sensible and well-constructed research questions navigate the researcher in strategizing and exploring the next course of actions in the quest for accurate findings. To guide the researcher, five research questions have been constructed that streamline the researching works and lead the researcher to conduct the study till the completion. In addition, the presence of research framework is to assist the researcher in setting the right scope to be covered and identifying the materials to be researched in the study. Careful management of the framework is vital in order to make sure that the research coverage fulfils the required depth and breadth in process of searching the outcome of the study.

The framework also gives the researcher an overview of what are the sequential processes of work to be observed in carrying through the research.

2.2 Scientific relevance to curriculum development

It is irrefutable that sciences had played their parts in all aspects of our live including in the TEVT. For the purpose of visualising the scientific relevance to curriculum development with regard to vocational education of the dual system, particularly in curriculum development - the following assumptions of basic and generalized quality criteria for a vocational curriculum have been made (cf. Spöttl and Becker, 2008, p. 106):

i. The curriculum states those contents which are presently and in the future necessary for the coping with tasks in the occupation. Contents thereby always mean the work contents rather than the specialized contents derived from scientific systematics (cf. Rauner 2004, p. 9). Thus the subject is the occupational subject rather than the specialized science of a technology;
ii. The competency requirements encompassed by a curriculum are oriented towards the contents;
iii. The structure and the composition of a curriculum underpin the concept of teaching and learning arrangements for the educational goal to be reached; and
iv. The curriculum is temporally stable. It must not necessarily be revised according to the change of work, technology and education but refers to temporally stable categories.

The assumptions which were based on the definition established by Frey (cf. 1971, p. 50), who suggested that the curriculum was the systematic image of the intended instruction during a certain period of time as a consistent system with several areas for an optimal preparation, implementation and evaluation of instruction. Thus, procedures and instruments respectively and the methods applied within this framework are directly related to the quality of a curriculum. Weaknesses of the curriculum construction may be the result of neglecting the work coherences when considering the

above mentioned criteria. The possible identified conceptual weaknesses could be as follows.

- Link of occupational profiles to the surface of technological change or to a unilateral technology orientation;
- Occupations as a bundle of activities according to the performance principle which are set up in an analysis-synthesis-process;
- Correspondence of industrial and trade occupations with the specialized systematics of technological sciences rather than with the work task structures of the world of work; and
- Discrepancy between the contents of occupational profiles and corporate work performances (cf. Spöttl, 2000, p. 206).

With the help of vocational educational scientific work process analyses such weaknesses of the curriculum construction should be prevented by focussing the qualification research on the work coherences and the dimensioning of skilled work. The work process analyses are oriented towards vocational educational sciences comprise three objectives.

i. To identify the **competencies** for the coping and shaping of occupational work tasks;
ii. To access the most important coherences for **competency development**; and
iii. To determine the **work process knowledge** for the shaping of business and work processes;

The objectives which emphasise on competency, competency development and work process knowledge, hint at competing principles for the determination of the curriculum contents. In this respect, Reetz and Seyd (1983, 1995) presume the significance of three different curriculums structures and approaches namely science principle, personality principle and situation principle in the vocational educational practice as well as continuous dominance of the principle of science on the macro-level with its specialized scientific structures (ibid, p. 211). And as far as the scientific

relevance is concerned, work process analyses take into consideration all three principles as conceived by vocational educational science as unravelled in the subsequent sections.

2.2.1 Competences and the principle of science

Systematic identification of competencies for the coping and shaping of occupational work tasks can reflect these competencies in a systematic way. It is utmost important that regardless of the various problems of the practical realization (cf. Pahl, 2005, p. 80), it is assumed that competencies can be scientifically assessed in a scientifically systematic way. It is to be noted however, that the science which is being discussed here does not count among the classical orientation sciences such as engineering science or educational sciences but that they are vocational sciences. Purely specialised systematic structures of the engineering sciences or isolated pedagogical and hermeneutical structures of educational sciences are basically inadequate for the definition of competencies as they result in a curtailed comprehension of competencies. Specialized systematic structures of the engineering sciences only aim at knowledge or at skills which are relevant for the engineer albeit not for the skilled worker (cf. Spöttl and Becker, 2008, p. 107).

