



UNIVERSITI PUTRA MALAYSIA

***WORK-BASED LEARNING AND CAPABILITY DEVELOPMENT OF
MACHINING WORKERS IN AN AUTOMOTIVE COMPANY***

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MACHINING WORKERS IN AN AUTOMOTIVE COMPANY**

By

AZMIR BIN MOHD YUNUS

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of
Philosophy**

August 2016

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy.

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August 2016

Chairman : Ab. Rahim Bakar, PhD
Faculty : Educational Studies

The phenomenon of individuals entering the labor market without relevant qualifications is common in Malaysia. Many people choose to work instead of pursuing further education after secondary school. In the labor market, these individuals are considered to be low skilled because they had no training prior to employment. For those who begin employment without formal training, skill formation is likely to occur at the workplace through work-based learning. However, despite the apparent pervasiveness of work-based learning, its potential as an approach for developing individuals who lack formal education has not been fully explored.

In this thesis, the researcher presents a scenario in which individuals who lack formal education learned vocational skills in machining technology at the workplace and progressed from low-skilled to high-skilled jobs. The site of the study was a machine shop at a car engine factory. This study has four objectives: (1) to explore how workers learn vocational skills at work, (2) to explore how workers overcome the difficulties of learning vocational skills at work, (3) to explore the capability of workers who developed skills at work, and (4) to understand workers' values and expectations for their past, present, and future achievement.

This research took the form of a qualitative case study. Data were collected through in-depth interviews, factory observations, and documents. A total of 12 individuals were interviewed: 6 former rank-and-file workers who have advanced in their careers, 3 technical trainers, and 3 senior managers. The researcher also observed the factory's production and training facilities to obtain a better understanding of the jobs and learning opportunities available to

workers. In addition, the researcher obtained documents from the company pertaining to the planning and training of manpower.

The findings of this study demonstrate the strength of a work-based approach in training workers who lack formal education. The study shows that although skill is developed at the individual level, work practices and policies shape the form and amount of learning. There is a path for progression, or a “workplace curriculum,” that all workers follow, but the speed, depth, and breadth of skill formation depends heavily on workers’ engagement.

Access to on-the-job instruction from senior workers and superiors helped new workers develop the initial skills necessary to perform their work. Lateral moves to other stations within a production line and to other lines within the machine shop allowed workers to expand and refine their existing sets of operational skills. Engagement in product quality problem solving and machine maintenance tasks helped workers develop analytical and problem-solving skills, or higher-level skills, while deepening their interest in machining technology.

This study found evidence that the workers value several different forms of capabilities—capability for working, capability for learning and teaching others, and capability for problem solving—as these capabilities are important for the workers to work effectively in the factory. The workers also value the capabilities for work–life balance and for voice and participation, although the findings show that these capabilities are not always realized due to work-related factors.

In this study, all the workers earned promotions despite a lack of academic qualifications, and some of them even took on advanced roles, such as designing and installing new production lines. Despite making achievements within the company, some workers still searched for other career opportunities. However, without post-secondary qualifications, external mobility is difficult, as the workers’ knowledge and experience are not always endorsed outside of the company.

Several conclusions can be drawn from this study. The first is that skill acquisition at work, and through work, is a viable approach to providing skill training in machining technology for workers who lack formal education. The second is that there are many different strategies for learning at work. The difficulty of the subject matter was not off-putting; in fact, the workers found the subject matter interesting despite its difficulty. The third conclusion is that workers value many different forms of capabilities. However, the development of capabilities may be hindered without access to certain resources. Developing a higher capability for work requires access to advanced forms of

learning including learning through problem-solving and from errors, but company policies and practices must be supportive of these strategies. The fourth conclusion is that, from a career development point of view, although there is a pathway for low-skilled workers to progress at work, there is a limit to how far they can go without formal qualifications.

This study has implications to the provision of institutional-based pre-employment training in vocational trades, specifically in machining technology. Further, it has shown that an alternative approach through work-based learning can develop machining workers who lack formal education from low skill to high skill. Nevertheless, the skills achieved by these workers are only useful for career progression internally and are not recognized outside the company. Thus, several recommendations for practice in the forms of policy interventions are proposed. The first recommendation is the formulation of a policy for recognizing work-based learning as meeting the full or partial requirement for a vocational qualification. The second recommendation is providing financial support that may help workers gain qualifications related to their work. The third recommendation is providing career guidance and counselling for workers to increase their awareness of the options and opportunities in career and education that are available to them. These recommendations could help workers who lack formal education to further improve their potential and enjoy success in their careers and lives.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah.

PEMBELAJARAN BERASASKAN KERJA DAN PEMBANGUNAN KEUPAYAAN PEKERJA PEMESINAN DI SEBUAH SYARIKAT AUTOMOTIF

Oleh

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Fenomena individu memasuki pasaran pekerjaan tanpa kelayakan yang sesuai adalah perkara biasa di Malaysia. Ramai yang memilih untuk bekerja dan tidak menyambung pengajian setelah tamat persekolahan menengah. Di pasaran pekerjaan, individu ini dianggap berkemahiran rendah kerana tidak menerima latihan sebelum memulakan pekerjaan. Bagi mereka yang bekerja tanpa latihan formal, pembentukan kemahiran berkemungkinan besar berlaku di tempat kerja menerusi pembelajaran berasaskan kerja. Walaupun pembelajaran berasaskan kerja kelihatan diamalkan meluas, potensinya sebagai satu pendekatan untuk membangunkan individu yang kurang pendidikan formal belum diterokai sepenuhnya.

