The Impact of Learning on Low-Skilled Workers' Skill-Improvement

Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Arts in the Graduate School of The Ohio State University

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2009

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Abstract

Most low-skilled workers' opportunity has fewer to high-skilled worker. Research shows that learning activity through education and training is an appropriate alternative for low-skilled worker's skill-improvement which can improve their earning and quality of life. However, previous research related to a low-skilled worker's skill-improvement has many problems. Previous research reviews the meaning of a low-skilled worker and skill-improvement, and outlines which specific learning activities significantly influence low-skilled worker's skill-improvement. The previous research, however; does not systemically assess, the effectiveness of low-skilled worker's learning activity through education and training, without considering that other factors can simultaneously and independently influence their skill-improvement.

Considering these problems, the main purpose of this study is to explore (1) how a low-skilled worker's demographic factors significantly influence skill-improvement, and (2) how a low-skilled worker's learning activity significantly influence the skill-improvement?

Low-skilled worker's learning activity can be divided into two factors by the way of factor analysis; (1) informal learning by superiors, informal learning by co-workers and self-learning through work, and (2) formal OJT program, Task Force Team, Quality Circle, Knowledge Mileage System and Six-sigma. The former includes "informal

learning" activities by supervisors, coworkers, worker himself/herself, and the latter is "institutionalized learning" within the framework of organization.

The regression results show that a low-skilled worker's age and gender significantly influence skill-improvement, and clarifies that "informal learning" by co-workers, and worker himself/herself positively influences skill-improvement. Quality circle and six-sigma program positively influence as well. However, the finding shows that informal learning by supervisors negatively influence low-skilled worker's skill-improvement.

The implication presents that informal learning activity on a low-skilled worker's flat relationship and a worker's self direction through work can be effective to improve skill. It can be effective to be institutionalized learning activity with work-based continuity as well. However, the gender difference on skill-improvement should understand within the framework of society.

Dedication

Dedicated to my Father, mother, and younger brother whose caring I will forever remember

Acknowledgements

I would like to express my sincere appreciation to my advisor Dr. Joshua D. Hawley, who presented me the opportunity for academic research at the Ohio State University. When I was confronted with the difficulties in completing of my thesis, he caringly encouraged me, for which I will always remember.

Also, I would like to show appreciation for Dr. Ronald L. Jacobs, who provided me with many opportunities to participate in discussions. His concern gave me the motivation to fulfill my interest and direction.

Furthermore, I would like to all members of my academic program that gave me much inspiration to complete this thesis.

Finally, I would like to my younger brother who is studying at Georgia Institute of Technology. His encouragement has always given me as positive view of life and to confront new challenges optimistically.

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Fields of Study

Major Field: Education and Human Ecology

Area of Specialization - Workforce Development

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Chapter 1: Introduction

Most people engage in labor activity as a way for living, and receive wages as compensation for their labor. However, unrelated to the individuals' willingness, wages as remuneration on an individual activity are slightly decided by their intention. Rather, the wage generally tends to be decided by an intersection of supply and demand curve of workers in a labor market motivated by a mechanism of supply and demand. Assuming that employers tend to prefer to hire highly skilled workers to increase productivity in the organization, the level of a worker's skills can be an important factor regarding wages in the labor market. In the case of a low-skilled worker; their skill level is less preferred to high-skilled worker's level, and it can be probable that a low-skilled worker relatively earns a low wage or is easily excluded from regular labor market.

Recently, with the current global economic situation, the unemployment rate has increased, and a job-seekers' labor supply curve is likely to be elastic owing to a reduction of employment in the external labor market. In this case, most job-seekers should compete with each other to obtain a job position in the limited external labor market (Newman, 1999). Furthermore, most employers generally tend to present stricter employment criteria with high-level skills, considering a job-seekers' seeking intention (Jasinowski, 2001). Therefore, most low-skilled workers who do not satisfy a

employers' strict employment standards are easily excluded in the external labor market, and should upgrade their skills to reenter the external labor market.

With respect to the internal labor market, most of companies simultaneously pursue minimized input and maximized output for its survival in the general market where goods and services are exchanged. Assuming that there are workers with same wage in the internal labor market, employers will select more valuable workers. Even though employers should pay reasonable wages by level of skill, employers will select higher skilled workers for more efficiency.

Low-skilled workers are easily excluded in the external and internal labor market, but investment is necessary for low-skilled workers' skill-improvement. Investment in low-skill workers' skill-improvement can decrease the possibility of exposing to bad externality in the individual perspective. Furthermore, investment in low-skilled workers can be linked to an increase in low-skilled income, the firm's productivity improvement, and national economic growth (Schultz, 1961).

Regarding investment, many researchers insist that learning investment through education and training for low-skilled workers is effective in order to continuously improve their skills (Duleep & Dowhan, 2002; Powers & Seltzer 1998). Considering that there is little focus on how a learning program significantly influences low-skilled worker's skill-improvement, it is very important to explore how learning activity for a low-skilled worker significantly influences the skill-improvement. Therefore, the purpose of this study is to explore how a low-skilled worker's learning activity significantly influences in the skill-improvement, considering other factors.

Problem Statement

With scientific technology is developing, many workers have been required to be innovated. Many researches show that the "mass usage" of computers has been the main reason for the increasing need of high-skilled workers' demand by employers/industries (Krueger, 1993; Howell & Wieler, 1998). With such requirements of high-skilled workers, total social added-value has been increased by employing the workers, but a few problems have been accompanied as well.

First, the portion of low-skilled workers occupied in labor market has decreased. By substituting high-skilled workers for low-skilled workers in the labor market, the chance of low-skilled workers' seeking jobs has been decreased (Falkinger & Grossmann, 2001). In reality, empirical literature present that the gap between high- and low-skilled workers has increased across the industry (Berman et al., 1994; 1998; Machin et al., 1996; Machin & Reenen, 1998). With this social trend, low-skilled workers' unemployment has increased resulting in low social-preference by employers and industries (Falkinger & Grossmann, 2001). Furthermore, they can easily experience lower pay than higher skilled workers. (Hale, 2004).