2.2.2 Competency development and principle of personality

It is a central assumption that competencies are developing along with the dealing with occupational work tasks and problems. This assumption is based on an extended term of learning (cf. Becker, Spöttl and Stolte, 2001) comprehending the development of competencies as learning. An analytical differentiation between specialized, personal and social competencies is not intended; instead they are regarded as the dimensions of occupational acting competency. Within the framework of work process analyses, challenging situations, tasks and problems are investigated – above all how they can be mastered. This survey yields results and findings on how the (occupational) development of the personality can be best supported. Certain acting situations turn out to be beneficial for competency development and in turn call for the mastering of others. Work process analyses make a contribution to the access of coherences and conditions which allow for a

support of the transition of one development level to another (cf. Rauner, 1999, p. 431). The development is then 'logical' in terms of continuous occupational competency. The adequate consideration of development tasks leads to a curriculum that is structured in a development logical way (cf. Spöttl and Becker, 2008, p. 108).

2.2.3 Work process knowledge and situation principle

Work process knowledge interlinks the immediate coherence between the corporate work organisational knowledge and specialized theoretical knowledge. It is the acting relevant knowledge of this coherence. It is closely linked to one's own work experience and knowledge of the corporate world. It means to understand the entire work process which involves the respective person complete with its product related, technical, work organisational, social and system oriented dimensions as supposed by Kruse (1986, p. 189). These dimensions can be determined by work process analyses and thus the acting conditions would be determined by organisational decisions and technological influences (ibid, p. 109).

The above brief explanation denotes the importance of scientific roles in the vocational education particularly in the work process-based curriculum development for the dual system training. The following chapters will further explore the application of the subject on developing the curriculum.

2.3 Central research questions

The research will be conducted based on this focal question: Whether the existing NDTS curriculum was developed in accordance with the practices applied by developed countries and if not, what is the appropriate framework to be adopted for the NDTS curriculum development in future that can best address the issues of the shortage of the number of curriculum, curriculum mismatch and the development of competent workforce in Malaysia? In order to obtain the best result out of the study, five research questions have been constructed and would be utilised to guide the researcher in reaching the study outcome. The first research question is aiming to explore and

discover the actual practice of developing the existing NDTS curriculum. The answer for this question is very important to explain on how the curriculum was actually developed and on what basis did the curriculum developers refer to. Findings of this investigation are to unravel the reasons behind the issues that plague the implementation of the NDTS in the country.

The second question is to focus on investigating whether the practice applied by the developers of the existing NDTS curriculum was in accordance with the global best practices as applied by developed industrial countries. Benefiting the answer of this question would enable researcher to identify defects, flaws or mistakes of the existing curriculum and look forward to finding remedial measures for the betterment. Accordingly, the third question is to determine whether the existing NDTS curriculum development had been benefiting the advantages of theory on human learning and development of competence. In fact, the application of the theory is essential in ensuring the developed curriculum is truly effective for the teaching and learning processes.

The fourth question is all about making rectification and correction to the defects, flaws or mistakes found in the existing practice of developing NDTS curriculum as identified in the second research question. Thus, the search for suggestions of improvement for the NDTS curriculum development will be the focus of this research question. Finally, the fifth question carries the ultimate goal of the study that is to develop a new framework for the NDTS curriculum development. Therefore, the answer for this question would be a suggested framework to be used for developing NDTS curriculum in the future.

2.3.1 Research question 1

How was the practice of developing the existing NDTS curriculum in Malaysia?