Dalam tesis ini, penyelidik mengkaji satu senario di mana individu mempelajari kemahiran vokasional di tempat kerja dan meningkat dari pekerjaan berkemahiran rendah ke pekerjaan berkemahiran tinggi. Lokasi kajian ialah sebuah bengkel pemesinan di sebuah kilang enjin kereta. Kajian ini mempunyai empat objektif: (1) Meneroka bagaimana pekerja belajar kemahiran vokasional di tempat kerja, (2) Meneroka bagaimana pekerja mengatasi kesukaran belajar di tempat kerja, (3) Meneroka keupayaan pekerja yang melalui proses pembentukan kemahiran di tempat kerja, dan (4) Memahami nilai dan harapan pekerja dalam pencapaian di masa lampau, masa kini dan masa akan datang.

Rekabentuk penyelidikan adalah kajian kes kualitatif. Data diperolehi melalui temubual mendalam, pemerhatian kilang, dan dokumen. Seramai 12 individu telah ditemubual: 6 orang bekas pekerja bawahan yang telah maju dalam kerjaya, 3 orang jurulatih teknik, dan 3 orang pengurus kanan. Penyelidik turut

membuat pemerhatian terhadap kemudahan operasi dan latihan di kilang untuk memahami dengan lebih baik tentang pekerjaan dan peluang pembelajaran pekerja. Disamping itu, penyelidik menganalisa dokumen syarikat yang berkaitan perancangan dan latihan tenaga kerja.

Dapatan kajian ini menyokong kekuatan pendekatan pembelajaran berasaskan kerja dalam memberi latihan kemahiran kepada pekerja yang kurang pendidikan formal. Kajian ini menunjukkan bahawa walaupun kemahiran terbentuk di peringkat individu, amalan dan dasar kerja mempengaruhi jenis dan kandungan pembelajaran. Terdapat laluan untuk kemajuan, atau kurikulum tempat kerja, yang dilalui oleh pekerja, namun kepantasan pembentukan kemahiran, kedalaman dan kelebaran kemahiran banyak bergantung kepada keterlibatan pekerja.

Akses kepada arahan kerja oleh pekerja kanan dan penyelia membantu pekerja baru membangunkan keupayaan asas untuk bekerja. Pergerakan lintang ke stesen yang lain dalam jalur pengeluaran yang sama, dan ke jalur pengeluaran lain dalam bengkel pemesinan yang sama membolehkan pekerja melebar dan menghalusi set kemahiran operasi yang mereka ada. Penglibatan dalam penyelesaian masalah tentang kualiti produk dan penyelenggaraan mesin membantu pekerja membangunkan kemahiran analitik dan penyelesaian masalah, ataupun kemahiran peringkat tinggi, dan dalam masa yang sama mendalamkan minat mereka dalam bidang pemesinan.

Kajian ini menemui bukti bahawa pekerja menghargai pelbagai bentuk keupayaan contohnya keupayaan untuk bekerja, keupayaan untuk belajar dan mengajar orang lain, dan keupayaan untuk menyelesaikan masalah kerana keupayaan-keupayaan ini adalah penting bagi membolehkan pekerja untuk bekerja dengan berkesan di kilang. Pekerja juga menghargai keupayaan memiliki keseimbangan kerja-kehidupan dan keupayaan untuk bersuara namun dapatan kajian menunjukkan keupayaan-keupayaan ini tidak selalunya dapat direalisasikan disebabkan faktor berkaitan kerja.

Dalam kajian ini, semua pekerja berjaya mendapat kenaikan pangkat walaupun kekurangan kelayakan akademik, dan ada di antaranya yang mengambil tugas lanjutan, contohnya mereka bentuk dan memasang jalur pengeluaran yang baru. Walaupun berjaya di syarikat, ada pekerja masih mencari peluang kerjaya di tempat lain. Namun, tanpa kelayakan pasca menengah, mereka mendapati bahawa pergerakan luar menjadi sukar kerana pengetahuan dan pengalaman mereka tidak selalunya diterima di luar syarikat.

Beberapa kesimpulan boleh dibuat dari kajian ini. Pertama, pembentukan kemahiran di tempat kerja, dan melalui pekerjaan, adalah pendekatan yang berpotensi dalam memberi latihan kemahiran dalam bidang teknologi

pemesinan kepada pekerja yang kurang kelayakan formal. Kedua, terdapat banyak strategi yang digunakan untuk belajar di tempat kerja. Kesukaran subjek yang dipelajari tidak mengecewakan pekerja, malah pekerja mendapatinya menarik walaupun ianya sukar. Ketiga, pekerja menghargai pelbagai bentuk keupayaan. Walaubagaimanapun, pembangunan keupayaan mungkin tersekat tanpa akses kepada sesetengah sumber. Pembangunan keupayaan tinggi perlu akses kepada pembelajaran tahap tinggi, contohnya melalui penyelesaian masalah, atau melalui kesilapan, tetapi dasar dan amalan syarikat perlulah menyokong strategi ini. Kesimpulan yang keempat ialah, dari sudut pembangunan kerjaya, walaupun terdapat laluan kerjaya untuk diikuti oleh pekerja berkemahiran rendah, namun terdapat batas terhadap kemajuan mereka tanpa kelayakan formal.