In order to solve a low-skilled worker's problems with a high probability of low pay and underemployment, many researchers has presented that learning through education and training can be the most appropriate alternative to continuously include low-skilled workers in the labor market (Prince, 2008; Washington State Board for Community and Technical Colleges, 2005). Furthermore, it stressed, with continuous learning, earnings and quality of life can be improved by social learning requirements. Through empirical research, learning through education and training for low-skilled

workers is effective. In order to substantiate such assertions, proponents are likely to stress that learning participation is more effective on low-skilled workers (Duleep & Dowhan, 2002; Powers & Seltzer 1998).

However, there is a problem because there is or has been little focus on low-skilled worker's skill-improvement as precise meaning. Rather, the viewpoint has been that of learning activity for general workers, and some researchers present the connection between input and outcome in the workplace (Frazis & Loewenstein, 1999; Loewenstein & Spletzer, 1997; Kim, 2002).

Second, few include a clear definition of what a low-skilled worker is despite a common consensus about high-skilled workers. Maxwell (2006) delineates that low-skill includes the concept of "no more than a high school education and no more than one year of work experience", and Hale (2004) shows that low-skill is defined as "those not requiring formal training/education beyond high school" Thus, by presenting that low-skilled includes the concept of both scholastic and working experience, a low-skilled worker can be defined as a worker whose scholastic and working experience is absolutely insufficient. Adversely, Falkinger & Grossmann (1999) present that a low-skilled worker is understood by comparing with a higher skilled worker, with segmentation between low- and high-skilled workers in the labor market.

Third, previous research related to low-skilled workers focuses little on which learning program affects the output of learning. In the economic perspective, some researchers show that mere input of the learning components through education and training influence the output such as individual/corporate productivity (Frazis & Loewenstein, 1999; Loewenstein & Spletzer, 1997; Kim, 2002).

Finally, little has shown that other factors can influence the effectiveness of a low-skilled worker's learning participation, even though a low-skilled worker's irreversible factor is closely linked to the effectiveness. In order to precisely clarify effectiveness of a learning activity for a low-skilled worker, it can be more appropriate to measure the effectiveness considering other factors.

Precise definition of what a low-skilled worker is, and research for low-skilled worker's skill-improvement should not be based on general but for a low-skilled worker. Furthermore, it is necessary to research which learning activity is effective to improve a low-skilled worker's skill, considering that other irreversible factors are closely linked to effectiveness. Regarding research for low-skilled worker's skill-improvement is satisfied, the result of research can show which learning activity for a low-skilled worker is more effective to improve their skills, and then show the extent of skill-improvement resulting from the measured learning activity.

It is necessary that this research focuses on how a low-skilled worker's demographic factor significantly influence the skill-improvement and how low-skilled worker's learning activity with demographic factor significantly influence the skill-improvement. Considering that low-skilled workers are more affected by the workplace, the research should be based on the learning activity for a low-skilled worker employed in the workplace. Prior to such process, the concept of a low-skilled worker is necessary to understand by the reviewing literatures in the various perspectives. Overall, the purpose of this study is to clarify:

1. How a low-skilled worker's demographic factor significantly influence in the skill-improvement?

2. How low-skilled worker's learning activity significantly influence the skill-improvement?

Chapter 2: Literature Review

In order to understand the impact of a low-skilled worker's learning participation on his/her skill-improvement, it is necessary to understand the concept and characteristics of a low-skilled worker before everything. On the understanding of how a low-skilled worker is conceptualized with his/her characteristics, the following process explores how the previous research presents the impact of low-skilled worker's learning participation on his/her skill-improvement, and what the intervention factor(s) of low-skilled worker's learning participation on his/her skill-improvement is. Through this process, the literature review can present the necessity of why it is important to examine the specific relationship between low-skilled worker's learning participation and his/her skill-improvement.

With such fundamental understanding of low-skilled worker's research, the following stage is necessary to simultaneously consider all of educational and economic perspectives, because the two are typical of each different perspective about worker's learning participation. Generally, an educational perspective is based on the belief that a person participates in learning activities to change their life (Merriam, Cafarella, & Baumgartner, 2007). Along with such beliefs about the infinite possibility of learning for a person, their life can be improved by continuous learning activity with the change of their cognitive and psychological aspect. Especially, each of behavior and social

cognitive/learning perspective is an important theoretical foundation in that the two perspectives are closely linked to workers' learning participation on his/her skill-improvement in the workplace. Therefore, the literature review explores how each of behavior and social cognitive/learning perspective can be connected to the purpose of this study.

Along with the educational perspective that emphasizes such possibilities of learning participation, Human Capital Theory (HCT) is typical of analyzing worker's learning participation and the effectiveness in an economic perspective. Regarding economic connection within the input-output mechanism, human capital theory is based on the belief that economic value can be produced by a worker's skill and knowledge gained through education and experience (Becker, 1964). Compared to an educational perspective on behaviorism and social cognitive/learning theory, human capital theory focuses more on economic aspects of effectiveness through learning participation.

Consequently, this review focuses on how low-skilled worker's learning participation influence his/her skill-improvement considering demographic factor(s). Specifically, it presents low-skilled worker's concept, characteristics, learning participation, and intervention factor(s) to clarify relationship between low-skilled worker's learning participation and his/her skill-improvement as well. Next, the following explores Human Resource Development (HRD) perspective and Human Capital Theory (HCT) perspective to clarify that worker's learning participation influences in his/her skill-improvement as integration of both educational and economic perspectives.

Low-Skill Worker's Learning Participation and Skill-Improvement

Low-skill worker's learning participation

Concept of low-skill worker. The concept of low-skilled worker is likely to depend upon the purpose of research linked to either economic or educational perspective. The economic perspective assumes that the concept of low-skilled worker should be perceived by comparison between low- and high-skilled workers resulted from segmentation in the labor market (Falkinger & Grossmann, 1999). On such assumptions, Crandall et al. (1973) conceptualizes low-skilled workers as retaining lower human capital compared to high-skilled workers, with segmentation between low- and high-skill workers in the labor market.

The educational perspective is likely to understand the concept of a low-skilled worker with his/her own characteristic. According to Hale (2004), low-skilled workers can be defined as "those not requiring formal training/education beyond high school". Considering HRD concept that emphasizes performance improvement through learning, low-skilled worker concept is closely linked to workers who results in low-performance and learning level on account of little participating in postsecondary education. Therefore, by integration of both educational and economic perspectives, low-skilled workers can be conceptualized as individual who retains low-performance and low Human Capital (HC) level by experiencing difficulty in learning participation in his/her organization owing to little participate in postsecondary education.