The NDTS may be regarded as a new training system in the country due to its inception of implementation in 2005 (cf. MLVK, 2005a) and still in the experimental status. Hence, the optimisation process is under consideration of the DSD. Due to that, it is not unusual that there is only a handful of literature and reference materials are available to

provide necessary information about its presence, progression and achievements. Besides, the accessible information is generally in the form of 'loose-type' and 'piecemeal' such as brochures, leaflets, flyers, presentation materials and limited publications. Those materials were produced as part of the NDTS operational and promotional activities apart from official papers, reports and meeting minutes. As far as the NDTS curriculum development is concerned, the only available relevant information is the 'Curriculum Development for Highly Skilled Work National Occupational Core Curricula' (DSP, 2004b) in the form of a presentation material which briefly highlights the outline of the curriculum development process mainly on the macro-level aspects of developing a curriculum.

In addressing this question, the researcher will start off by studying the history of the NDTS from the outset of its establishment in micro-level. It begins with comprehending the concept and objective of the NDTS which aims to develop skilled workers in all economic sectors in which an effective and efficient TEVT system must be made available in order to develop competent workforce. Then, it will be subsequently followed by investigating the whole process of developing the NDTS curriculum or the NOCC for the Automotive Mechatronics training occupation. Since the scope of the study focuses mainly on the curriculum development, the researcher is bound to do a comprehensive analysis of the development process that has been in practice in the country. The data collection focal point is on the existing approach used whereby the work processes have the essential elements in developing the curriculum. The step-by-step explanation evolves from the selection and appointment of the development panels, work process analysis till the organisation of curriculum content.

In terms of data collection, semi-structured in-depth interviews will be the main method besides document review and observation. The curriculum development panels who are directly involved in the development of the NOCC for the Automotive Mechatronics will be the selected respondents which are comprised of automotive industry experts and skilled workers as well as experienced training personnel from skills-based training institutions. The findings of the study will finally enable the researcher to track and understand the curriculum development approach and process used in the past.

2.3.2 Research question 2

Was the process of developing the existing NDTS curriculum in accordance with the approach used in developed countries?

The determination of whether the process of developing the NDTS curriculum was in accordance with the approach used in the developed countries by and large refers to the best practices in the established developed countries in relation to dual training system. However, to address this question, the researcher puts more attention during the process of the NOCC curriculum development. The key persons' verification in the NOCC development as well as experts' and skilled workers' and training personnel's point of view will be sought for to verify the enquiries. The compliance with the global principle in the curriculum development process will be assessed mainly on the identification and determination of work processes which entails the scientific research of various levels of instrument such as sector analysis, case study and work process analysis as well as expert-skilled-worker workshop.

In brief, the sector analysis's objectives are to investigate the structure of a sector, the employment conditions, the development trends, the institutional interrelations, the technical and work organisational innovations and the kind of products and services rendered, currently and in the future. The case studies are to interrogate the access of work interrelations, work tasks and processes as well as organisational structures relevant for a branch. The work process studies are to identify work process knowledge of skilled workers and their interrelations including the formation process. Expert-Skilled Workers-Workshops (ESWW) mean to organise the sorting of typical work tasks in a development logical succession. The experts of ESWW are mostly skilled workers and persons from related industry with a connection to skilled work who can provide information on the knowledge necessary for the coping with work tasks (cf. Spöttl and Becker, 2004, p. 4).

In order to determine whether the current NDTS development practice was in line with the approach applied in the developed countries, the research findings would be benchmarked against the practice of the dual training curriculum development processes as used by developed countries.

2.3.3 Research question 3

Had the existing NDTS curriculum been structured based on a theory on human learning and development of competence?

In determining whether the existing NDTS curriculum has been structured or organised based on and in line with a theory on human learning and development of competence, the researcher is going to review few relevant theories. Prior to the review of the theory on human learning and development of competence, a search on appropriate and useful learning theories regarding the vocational education and training are also to be explored that includes; behaviourism, constructivism, realism or essentialism and pragmatism or also known as progressivism.