Kajian ini memberi implikasi terhadap pendekatan memberi latihan pra-pekerjaan di institusi dalam bidang vokasional khususnya dalam teknologi pemesinan. Hasil kajian ini menunjukkan bahawa pendekatan alternatif melalui pembelajaran di tempat kerja mampu melatih pekerja pemesinan yang kurang pendidikan formal dari kemahiran rendah kepada kemahiran tinggi. Walaubagaimanapun, kemahiran yang diperolehi oleh pekerja hanya bermanfaat untuk kemajuan kerjaya peringkat dalaman dan tidak diiktiraf di luar syarikat. Sehubungan itu, beberapa amalan untuk tujuan praktik dalam bentuk intervensi dasar adalah dicadangkan. Cadangan pertama ialah formulasi satu dasar bagi mengiktiraf pembelajaran di tempat kerja sebagai memenuhi sebahagian atau sepenuhnya syarat bagi keperluan kelayakan vokasional. Cadangan kedua ialah memberi sokongan kewangan yang boleh membantu pekerja memperolehi kelayakan yang berkaitan pekerjaan mereka. Cadangan yang ketiga ialah memberi panduan kerjaya dan kaunseling kepada pekerja supaya mereka sedar akan ruang dan peluang dalam kerjaya dan pendidikan yang boleh dimanfaatkan. Cadangan-cadangan ini berpotensi membantu pekerja yang kurang pendidikan formal untuk meningkatkan lagi potensi diri mereka untuk berjaya dalam kerjaya dan kehidupan.

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I certify that a Thesis Examination Committee has met on 30 August 2016 to conduct the final examination of Azmir bin Mohd Yunus on his thesis entitled "Work-Based Learning and Capability Development of Machining Workers in an Automotive Company" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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LIST OF ABBREVIATIONS

CA	Capability Approach
CAD	Computer-aided design
CAM	Computer-aided manufacturing
CNC	Computer numerical control
CVT	Continuing vocational training
DSD	Department of Skill Development
HRDF	Human Resource Development Fund
IKBN	<i>Institut Kemahiran Belia Negara</i>
IKM	<i>Institut Kemahiran Mara</i>
ILO	International Labour Organization
ILP	<i>Institut Latihan Perindustrian</i>
NDTS	National Dual Training System
OECD	Organisation for Economic Cooperation and Development
IVT	Initial vocational training
PSMB	<i>Pembangunan Sumber Manusia Berhad</i>
SKM	<i>Sijil Kemahiran Malaysia</i> (Malaysian Skill Certificate)
TVET	Technical and vocational education and training
UNESCO	United Nations Educational, Scientific and Cultural Organization

CHAPTER 1

INTRODUCTION

1.1 Introduction

This thesis explores work-based learning and methods for developing the capabilities of workers who lack formal education. The focus is on machining workers in an automotive manufacturing company. In Malaysia, about 28% of the workers in the labor force are employed in the manufacturing sector, making it the second biggest sector for employment after the service sector (Economic Planning Unit, 2012). Many workers in the manufacturing sector have no formal qualifications beyond secondary school. According to the Department of Statistics (2012), 80.8% of the workers in the manufacturing sector have secondary school qualifications or lower. This is higher than the percentage of individuals with these qualifications in all sectors: 75.5% (Department of Statistics, 2013).

Less-educated workers are usually employed in low-skilled occupations and are paid low wages. Starting a career in a low-skilled, low-paying job is acceptable if it is a “stepping stone” to a better job (Campbell, 2012). However, making career progress requires workers to develop capabilities that allow them to function in increasingly complex occupational roles. How much of this can be accomplished by workers with a low level of education needs to be studied.

Developing workers’ capabilities is possible by learning at work and through work. The workplace has the potential to be a “school” for less-educated workers, not just a place to earn a living. Perhaps it is the most sensible place for these workers to acquire knowledge and skills since most of them don’t participate in formal lifelong learning. The reason for this, according to Illeris (2006), is that most of them did poorly in school, so they are reluctant to pursue further education for fear of reliving bad experiences.

In Malaysia, there is no strong policy or initiative to educate workers who are already employed in the labor market. A priority of the nation is to educate youth (Merriam & Mohamad, 2000), causing Malaysian adult learners to be somewhat neglected (Tan, 2005). Resources, guidance, and support are often not available to encourage workers to engage in lifelong learning. While this scenario may be tolerated by better-educated workers, less-educated workers lack the resources to pursue further education and training on their own. They are likely to need all the help they can get in order to develop their capabilities to advance in their careers and lives.

Providing individuals with the right skills and qualifications for the labor market is supposed to be the role of the technical and vocational education and training (TVET) sector. However, the Malaysian TVET sector seems to be occupied with pre-employment education and training for youth, thus neglecting the needs of workers who are already employed with no relevant qualifications. It is ironic that while policy makers intend to increase the percentage of highly skilled workers, there are not many policy tools to encourage existing low-skilled workers to become more skilled.

In this thesis, the researcher studied the development of skills among individuals who began their career as low-skilled operators at the machine shop of a car engine factory. Their highest academic qualification was *Sijil Pelajaran Malaysia* (SPM). When they first started, they knew nothing about their work. Over a period of time, they continuously learned through practice and improved their work capability. Now, in their mid- and late 30s, they have made career progress and hold higher-skilled positions, such as team leaders, executives, and supervisors. The development of skills needs to be studied to better understand how development is made possible, how skills and capabilities are initially formed and then further developed, how workers value the progress they make, and what kind of future they hope for.