Characteristics of low-skilled worker. Along with low-skilled worker's characteristic that they are closely linked to low-educational levels, the demand of low-skilled workers is "inelastic", but the supply is "backward bending" in the labor market

(Crandall et al., 1973). Based on such labor-demand and supply, low-skilled workers' wage hardly increases and their permanent wage tends to become steady. As empirical evidences about such logic, many research shows that low-skilled workers are likely to receive low-paying/wages compared to high-skilled workers (Connolly & Gottschalk, 2000; Hale, 2004; Heckman, Lochner, & Taber, 1998). Compared to high-skilled workers, low-skilled workers are likely to become worse-off from permanent employment in occupational labor market as well (Grip & Wolbers, 2005). Moreover, Hale (2004) shows that low-skilled workers possess "weak self-efficacy", and "external locus of control" compared to high-skilled workers in the educational perspective. With respect to information acceptance, Booth et al. (1996) present that these tend to be less flexible to accept new technology compared to highly skilled workers. Therefore, low-skilled workers comparatively receive low-paying/wages, experience unstable employment condition, and express dependent mentality with less flexibility to learn new skills.

Learning for low-skilled workers. Many researchers agree that low-skilled worker's learning participation improves his/her productivity through their skill-improvement with presenting various empirical researches (Kahn & Lim, 1998). However, considering the fact that low-skilled workers tend to be less flexible to accept new technology and be easily affected by institutional features, low-skilled worker's learning participation should be performed within the framework of organization (Booth & Snower, 1996; Maxwell, 2006). Furthermore, from the viewpoint of the HRD perspective that individual development is based on personal growth and development by formal and informal learning activity, it is acceptable that a learning program for low-skilled workers should be performed as form of formal and informal learning within

organization (Gilley & Maycunich, 2000). It is likely that organization explicitly or implicitly performs formal and informal learning program such as informal learning by superiors, informal learning by co-workers, self-learning through work, formal On-the-Job (OJT) Program, Task Force Team (TFT), Quality Circle (QC), knowledge mileage system, and six-sigma.

Intervention. Such learning participation for low-skilled workers are provided within the framework of the organization and positively influences skill-improvement, but other factors can interfere with low-skilled worker's skill-improvement in their learning. According to Beach (2009), the effectiveness of learning through education and training can be negatively affected by either irreversible characteristic unrelated to a learner's willingness or factors with difficulty out of the learner's control. Many empirical research states that such factors negatively influence low-skilled worker's skill-improvement, and it is believed that their gender, age, and educational level can largely distort low-skilled worker's learning effectiveness.

Through low-paying/wage worker's research, Carrington & Falick (2001) presents that low-paying/wage worker's acquired behavior is largely affected by factors such as gender, race, age and educational level. Considering that most low-skilled workers are likely to receive low-paying/wage compared to high-skilled worker, such factors largely influence low-skilled worker's behavior as well (Connolly & Gottschalk, 2000; Hale, 2004; Heckman, Lochner, & Taber, 1998).

With respect to gender and educational level, Becker (1975) historically states that women have less accumulated HC. By explicit and implicit discrimination that women have experienced in the society, women have gained little educational

opportunity and therefore have accumulated HC of a high level in the workplace. Considering such insistences that gender and educational level is closely linked to individual HC, it is acceptable that gender and educational level influence low-skilled worker's learning participation and skill-improvement in the workplace. Furthermore, because educational level can independently influence individual HC, educational level itself can influence low-skilled worker's learning activity and skill-improvement without intervention of other factors (Garavan et al., 2001; Youndt et al., 2004).

Age can be an important factor related to low-skilled worker's skill-improvement as well. Old workers generally tend to consider that stability and sustainability of employment is important to be involved in their job, and express a positive standpoint to acquire new technology on such judgment (Farber, 2005). With such positivity related skill acceptance, an old worker can easily accept new skills because they have much experienced in their life (Merriam, Cafarella, & Baumgartner, 2007). Therefore, old worker independently increase their skill by his/her individual experience without any organizational support. Broadening this thought to low-skilled worker's aspects, old and low-skilled workers can be closely linked independent improvement of his/her skills.

Consequently, through many empirical literatures, it can be understood that various factors largely influence low-skilled worker's skill-improvement. Especially, low-skilled worker's irreversible and difficult to reverse factors can influence their skill-improvement by either independent or dependent mechanisms. Therefore, considering these two facts that either low-skilled worker's learning participation or other factors influences their skill-improvement, it is important to understand how low-skilled worker's learning participation influences their skill-improvement and which factors

influence a low-skilled worker's skill-improvement in independent or dependent mechanisms.

Educational Perspective on Human Resource Development

Learning is defined as "a process that brings together cognitive, emotional and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and worldviews" (Ormord, 1995, as cited in Merriam, Cafarella, & Baumgartner, 2007). This definition emphasizes continuous process of learning, and learning theory is categorized into two types: mechanistic and organistic perspective (Knowles, 1984). Behaviorism is representative of the former, and social cognitive/learning theory is that of the latter.

Behavioristic Perspective

It is likely that behavioristic perspective basically includes a few assumptions. According to Ormond (1999), the constructive factor of learning is primarily a series of stimulus and response process involved in a behavior change, which mainly results from environmental events. Similar to this assumption, Grippin & Peters (1984) delineates that learning is accompanied with behavior change, and the behavior is affected by the environment. Receiving these assumptions, learner includes passive and dependent characteristic (Swanson & Holton, 2001). On such assumptions, most of behaviorists focus that a learner's behavior is changed by a lopsided relationship between learner and environment on stimulus and response.

In the behavioristic perspective, few learners can implement self-directed role about their activity, and most learners can prove their value by only exterior influence.

Along with a learner's passive and dependent characteristics, learning is considered as a part of the environmental event, and learning for a learner's change is delineated as a stimulus, and the learner's change is clarified as a response. Consequently, a learner's behavior change through learning is a primary concern of behaviorists.

With concern about learning and a learner's behavior change, behaviorism focuses on measurability among factors which construct learning mechanisms between environment and learner. The meaning of measurability includes that policymakers can perform educational intervention through measuring and quantifying a learner's activity and objective as reason of the activity (Merriam, Cafarella, & Baumgartner, 2007). Therefore, such measurability can be connected to HRD theory to increase a worker's performance in the workplace.