As far as the theory on human learning and development of competence is concerned, three different theories have been selected for review. They are the Thorndike's Theory, the Piaget's Theory and the Dreyfus's Theory. The selection of these theories has been based on their appropriateness with regard to TEVT of dual system such as the application aspects, skills acquisition processes and competency developmental phases as well as the compatibility and feasibility of the theory in benefiting the dual system of vocational training. The application of the right and appropriate theory in structuring and organising the training contents is very important. It is pivotal in ensuring that the curriculum to be developed is able to provide a training programme which develops competent workforce needed by the country.

Subsequently, to ascertain that the current NDTS development has been structured or organised in accordance with the right theory on human learning and development of competence, the research findings will be compared with the reviewed theory and as applied by developed countries in developing their curriculums.

2.3.4 Research question 4

What are the prospective improvements that could be proposed for the future development of the NDTS curriculum?

It is expected that during the data collection process and analysis of finding, numerous weaknesses and shortcomings of the existing NDTS curriculum development process will be discovered. In seeking out the prospective improvements that could be proposed for the future development of the NDTS curriculum, the researcher will organise the data collection process especially the interviews in such a manner that the respondents who are comprised of the former NDTS curriculum developers and users of diverse background such as skilled and expert industry practitioners, experienced trainers and teachers from relevant training institutions to voice their views, credits, comments, concerns, doubts, criticisms, or objections for or against the current NDTS curriculum. Accordingly, above all, the respondents would be asked to express as many suggestions, opinions, points of view, measures, recommendations and ideas as possible, all of which can be used for the purpose of addressing, overcoming, rectifying or fixing all the weaknesses and shortcomings they did mention beforehand.

In order to generate the most effective outcome for the required improvement out of those data, all the findings then will be analysed and verified and validated from various backgrounds of respondents by comparing against each other. In this respect, since all of the respondents are from the local industries and have significant experience in developing and applying the NDTS curriculum, the process is quite in tandem with what as suggested by Richard (2001) that curriculum innovation is a complex social phenomenon because of the social, economic, political, and cultural factors embedded in the teaching and learning process as supported by CURRENT (cf. Adam et al., 1999, p. 11) that the curriculum development is shaped by the requirements of the country in question, which will in turn depend on the socioeconomic, technical, organisational and cultural fabric of the country. Ultimately, these recommended improvements will be adapted and proposed for the future development of the NDTS curriculum.

2.3.5 Research question 5

What is the suggested curriculum development framework to be adopted for the NDTS?

Basing on the overview of this study, it is expected that the development process of the NDTS curriculum in Malaysia certainly needs a transformation. For that reason, based on the findings from the previous investigations, subsequent efforts will be focused on developing a framework for the NDTS curriculum development. This is the prime goal of the study in which all efforts will be streamlined to analyse the collected data and information in building the necessary framework. It is expected that the framework will be built upon three main phases as follows; (i) Preliminary and preparation phase which comprises of establishment of working team, analysis of training influencing factors and promotion of industrial relation. (ii) Work-process-oriented content development phase that emphasises on the importance of carrying out of sector analysis, case study, work process analysis and expert-skilled worker workshop in acquiring the training content of work process-based curriculum. (iii) Curricular working phase which dedicates to formulating and organising the content into useable and pragmatic curriculum - in this case, the National Occupational Core Curricula. Accordingly, every phase will consist of elements that complement and supplement the roles and functions of the respective phase in the process of developing the curriculum.

2.4 Research theoretical framework

As mentioned previously, the study focuses on the dual training curriculum development in Malaysia which based on the work process, thus the researcher needs to have a clear understanding of what a work process-based curriculum development is all about. Undoubtedly, they are many different curriculum development approaches used in developed industrialised countries. Nevertheless, for the work process-based curriculum development as applied by the NDTS, a research framework to be engaged must be able to accommodate the specific requirements of the study.

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