This study provided an opportunity to explore an enterprise-based approach to skill formation for workers with low academic qualifications. It presents an alternative scenario to institution-based TVET, which many Malaysians are familiar with. This thesis hopes to encourage further discussion on policies and strategies to develop workers' skills at work and through work, especially for those who lack formal education.

1.2 Background of the study

Young workers with limited education are considered to be a vulnerable labor market group (De Lange, Gesthuizen, & Wolbers, 2014; Gesthuizen & Solga, 2014; Soboleva, 2012). Statistics indicated that they are at higher risk of unemployment. For example, in countries involved in the Organisation for Economic Cooperation and Development (OECD), the unemployment rate for workers with only a basic education was 10 percent, compared to 5 percent for those with upper secondary education and 4 percent for those with tertiary education (OECD, 2008).

In Malaysia, the overall unemployment rate is 3 percent, which is reasonably low (Department of Statistics, 2015). However, the youth unemployment rate is much higher, rising from 10 to 11 percent from 2010 to 2013 (World Bank, 2015). In addition, wage growth has been slow despite economic growth (Xavier & Ahmad, 2012). To make things worse, Malaysia has the most

uneven income distribution of any Southeast Asian country (Chongvilaivan, 2014). This implies that the wage gap between high-income and low-income workers is large. This scenario, coupled with the rising cost of living, burdens low-educated workers who are also earning low wages.

Further education and training can help workers escape from low-wage employment. However, for less-educated workers, obtaining access to further education and training may be difficult, and the only form of learning they have easy access to is work-based learning. In this thesis, the term “work-based learning” is defined as “learning that derives its purposes from the contexts of employment” (Evans & Guile, 2012, p. 114). For less-educated workers with little access to formal education, work-based learning is probably the only viable option for learning.

1.2.1 Enterprise-based approach to skill formation

P. Brown (1999) defines the term skill formation as “the development of the social capacity for learning, innovation and productivity” (p. 235). In Malaysia, skill formation at work is common, especially among people who are less educated. Because they did not have training prior to employment, less-educated workers have few skills when they first start working. Hence, much of the training and learning about their occupations must occur at the workplace. It should be noted that Brown’s definition implies that learning requires social competence, not just the ability to comprehend knowledge.

The form and amount of learning that less-educated workers have access to within the workplace may be different depending on the nature of their vocation. In some vocations, it is possible that less-qualified workers are learning a lot more than we think. Schindler, Weiss, and Hubert (2011) argue that the training gap between high-skilled and low-skilled workers is primarily due to job characteristics, especially the tasks performed and technology used, rather than workers’ characteristics. If we accept this argument, it is reasonable to suggest that manufacturing firms are likely to provide more training because they require workers to use advanced technology. This argument is supported by Xiao (2002), who studied both manufacturing and service firms. Xiao found that manufacturing firms provided more on-the-job training than service firms to ensure that workers could use new technology.

Ashton, Brown, and Lauder (2009) clarify that “the notion of skill typically applies to individuals and refers to expertise, experience, and attributes acquired by individuals and sometimes identified through qualification” (p. 324). The term skill formation integrates different ideas about how skills are learned by individuals. It is “a holistic concept that includes education, personal

development, formal vocational training, on-the-job learning and experiential learning” (Field, 1990, p. 3).

The initial stage of skill formation may take place at a TVET institution. This is referred to as institution-based skill formation. It may also take a hybrid approach, such as Germany’s dual-training system, in which the theoretical components of learning are taught at an institution and practical lessons are taught at the workplace. Finally, there is fully enterprise-based skill formation, where both theoretical and practical learning take place at work. This is what the researcher refers to as work-based learning in this thesis. Essentially, this thesis is focused on work-based learning as a means of skill formation. The machining workers who participated in this study started as low-skilled operators. As they gained more working experience, they acquired the skills necessary to perform high-skilled work in production lines. Thus, their situation provides an excellent opportunity to study an enterprise-based approach to skill formation.

Ashton, Brown, and Lauder (2009) suggest that a study on skill formation within a company should try to understand four things: (1) how skills are created within the company, (2) how skills are combined and used, (3) where skills are sourced, and (4) how skills are developed. They also explain that a study on enterprise-based skill formation is needed as most previous studies on skill formation have focused on states’ role in skill formation.

1.2.2 Training and career paths of machinists

In Malaysia, the formal way to be trained as a machinist is to enroll at skill training institutions such as *Institut Latihan Perindustrian* (ILP), *Institut Kemahiran Mara* (IKM), or *Institut Kemahiran Belia Negara* (IKBN). Most skill training centers in Malaysia are registered as “accredited centers” with the Department of Skill Development, Ministry of Human Resources. Accredited centers can offer programs that provide national skills certificates, known as *Sijil Kemahiran Malaysia* (SKM). Level 1, 2, and 3 SKMs are considered certificate-level qualifications, while level 4 and 5 SKMs are considered diploma-level and advanced diploma-level qualifications. Before 2013, the basic qualification for general machinists was a level 1 SKM. To progress, workers can take one of three other qualification paths: machining, mold making, or die making (Department of Skill Development, 2012). This is shown in Figure 1.1.