HRD is defined as "the process of improving organizational performance and learning through the accomplishments that result from employee development, organization development, and career development programs" (Jacobs, 2008). The core factor of HRD is worker's performance improvement and learning in the workplace where is accompanied with learning by either influence from environment or reciprocity between learner and environment. From former perspective-behavioristic perspectives, worker's learning activity is performed by the exterior.

Furthermore, HRD of behavioristic perspectives focuses on learning as "performance technology" to improve learner's performance (Jacobs, 1987). Learner's learning activity is an important mechanism for the purpose of their performance improvement. With such beliefs about relationships between learning activities and performance improvement, HRD theory requires the recognition of a learning process in

the systematic perspective, because the learning is based on a continuous process between learner and environment (Sleezer, Conti, Nolan, 2003).

Social Cognitive/Learning Perspective

Similar with behavioristic perspective, social cognitive/learning theory includes four assumptions; (1) Individual can learn through observing activities of others. (2) Learning can generate without any change of activity. (3) Learning involves the result of behavior. (4) Cognition is an essential factor for learning (Ormond, 1999, as cited in Merriam, Cafarella, & Baumgartner, 2007). Including behavioristic and cognitive perspective, such assumptions emphasizes the importance of learning in social perspectives (Lefrancois, 1999).

It is likely that learning of the social perspective emphasizes a learner's self-directed characteristic when a learner participates in learning process. As self-directed learners can obtain skills, knowledge, rules, and strategy by process of observing others, they internalize its usefulness and appropriateness after obtaining the immaterial outcome (Schunk, 1996). This theory is likely to weigh on the learner's identity in that learner's value is obtained by their positive internalization as well as exterior stimulus. Regarding a learner's identity, learners can recognize matters and events through relationship between learner and environment, and such relationships are based on reciprocity between the two (Merriam, Cafarella, & Baumgartner, 2007). Overall, social cognitive/learning perspective emphasizes the importance of learning through social relationships with others, and each factor within the social relationship is independently and mutually connected (Phares, 1980, as cited in Merriam, Cafarella, & Baumgartner, 2007).

With respect to HRD, social cognitive/learning theory largely influences a worker's learning in the workplace. This perspective focuses on learner's learning activity not only by formal and informal learning in the conventional classroom, but also by OJT in the "on-site" workplace (Gibson, 2004). Learning is likely to be generated by both of formal and informal relationships between leaner and instructor/colleague in the classroom and OJT process. Through such relationships, the learner can obtain skills and knowledge to continuously perform their working activity, and implicitly internalize organizational culture. This is a series of formal and informal learning process through social relationships, and condition for learner's socialization (Holton, 1996; Holton & Russell, 1999). Consequently, different from behavioristic perspective, social cognitive/learning theory emphasizes learner's possibility of development through social relationship on learner's positive aspect.

Development by Learning on HRD

Development means a "systematic change" with stability and changeability which might be discrepant (Merriam, Cafarella, & Baumgartner, 2007). With respect to changeability, development is an individual psychological and cognitive movement by hereditary or acquired factors; and with respect to stability, it means that sustainability of an individual activity is influenced. In the HRD perspective, such development can be connected to employee/individual, organization, career development. Among these development concepts, a worker's skill-improvement in the workplace can be closely linked to individual development owing to primarily focusing on their skill.

Individual development focuses on personal growth and development by formal and informal activity, and personal development means improvement of individual skill,

knowledge, and competency (Gilley & Maycunich, 2000). Learning activity can be one important element including formal and informal activity. Through various methods, a worker is likely to study job-related skills and knowledge which can be necessary to perform their work in the workplace. The skill and knowledge can be directly acquired by him/herself or other individuals such as colleagues, supervisors, and other job-related people. Different from the direct method, skill and knowledge can be indirectly learned by participation in certain teams and systems. Furthermore, such direct and indirect learning can be implemented under formal or informal learning environment. By the empirical facts that learning activity can be accomplished under various conditions, it is acceptable that a worker's learning activity and skill-improvement should be considered within the framework of development when considering its systemic approach (Merriam, Cafarella, & Baumgartner, 2007). The belief that a worker's skill and knowledge are acquired by learning activity should be preferentially applied to the task and job in their workplace, and can give us with the importance of relationship between learning and skill-improvement (Brinkerhoff & Gill, 1994).

Consequently, in the educational perspective, worker's learning for skill-improvement can be directly and indirectly accomplished by combination of various formal and informal activities with himself/herself and job-related factors in the systemic approach, and the process based on either unilateral or reciprocal relation between learner and others.

Economic Perspective on Human Capital Theory

Before the monumental economic growth of the 1950's, most of economists had

believed that conventional investment on land, capital, and machinery can be directly linked to growth of firm productivity and national economy (Smith, 2006). Thereafter, many empirical research, different from such conventional beliefs, many economists could understand that a worker's income increases, and firm's productivity improvement, national economic growth largely resulted from investment of education and training (Denison, 1962; Schultz, 1961). The results of the investment in education and training were effective with respect to individual, and firm; some economists presented the new concept of human capital, and developed it into an important theory. Furthermore, with the concept and theory of HC, many economists attempted to empirically research the correlation between learning and production capacity in the economic perspective (Dale & Krueger, 1999; Leslie & Brinkman, 1998).

According to Schultz (1961), HC is an invisible formation of capital that humans obtain through continuous acquisition of processing skills and knowledge. Similar to this concept, other researchers delineates that HC is education, skill, ability, and knowledge to be internalized within the human mind (Garavan et al., 2001; Youndt et al., 2004). Overall, HC is an abstract value to be internalized as formation of capital within the human mind.

On the economic perspective of HC, learning participation is an important unit to measure which the extent of the individual internalizes their skills and knowledge. By acceptance of such beliefs, it can be reasonable that a high learning participation level of an individual can be closely connected to a higher human capital level of himself/herself. Spence (1973) presents that a worker's learning and participation level through education and training can generate a signal which employers believe that the worker has the

possibility of better performance. Furthermore, research show that workers with a higher level of learning participation can easily perform job-seeking activities compared to otherwise (Greider, Denise-Neinhaus, & Statham, 1992; Vinokur et al., 2000). Even though such results may be based on relative scarcity among learning-related workers, few can deny that the learning participation for themselves functions as a signal in the labor market. Considering this empirical research, learning participation through education and training can be an important factor to measure the extent of internalizing a worker's skill and knowledge.