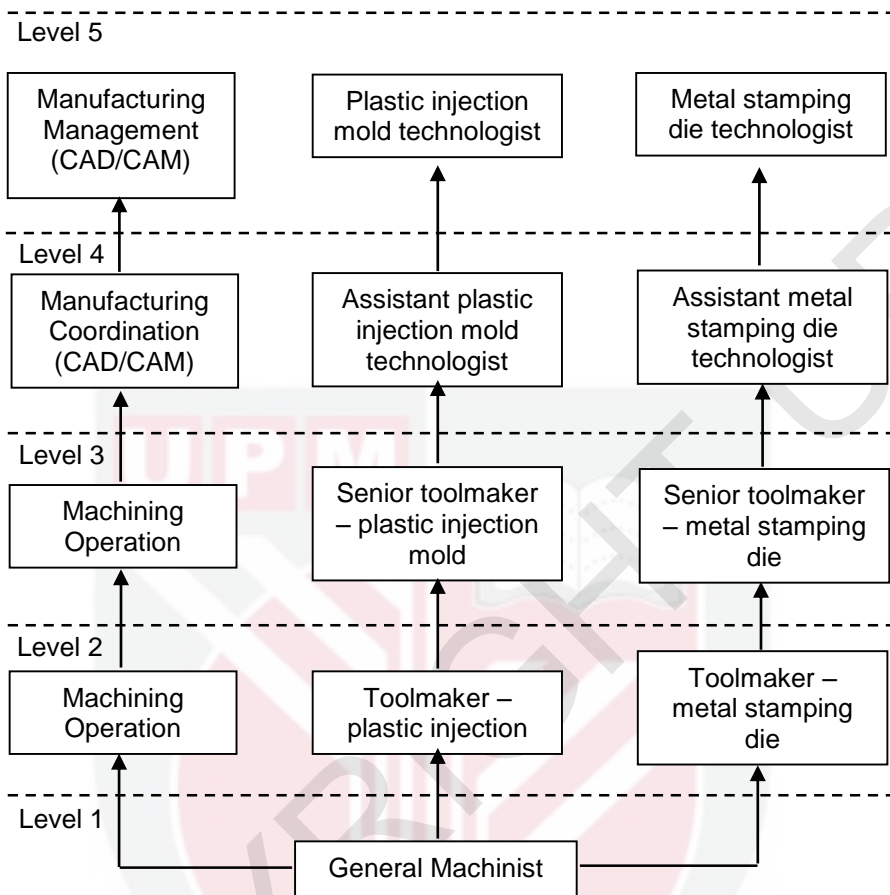


Figure 1.1: Certification paths for machinists prior to 2013

The machinist path requires further training in machining and computer-aided design and manufacturing (CAD/CAM). The mold maker path requires further training in the design and production of metal molds for plastic injection molding operations. The die maker path requires further training in design and production of metal stamping dies.

The paths for machinists are clearly defined in the National Occupational Skill Standard (NOSS). However, it is important to note that they are certification paths rather than career paths. The actual progression paths for machinists in the industry are not clearly understood. It is possible that the industry provides a more flexible career path that allows vertical and horizontal movement.

In 2013, some changes were made to the NOSS for machining. The main difference now is that the level-1 qualification no longer exists. The lowest machining qualification now starts at level 2. Nevertheless, the choices of qualification paths to go into machining/manufacturing, mold making or die making are still available.

In the US, machinists are paid better than most other factory workers. Table 1.1 compares the salaries for particular factory jobs based on data from the Bureau of Labor Statistics, US Department of Labor (2012). Similar occupational pay data are not available in Malaysia. However, a salary survey conducted by the Malaysian Employer Federation, cited by the Malaysian Investment Development Authority (2012), shows that the best-paid non-executive positions are information technology (IT) supervisor, chargeman, secretary, production supervisor, and quality control supervisor. Machinists and other metalworkers are not on the list.

Table 1.1: Salaries for selected factory jobs in the US

Occupation	Median Pay (2010)
Millwrights	\$48,360
Industrial machinery mechanics	\$44,160
Machinists and tool and die makers	\$39,910
Metal and plastic machine workers	\$31,910
Painting and coating workers	\$31,170
Assemblers and fabricators	\$28,360

Technological innovations had a strong influence on machinists' careers, as described in a study by Hungwe (2012) on a group of machinists working in the machine shop of an American automotive manufacturing company. The machine shop had been running for 50 years. Hungwe observed that technological improvements changed the division of labor. During the first twenty years, machinists operated conventional machine tools. The introduction of numerical control (NC) and computer numerical control (CNC) technology in the 1960s and 1970s allowed management to divide workers into programmers and machine operators. In the 1990s, the company brought in CAD and CAM systems, resulting in further division of labor. The machine shop now has conventional machinists, CNC programmers, CAD/CAM programmers, and CNC machine operators.

Technological innovation, while important for improving the speed and precision of machining, has caused machinists to be devalued. By breaking down complex machining tasks into several subtasks, manufacturing companies reduced their dependency on skilled machinists, transferring the bulk of precision metal cutting work to CNC machines. However, although the

demand for highly skilled conventional machinists has diminished, the demand for qualified CNC machinists and programmers has increased (Coffman, 2003).

1.2.3 Current view on training and learning at work

The development of individuals' potential through work-based learning hasn't been given enough consideration. Perhaps this is because many look at workers' training from a human capital perspective. When a company trains workers, the aim is to ensure that the workers' performance meets the company's expectations. Many organizations follow the human capital approach, where individual workers are considered "human capital" that can be trained. Training is supposed to improve workers' skill and performance, thus making them more effective and productive. This is the view that Anderson (2009) refers to as "productivism," based on the work of Giddens (1994). According to Giddens,

Productivism is an ethos where work has a very distinctive and central role – work expresses the primacy of 'industry', in the active sense of that word, in the life of modern society. (p. 175)

There are two examples of how productivism influences national policy on worker training. The first example is funding for training. Under the Human Resource Development Act of 1992, companies are obliged to make contributions to a national training fund known as the Human Resource Development Fund (HRDF). The fund is managed by the *Pembangunan Sumber Manusia Berhad* (PSMB), a statutory body within the Ministry of Human Resources. Companies utilize the training fund by sending employees to PSMB-approved training programs. Although the aim of this levy system is to upgrade the skills of workers, workers have little say in the type of training they receive or whether they get training at all. Training decisions are made by employers, and thus the outcome suits the needs of the employers more than the needs of the workers.

The second example is the role of TVET institutions to produce skilled workers. The aim of TVET, as described by the Economic Planning Unit (2010), is "to provide skills that will be immediately applicable in the labour market" (p. 216). This means that TVET institutions are seen not only as providers of education and training but also, more importantly, as producers of human capital for the immediate needs of the industry. When TVET is seen as a supplier of industrial human capital, naturally the industry is seen as the "customer" whose needs must be fulfilled. But fulfilling the needs of an industry is sometimes detrimental to the workers. For example, manufacturing industries that are labor-intensive utilize less technology and are less likely to provide workers with advanced training. Producing human capital for this type of industry is not going to raise the overall skill level of Malaysian workers.

When policymakers consider the *raison d'être* of TVET to be supporting the growth of industry, the voice of vocational learners is often neglected. In Australia, for example, the voices of business and industry have dominated TVET policy discourse (Angus, 2006; Figgis et al., 2007). The situation is similar here in Malaysia. In Australia, there is growing concern for vocational learners, particularly those who are considered to be disadvantaged within the system (Angus, Golding, Foley, & Lavender, 2013). In Malaysia, however, such concerns seem to be absent from TVET policy discussions.

Despite its drawbacks, the human capital approach is understandable in private enterprises in which the management views training as an investment. The investment is expected to bring positive impacts such as increases in productivity, efficiency, and growth. This seems like a fair perspective, but this productivist way of thinking is problematic for government policymakers who are responsible for developing national policy on training for industry workers. When policymakers consider the primary purpose of training to be to serve the needs of employers, there is a risk that workers' needs will be suppressed. To avoid this, a different way of thinking is needed. This is when the Capability Approach can be useful.

1.2.4 Capability Approach in worker training

Besides productivism and the human capital perspective, it is also possible to view training from the perspective of capability development for individual workers. From this perspective, skill training at the workplace can be seen as a way to develop the initial capabilities required for work and to continuously expand workers' capabilities throughout their working lives.

Expansion of capabilities occurs through the acquisition of new knowledge and skills that are relevant to workers' occupations. This perspective is based on the Capability Approach, which was developed by economist Amartya Sen (1980, 1985). The approach was intended for economics but was later expanded to other fields, including human development, social policy, and education. The idea of using the capability approach as an underlying philosophy for TVET has received much support (e.g., Powell, 2013; McGrath, 2012; Harreveld & Singh, 2008). However, there are not many studies that investigate the application of the Capability Approach in educational institutions or at the workplace in the Malaysian context.

The following piece by Ingrid Robeyns provides a fairly comprehensive description of the Capability Approach and how it is utilized in various fields:

The Capability Approach is a broad normative framework for the evaluation and assessment of individual well-being and social arrangements, the design of policies, and proposals about social change in society. It is used in a wide range of fields, most prominently in development studies, welfare economics, social policy and political philosophy. It can be used to evaluate several aspects of people's well-being, such as inequality, poverty, the well-being of an individual or the average well-being of the members of a group. It can also be used as an alternative evaluative tool for social cost-benefit analysis, or as a framework within which to design and evaluate policies, ranging from welfare state design in affluent societies, to development policies by governments and non-governmental organizations in developing countries. (Robeyns, 2005, p. 94)

The core idea of the Capability Approach is freedom, particularly one's freedom to live a life one has reason to value. There are three important concepts in the Capability Approach: capability, functioning, and agency. Capability is one's potential capacity, functioning is the actual or the realized capacity, and agency is one's personal freedom to decide whether or not to use a particular capability.

Examples of capability, functioning, and agency can be seen in soccer. A soccer player needs to train for a long time in order to develop the capability to play as a striker. After years of training, the player can eventually claim that he has the capability to play as a striker, but he functions as a striker only when he actually plays in this position during games. One's agency to play one's favorite position is limited because the decision lies with the manager of the team. If the manager decides to bench the player or play him in other positions, then the player's capability as a striker may not be realized.

In the workplace, there are elements that may hinder the acquisition of capability and the exercise of personal agency, such as gender, social status, academic background, hiring policy, training policy, and management practices. Improving the understanding of this situation requires an in-depth study on how capabilities are developed at the workplace. The investigation should explore the types of capabilities that workers value, the way these capabilities are developed at work, and the factors that may hinder them from exercising these capabilities.