Not only learning participation can decide the level of human capital, but human capital can be increased by learning participation. Namely, individual formless value can be increased by learning investment through education and training for him/her. With such beliefs that learning participation is an important factor to increase human capital, Becker (1992, 1993) shows that individual benefit of participating in learning activity through education and training can offset the cost of participation, and the gap between benefit and cost is widened with a lapse of time. Therefore, it can be a reasonable belief that learning investment through education and training for workers continuously improves his/her benefits as a powerful mechanism.

The subject of such learning investment can be a nation, a firm, and an individual, and either firm or individual can be in charge of learning investment (Mincer, 1974). In reality, learning can be spontaneously performed by worker himself/herself, and skills and knowledge experience can be accumulated without any outside help (Roussel et al., 2002). In respect of each individual and firm, individuals are likely to consciously invest in learning activity for various reasons such as wage increases and career development,

but firm tend to invest in learning activity with belief that it can meaningfully contribute to essential business in the organization (Becker, 1976; Lepak & Snell, 1999).

The learning investment through education and training performed by either individuals or firms primarily improve a worker's job-related skill and knowledge level in the individual perspective. Furthermore, the worker can obtain relatively predominant position compared to the internal labor market, because the worker's productivity is increased by the skill and knowledge improvement. By the scarcity that worker occupies a more predominant position owing to learning participation for himself/herself, the high-skill/knowledge worker can easily control his/her labor and working environment in the workplace, and receive relatively a high wage in the internal and external labor market (Edward, 1979).

In the perspective of firm, learning investment through education and training for a worker can positively influence the firm itself. The investment increases the firm's productivity, because well-learned workers can easily control their working conditions, and actively satisfy firm's requirement about technology level. The results that workers efficiently perform their task and job, the firm can more efficiently perform its business by method of input decreases and output increase. With such beneficial consequences, a firm can more positively receive new technology owing to improvement of workers' skill and knowledge (Bartel & Lichtenberg, 1989; Booth & Snower, 1996). Such positive acceptance of new technology endow a firm with opportunity that can occupy a more predominant position than a competitive firm and achieve sustainable development

Consequently, HCT is based on the belief that learning investment through education and training for worker positively influences a worker and a firm in each

individual and firm perspective. The worker's learning activity is a process to accept meaningful value by either worker himself/herself or firm (Mclagan, 1989). Eventually, by such added value, worker and firm can occupy a relative predominant position compared to the previous time which little experienced learning through education and training.

Integration of Perspectives and Application

Considering educational perspectives, learning for worker's skill improvement in the workplace tends to focus on "relationship" between learner and others except learner. The relationship can be based on either "one-way" direction between learner and instructor in conventional classroom or "two-way" reciprocity between learner and environment around learner. Along with these relationships; worker acquires skills and knowledge through either formal or informal learning activity, and then the worker's growth and development is accomplished by such internalization of skill and knowledge. Therefore, educational perspectives focuses on both learning as "purpose" and learning through the education and training as "means", with conviction that individual development can be drawn from learning.

The difference between educational perspectives and HC perspective is that HC tends to focus on learning as a "means". Learning investment through education and training is an important factor to improve HC, and it stresses the importance of learning activity to generate new added-value such as productivity. Even though the two perspectives for worker's skill-improvement include reciprocal discrepancy, each perspective include common characteristics that learning activity through education and

training for worker can be an important mechanism to improve their skills and knowledge.

It is by conviction that a worker's learning activity through education and training can eventually result in their skill- and knowledge-improvement; the assumption that learning for a low-skill worker improves their skill and knowledge can be accepted as well, because both educational and economic perspectives are based on the belief that a worker's skill- and knowledge-development can be accomplished through learning activity.

Conceptual Framework

A review of literature revealed an importance of learning activity by education and training of low-skilled workers for skills-improvement. Furthermore, the research presented low-skilled worker's learning participation influenced a lot skill-improvement, considering various demographic factors such as gender, age, and education level. It could be understood that a demographic factor(s) can independently influence a low-skilled worker's skill-improvement.

In the workplace, a low-skilled worker is more likely to participate in formal and informal activities: informal learning by superiors, informal learning by co-workers, self-learning through work, formal OJT Program, TFT, QC, knowledge mileage system, and six-sigma. Furthermore, low-skilled worker's skill-improvement can be affected by demographic factors: age, gender, and educational level.

Consequently, through literature review, the purpose of this study is clear as seen in Figure 1: (1) How low-skilled worker's demographic factors significantly influence the skill-improvement? (2) How low-skilled worker's learning activities significantly

influence a skill-improvement? On literature review, the concept of a low-skilled worker can be conceptualized as an individual who retains low-performance and HC level by experiencing difficulty of learning participation in a worker's organization with little participation in postsecondary education.