1.3 Problem statement

The workplace is more than just a place to earn a living; it has the potential to be a “school” for people who lack access to continuing education. In Malaysia, these are individuals who have only completed secondary school. They joined the labor market without qualifications that were relevant to their careers, and they are at risk of remaining stuck in low-wage jobs.

Ideally, people who lack formal education should return to school and obtain some form of post-secondary academic or vocational qualifications. However, this may be difficult for them due to financial, institutional, and situational barriers (O'Mahony & Silitoe, 2001). Hence, work-based learning may be a more practical path towards initial skill formation and further skill advancement.

Currently, 64% of the Malaysian labor force has secondary education or lower (Department of Statistics, 2015). This implies that many young Malaysians enter the job market without any post-secondary education or training and must acquire vocational knowledge and skills at the workplace. However, despite the apparent pervasiveness of work-based learning, its potential as an approach for developing workers who lack formal education has not been fully investigated.

In Malaysia, institution-based TVET continues to be the dominant approach for delivering skills and qualifications. Indeed, public and private TVET institutions are important parts of the Malaysian TVET system (Md. Yunos, Wan Ahmad, Kaprawi, & Razally, 2006). Although the idea that work-based learning could be a full or partial replacement to institutional TVET is recognized (Illeris, 2003), the viability of work-based learning as an alternative to institution-based TVET has never been fully investigated. For example, it has not been determined whether the abilities of company-trained workers are comparable to those of workers trained at TVET institutions.

One issue regarding learning at work is that the main goal of such learning is often to meet the short-term needs of the employer (Schmidt, 1995). Workers are afforded learning opportunities so that they can contribute more productively at work (De Grip & Sauermann, 2012). While this may seem fair to the employer, it can limit an individual's true potential. To improve this situation, a different way of thinking about learning at work is needed, such as the Capability Approach.

At the time this study was carried out, there were no other studies utilizing the Capability Approach to explore work-based learning in the context of Malaysian workers. Studies on training for workers (whether vocational training, on-the-

job training, formal training, informal training, etc.) usually emphasize the perspective of management (see, e.g., Hooi, 2010; Goldsmiths & Mohd Zahari, 1994; Hamzah & Ho, 1994). While some studies have attempted to present workers' views on certain issues (see, e.g., Abdul-Aziz, Jaafar, Enshassi, & Mohamed-Salleh, 2008; Muhammad & Idris, 2005), the researcher has found no studies from Malaysia that discuss work-based learning from the capability perspective.

Thus, this study is an opportunity to concurrently explore two different concepts: work-based learning and capability development for workers who lack formal education. This exploration may provide a better understanding not only of how skills are formed and utilized but also of how workers progress in their careers despite lacking in formal qualifications. This study fills the gap in our knowledge of work-based learning as an alternative pathway for acquiring vocational skills. By exploring how skills are developed at the workplace among workers who never had formal training prior to employment, this study could offer insights into the processes and outcomes of learning at work and how they might be improved.

Moreover, this study is an opportunity to identify barriers to capability development at the workplace, particularly in the context of workers who lack formal education. This is important so that workers may learn and develop capabilities that can be useful throughout their working lives and are not just limited to achieving the short-term goals of the companies for which they work.

1.4 Aim of the study

The general aim of the study was to explore work-based learning and the development of capabilities at work for individuals who lack formal education. More specifically, this study aims to explore the skill formation of low-educated machining workers at a car engine factory. These workers began working at the factory with only SPM qualifications, but through work-based learning they managed to develop the capabilities they needed for work and successfully became high-skilled workers.

1.5 Objectives of the study

There are four research objectives of this study. Each objective helped the researcher accomplish the aim of the study. These objectives are:

1. To explore how workers learn vocational skills at work.
2. To explore how workers overcome the difficulties of learning at work.

3. To explore the capability of workers who went through the process of skill formation at the workplace.
4. To understand workers' values and expectations for their past, present, and future career achievement.

1.6 Research questions

The main research question of this study was: How did workers who had no prior education or training in their field of occupation develop skills and capabilities through work-based learning? From this question, four individual research questions (RQs) with sub-questions were derived:

- (RQ1). How did workers who began working with no initial training acquire the skills that they needed for work?
 - a. How did the workplace provide learning opportunities for workers?
 - b. How did workers utilize the opportunities available for learning?
- (RQ2). How did workers cope with the difficulties of learning at work?
 - a. How does work knowledge differ in terms of difficulty?
 - b. How did workers cope with the difficulties of learning?
- (RQ3). How do workers value the development of their own capabilities?
 - a. What forms of capabilities are important to the workers?
 - b. Why do workers make an effort to develop their own capabilities?
 - c. Who or what is credited by workers as having the most influence on their capability development?
- (RQ4). How do workers value their past, present, and future achievements?
 - a. What kind of achievements do workers value?
 - b. How may the workers' careers evolve in the future?
 - c. How much freedom do they have when making future career decisions?

1.7 Site, scope, and rationale of the study

This study explored the skill formation of machining workers who began working with no initial training in machining technology. They started working when they were teenagers with only SPM qualifications. Despite a lack of academic credentials, the workers managed to progress from low-skilled jobs to high-skilled jobs within the company at which they work. Their progress was helped by the process of learning at work and through work. This process helped them gradually develop the capabilities they needed to become skilled employees in a manufacturing environment.

1.7.1 Site

The site of this study was an automotive manufacturing facility located on the west coast of the Malaysian peninsula. The facility is owned by an automotive company that manufactures vehicles for the local market. It is comprised of an engine factory and a car assembly factory. This study only involved the machining section, hereafter referred to as the machine shop. The machine shop is located in the engine factory. Though it is referred to as an engine factory, it also produces transmission components. The flow of the production process is shown in Figure 1.2.

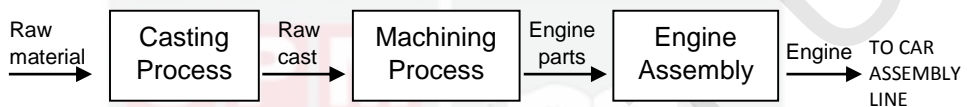


Figure 1.2: Flowchart for the production of car engines

The manufacturing process starts with the casting of engine components at the casting shop. Casting is a process in which molten metal is poured into molds to produce engine components of various shapes. The products from the casting shop are called raw casts. The raw casts are transferred to the machine shop, where they are machined into high-precision engine parts before being assembled. Each type of engine component is machined in a dedicated production line. There are 9 production lines at the machine shop: 2 lines for making cylinder blocks, 2 lines for making cylinder heads, 3 lines for making crankshafts, 1 line for making transmission/transaxle components, and 1 line for making knuckles. The engine parts produced by the machine shop are assembled at the engine assembly section. Completed engines are then transferred to the car assembly lines to be fitted into vehicles.

1.7.2 Scope

The scope of this study was confined to exploration of the process of learning vocational skills at the workplace among selected individuals who work at the machine shop of an automotive company. These individuals were purposely selected for this study because of their successful progression from low-skilled jobs to high-skilled jobs at the factory. All these workers joined the company with only SPM qualification and they had no prior education or experience in machining technology. The study explored the learning process and the kinds of capabilities developed as a result of the process of learning at work.

1.7.3 Rationale

One of the reasons to study machining is that it is an important process in the manufacturing industry. Many types of products are directly or indirectly linked to machining. For example, plastic products require steel molds, which are made by specialists with advanced machining skills, and sheet metal products are formed by stamping machines that use metal dies produced by machining. In fact, machining is “the most widely used machine-performed process in the manufacture of mechanical products” (Merchant, 1998, p. 158). Many machinists work in the manufacturing industry, especially in companies that produce large quantities of metal parts, such as those in the automotive industry (Kennedy, 2005).

Another reason for examining machining in this study is that machining requires a complex set of skills and conceptual knowledge that seem difficult to teach outside formal education settings. In essence, machining is a process in which machine tools are used to cut metal into precise shapes. Machine tools refer to various types of power-driven metal cutting machines, such as milling, lathe, and drilling machines (Moltrecht, 1981). The job of a machinist is to make metal parts according to specifications.

A conventional, or manual, machine tool requires a highly skilled machinist to operate it. The machinist must be able to read and interpret technical drawings, determine the appropriate machining processes and parameters, set up tools, select appropriate fixtures, manually operate the machine, and measure and inspect the dimensions and quality of the finished product using the appropriate gauges and equipment. To perform these tasks, machinists must have knowledge of machining symbols and drawings, physical measurements, dimensional tolerance and error, part geometry, surface roughness, and measurement of physical dimensions. How workers learn these skills with limited education through work-based learning processes has not been studied the literature.

1.8 Limitations of the study

This study was carried out within the scope of one particular occupation and at one particular site (i.e., machining workers at a car engine factory). Obviously, the findings of the study may not be generalizable to other occupations. However, the researcher hopes to obtain useful findings that can be further tested by replicating this study at multiple sites within the same group of occupations, or within the same industry, in the future.

1.9 Significance of the study

This thesis is relevant to TVET because it can potentially contribute to the discussion on vocational training policies for enhancing the capabilities of local industry workers, especially those who lack formal education. The findings of this study are useful at several levels. For practitioners in the field of TVET, the findings may improve the understanding of work-based learning, especially its contribution to improving individual workers' capabilities. At the company level, the findings may enable the management of the company to rethink and revise some aspects of the existing training system after considering workers' perspective on work, training, and capability development. At the national level, the findings may contribute to a discussion on training policies for workers. Currently, policy formulation seems to concentrate mostly on pre-employment TVET and secondary school graduates while neglecting the vocational training needs of existing workers who are employed in various industries throughout the country.

1.10 Operational definitions

There are several important terms that must be clearly defined in this study. These terms are explained here:

- **Capability**. The set of functions an individual can perform.
- **Capability Approach**. A framework for analyzing the well-being of individuals within a particular social context.
- **Vocational education**. Formal educational programs in secondary schools or post-secondary institutions leading to an accredited vocational qualification.
- **Vocational training**. Training to acquire the knowledge and skills necessary for a specific vocation.
- **Initial vocational training**. Vocational training prior to employment. Training may take place in secondary school, at post-secondary vocational institutions, or through apprenticeships.
- **Continuing vocational training**. Training measures or activities a worker participates in to acquire new skills or improve existing skills.
- **Work-based learning**. Learning that takes place at work through workers' involvement in work-related activities.
- **Institution-based vocational training**. Vocational training for individuals that takes place at a vocational institution.
- **Vocational institution**. A public institution in Malaysia with the main purpose of providing pre-employment VET to young adults.

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