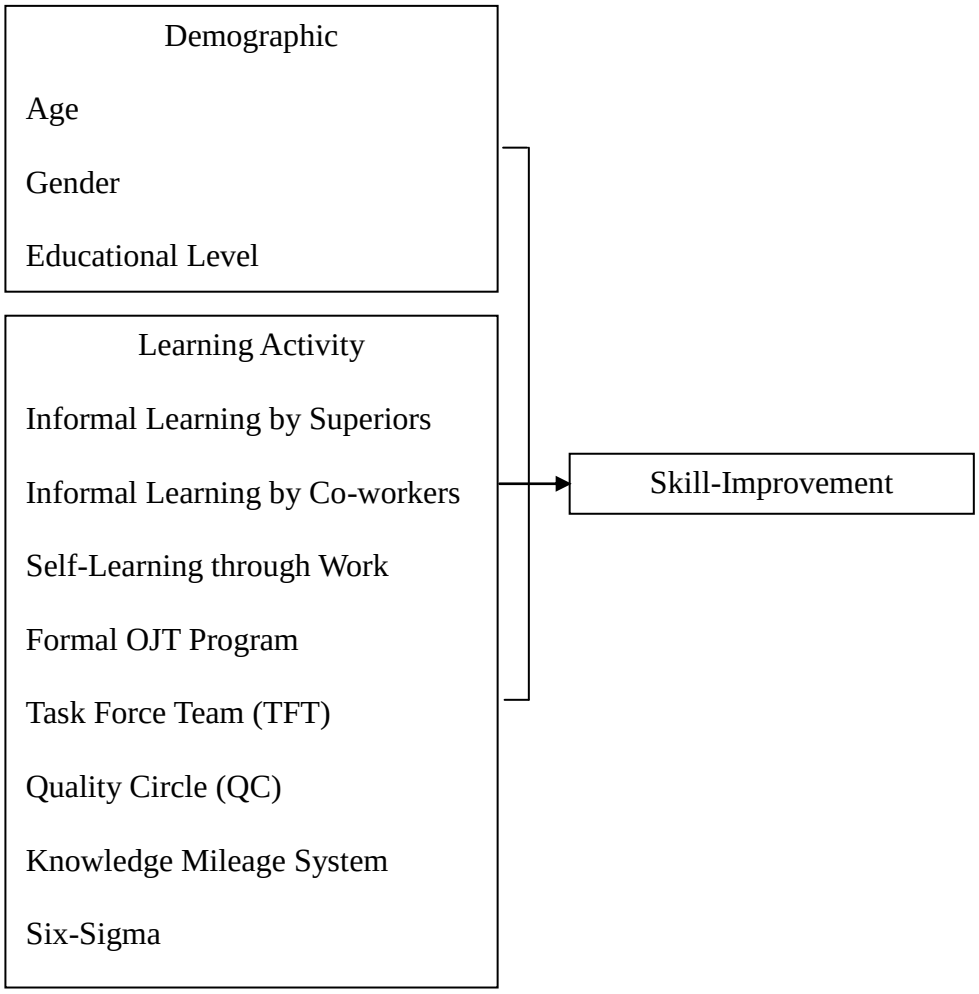

Figure 1. Research Design

Chapter 3: Methodology

The methodology section of this composition is categorized into four sections: research design, data collection, variables, and data analysis.

Research design

Research about how low-skilled worker's learning participation has influenced his/her skill-improvement has been independently performed by each educational or economic perspective. Simultaneously, the previous empirical studies present that low-skilled worker's skill-improvement can be performed with either learning-related or demographic factors such as age, gender, and educational level.

Most research has been based on slightly integrated perspective; the research design of this study is based on how low-skilled worker's learning activity influences a skill-improvement, with considering many demographic factors on integrated perspective.

Consequently, the fundamental purpose of this study is to explore how low-skilled worker's skill-improvement is influenced by a learning participation with primary demographic factor. Before clarifying the relationship between the low-skilled worker's learning activity with demographic factor and his/her skill-improvement, this research explores how low-skilled worker's demographic factors influence his/her skill-improvement. Through such process, this study can simultaneously clarify the "pure"

affect of demographic factors about low-skilled worker's skill-improvement, and the "integrated" affect of learning factors with demographic factors.

Data Collection

Data in this research is based on Human Capital Corporate Panel (HCCP) data, and 1,454 low-skilled workers that were selected, considering that each worker responses all questions related to dependent and independent variables. Furthermore, this research focuses on low-skilled workers employed in on-site manufacture industry to easily measure the extent of skill-improvement, because management positions employed in either finance or service industries are difficult to measure the extent of skill-improvement through learning activity. Considering that a worker's skill level can be changed by the movement of a job-related position without effect of any other factor, this research focuses on low-skilled workers without any movement of a job-related position after being employed by the company as well.

On the definition of terminology, the range of a low-skilled worker is based on both beginner and apprenticeship with middle school below, high school graduate, vocational high school graduate, and other technical high school graduate without any movement of a job-related position after being employed by a company.

In Table 1, the ratio between low-skilled male- and female- workers is 2.02:1 (Male = 973, Female = 481). Furthermore, most of low-skilled workers are distributed between their twenties and forties (Below 19 = 47, 20 – 29 = 482, 30 – 39 = 512, 40-49 = 331, 50 -59 = 73, Above 60 = 9). This distribution of age is closely linked to the fact that most of on-site workers are employed in manufacturing industry, and are likely to retire

before sixties. Finally, the educational level of low-skilled worker is “nearly equivalently” distributed except “below middle-school” (Below middle-school = 133, Graduation of high-school = 416, Graduation of vocational high-school = 412, Graduation other technical high-school = 493).

Section	Frequency	Ratio
Gender		
Male	973	33.1
Female	481	66.9
Age		
Below 19	47	3.2
20 – 29	482	33.1
30 – 39	512	35.2
40 – 49	331	22.8
50 – 59	73	5.0
Above 60	9	0.6
Educational Level		
Below middle-school	133	9.1
Graduation of high-school	416	28.6
Graduation of vocational high-school	412	28.3
Graduation of technical high-school	493	33.9

Table 1. Demographic distribution of low-skilled workers

Variables

Dependent variable

In the HCCP questionnaire, a dependent variable was originally constituted into each questionnaire by the skill level at the beginning of working for this company and current skill level, which is categorized into beginner, apprenticeship, and skilled worker 1, skilled worker 2, skilled worker 3, skilled worker 4, and skilled worker 5. The terminology from skilled worker 1 to skilled worker 4 is defined by the level of skill that each worker is obtained. Skilled worker 1 is a worker who has just one skill, worker 2 has more skills than worker 1, worker 3 has various skills, worker 4 is more skilled than worker 3, and worker 5 has various skills and has skill-related theory, knowledge, and overall judgment ability. The degree of worker's skill-improvement is defined by the difference between "the skill level at the beginning of working for this company" and "current skill level", and the range of low-skilled workers is based on both "beginner" and "apprenticeship" with an educational level below high school when the worker begin work for the company. Therefore, low-skilled worker's skill-improvement (SKILL) is based on difference between "the skill level at the beginning of working for this company" and "current skill level" of worker whose educational level is below high school and the skill level at beginning of working for the company as a beginner or apprenticeship.

Independent variable

Independent variable is largely divided into two sections: demographic and learning participation. In Table 2; the demographic factor is categorized into three variables of GENDER, AGE, and EDULEVEL, and the learning participation factor is

categorized into eight variables of SUPER, COWORK, SELFLEARN, OJT, TFT, QC, KNOW, and SIXSIGMA. All variables except AGE are applied to model as a form of dummy variable as well.

Variable	Definition
Dependent	
SKILL	Degree of workers' skill-improvement (continuous)
Independent	
Demographic	
GENDER	Respondent's gender (male = 1, female = 0)
AGE	Respondent's gender (continuous)
EDULEVEL	Respondent's educational level
EDU-1	(below middle-school = 1, otherwise = 0)
EDU-2	(graduation of high-school = 1, otherwise = 0)
EDU-3	(graduation of vocational high-school = 1, otherwise = 0)
Learning Activity	
SUPER	informal learning by superiors (participation =1, otherwise = 0)
COWORK	informal learning by co-workers (participation =1, otherwise = 0)
SELFLEARN	self-learning through work (participation =1, otherwise = 0)
OJT	formal OJT program (participation =1, otherwise = 0)
TFT	Task Force Team (TFT) (participation =1, otherwise = 0)
QC	Quality Circle (QC) (participation =1, otherwise = 0)
KNOW	knowledge mileage system (participation =1, otherwise = 0)
SIXSIGMA	Six-sigma (participation =1, otherwise = 0)

Table 2. Definition of variables

Note. EDU-4 is “Graduation of technical high-school”.

Data analysis

In Figure 1, the data analysis of this study is primarily performed by three ways. Factor analysis is applied to find a common factor of low-skilled workers’ learning activities, and reliability analysis is applied to clarify reliability of the questions. Next, Multiple Linear Regression Analysis (MLRA) with Ordinary Least Squares (OLS) is applied to explore how a low-skilled worker’s demographic variables influence the skill-improvement. Through the process, this study clarifies which variables significantly influence low-skilled worker’s skill-improvement with respect to demography.

After clarifying such influence, the following MLRA with OLS is applied to examine how a low-skilled worker’s learning activity with demographic variables influences the skill-improvement. Compared to the first analysis, this analysis presents which variables influence a low-skilled worker’s skill-improvement in the integrated perspective. Through the change of R^2, this analysis shows the influencing power among variables as well.

Chapter 4: Finding

This chapter is categorized into three sections. The first section reveals common factors of low-skilled workers' learning participation through factor analysis, and reliability of the questions through reliability analysis. Second, it presents which demographic variables influence low-skilled worker's skill-improvement. Third, it shows how learning activities with demographic variables influence low-skilled worker's skill-improvement. With final clarification, this analysis presents the influencing power among variables through the change of R^2 as well.

Validity and reliability

As can be seen in Table 3, each result of the factor and reliability analysis is presented with the Component, Eigen Value, and Cronbach's alpha. Factor analysis is performed by Principle Component Analysis with Varimax Rotation, and the standard of Factor Loading is based on .3.

Variable	Total	Component	
		1	2
SUPER		.845	.098
COWORK		.861	.117
SELFLEARN		.801	.143
OJT		.282	.642
TFT		.071	.710
QC		.274	.569
KNOW		-.076	.645
SIXSIGMA		.101	.650
Eigen value		2.903	1.491
R^2	54.921	36.282	18.639
Cronbach's alpha	.745	.811	.648

Table 3. Validity and reliability

The standard of Factor Loading above .3, the analysis shows that low-skilled worker's learning activity can be divided into two factors, one is SUPER, COWORK, SELFLEARN, and the other is TFT, QC, KNOW, and SIXSIGMA. The first component means that informal learning activity by supervisors, co-workers, and self-learning through work can be closely linked to the characteristics of informal learning by a worker himself/herself or others within the framework of an organization. However, the second component means formal OJT program, TFT, QC, knowledge mileage system, and Six-sigma can be closely linked to the characteristics of institutionalized learning within the framework of organization. Furthermore, the coefficient of Cronbach's alpha presents that

the reliability of the questions is acceptable (Cronbach's alpha: .745). Therefore, the analysis shows that each component can be categorized into informal learning activity and institutionalized learning within the framework of organization.

Effect of demographic factors on low-skilled worker's skill-improvement

In Table 4, the overall finding of this study is presented with coefficient of variables, t-statistics, and Tolerance and Variance Inflation Factor (VIF) as collinearity statistics.

	B	t	Tolerance	VIF
Constant	1.287	8.072		
AGE	.024**	5.931	.999	1.001
GENDER	.464**	5.000	.999	1.001
EDULEVEL				
EUD-1	-.049	-1.826	.901	1.110
EUD-2	-.032	-1.240	.998	1.002
EUD-3	.004	.128	.832	1.202

Table 4. Effect of demographic factor on low-skilled worker's skill-improvement

Note. Dependent variable: SKILL; EDU-1: below middle-school, EDU-2: graduation of high-school, EDU-3: graduation of vocational high-school, EDU-4: graduation of technical high-school; R^2 = .041, Adjusted R^2 = .039; Durbin-Watson Statistic = 1.548; *p < .05, **p < .01.

First, the result of MLRA with OSL shows that all independent variables explain only 3.9 % of the dependent variable (R^2 = .041, Adjusted R^2 = .039). Second, the most significant finding is AGE and GENDER. The coefficient of each AGE and GENDER is consistently positive and highly significant (P < .01). Therefore, this finding depicts that "old low-skilled male worker" can largely influence the skill-improvement, though there is little considering any other learning activity. With such findings that AGE and GENDER is consistently positive and highly significant, EDULEVEL is slightly significant.

In terms of collinearity, this finding shows that collinearity among independent variables is very little within this model owing to the stability of Tolerance and VIF (Tolerance < 1.000, VIF < 10.000, respectively). By presenting that collinearity exists very little, the finding presents that low-skilled worker's demographic factors independently influence his/her skill-improvement.

Significant Durbin-Watson statistics present that there is few problems with autocorrelation in the residuals (Durbin-Watson Statistic = 1.548). Therefore, the regression model is acceptable to explore the causality between dependent and independent variables.

The Effect of learning activities with demographic factors on low-skilled worker's skill-improvement

The next finding is based on how low-skilled worker's learning activity influence the skill-improvement with considering the demographic variables. In Table 5 with coefficient of variables, t-statistics, and Tolerance and VIF, the result of MLRA with OSL

shows that all independent variables explain only 14.6 % of the dependent variable (R^2 = .150, Adjusted R^2 = .146). Compared to Table 3, the explanatory power of model on SKILL is largely improved by the addition of learning activity variables. Therefore, the change of R^2 presents that the effect of low-skilled worker's learning activity on SKILL is larger than that of his/her demographic factors.

	B	t	Tolerance	VIF
Constant	.785	4.882		
AGE	.018**	4.726	.975	1.026
GENDER	.402**	4.567	.988	1.012
EDULEVEL				
EDU-1	-.037	-1.451	.898	1.114
EDU-2	-.025	-1.014	.994	1.006
EDU-3	-.007	-.251	.827	1.209
SUPER	-.389**	-3.375	.537	1.863
COWORK	.962**	7.983	.496	2.016
SELFLEARN	.385**	3.384	.601	1.663
OJT	-.008	-.277	.765	1.306
TFT	.009	.334	.869	1.151
QC	.316**	3.112	.863	1.159
KNOW	.015	.593	.891	1.123
SIXSIGMA	.303*	2.401	.904	1.107

Table 5. Effect of learning activity with demographic factor on low-skilled worker's skill-improvement

Note. Dependent variable: SKILL; EDU-1: below middle-school, EDU-2: graduation of

high-school, EDU-3: graduation of vocational high-school, EDU-4: graduation of technical high-school; R^2 = .150, Adjusted R^2 = .146; Durbin-Watson Statistic = 1.642; *p < .05, **p < .01.

Second, the coefficient of each AGE and GENDER is consistently positive and highly significant (P < .01), but absolute value of the coefficient is slightly smaller than that of the previous model (AGE: .024 → 018, GENDER: 464 → 402). Therefore, such change presents that the effect of a low-skilled worker's age and gender is decreased, considering other his/her learning activity factors. Similar to the result of previous model, this finding shows that older low-skilled male worker can largely influence the skill-improvement compared with considering any other learning activity.

Third, the coefficient of each COWORK, SEFLLEARN, QC, SIXSIGMA is consistently positive and highly significant (COWORK: P < .01, SELFLEARN: P < .01, QC: P < .01, and SIXSIGMA: P < .05, respectively). Compared to COWOAR, SELFLEARN, OC and SIXSIGMA, the coefficient of SUPER is consistently negative and highly significant (P < .01). Therefore, by the coefficient of each significant independent variable, this analysis shows that a low-skilled worker's participation of informal learning by supervisors negatively influences the skill-improvement, but that of informal learning by co-workers, self-learning through work, quality circle, and six-sigma positively influence the skill-improvement. However, EDULEVEL is slightly significant compared to the previous model, and OJT, TFT, and KNOW is shown little significance as well.

With respect to collinearity, this analysis presents that collinearity among independent variables slightly exists within this model owing to the stability of Tolerance and VIF (Tolerance < 1.000, VIF < 10.000, respectively). With presenting that collinearity very little exists, and the finding shows that each low-skilled worker's demographic variables and learning participation independently influence the skill-improvement.

Significant Durbin-Watson statistics present that there are few problems with autocorrelation in the residuals (Durbin-Watson Statistic = 1.642). Therefore, the regression model is acceptable to explore the causality between dependent and independent variables.

Overall, these findings present that a worker's age and gender independently or dependently influence the skill-improvement. However, considering the change of R^2 between the first and the second regression models, the influence of a low-skilled worker's age and gender is lower than that of low-skilled worker's learning activity. It shows that low-skilled worker's informal learning components positively influence the skill-improvement, but learning activity for a low-skilled worker on an organizational hierarchy can negatively influence the skill-improvement. Finally, it depicts that institutionalized learning for a low-skilled worker positively influences the skill-improvement when the learning activity is based on work-based continuity.

Chapter 5: Summary and Implication

Summary

By technology development in modern society, most of low-skilled workers are likely to be less employed in the labor market where high-skilled workers have many opportunities to be more employed by employers and industries. Such preferences are closely linked to the possibility that the opportunity of low-skilled workers' job-seeking can be continuously decreased. Furthermore, low-skilled worker's employment opportunity can be serious includes two meanings; low-skilled workers can be easily exposed by social bad externality such as crime, alcoholic and drug addiction, and the gap between low- and high-skilled workers.

For the purpose of solving this problem, much research presents that learning activity through education and training is the most appropriate alternative for low-skilled worker's skill-improvement which can improve their earning and life-quality. However, the previous researches related to a low-skilled worker's skill-improvement include many problems. A small amount of the previous research presents the meaning of a low-skilled worker and skill-improvement, and depicts which specific learning activities significantly influence low-skilled worker's skill-improvement. With such a problem, the previous researches hardly show the degree of effectiveness of low-skilled worker's learning activity through education and training, without considering that other factors can

simultaneously and independently influence their skill-improvement.

Therefore, when considering these problems, the main purpose of this study is to explore how low-skilled worker's learning activity significantly influences their skill-improvement. Prior to such analysis, the research was based on examining how low-skilled worker's demographic factor(s) significantly influence their skill-improvement. The research question is as follow: (1) How low-skilled worker's demographic factor(s) significantly influence his/her skill-improvement? (2) How low-skilled worker's learning activity(s) significantly influence his/her skill-improvement?

Such questions about relationships between low-skilled worker's learning activity and skill improvement, a low-skilled worker's learning activity can be divided into two components by way of factor analysis. The first component includes informal learning activity by supervisors, informal learning activity by co-workers, and self-learning through work. This can be closely linked to the characteristics of informal learning by a worker himself/herself or others within the framework of an organization. The second component includes formal OJT program, TFT, QC, knowledge mileage system, and Six-sigma, that can be closely linked to the characteristic of institutionalized learning within the framework of organization. Therefore, the analysis shows that each component can be categorized into informal learning activity and institutionalized learning within the framework of organization

Furthermore, the analysis on regression shows that a low-skilled worker's age and gender significantly influence skill-improvement. However, the influence of a low-skilled worker's age and gender is smaller than that of low-skilled worker's learning activity. It shows that low-skilled worker's informal learning components positively

influence the skill-improvement, but learning activity for low-skilled worker on organizational hierarchy can negatively influence the skill-improvement. Finally, it shows that institutionalized learning for low-skilled worker positively influence the skill-improvement when the learning activity is based on work-based continuity.

Implication

The question of how low-skilled worker's demographic and learning activity factor(s) significantly influence skill-improvement, the result of this research presents various meanings. First, low-skilled worker's age and gender significantly influence skill-improvement, considering their learning activity. This finding corresponds with the previous empirical research that older workers can rapidly improve their skill by easy acceptance of new technology. However, the fact that low-skilled male workers can rapidly improve their skill requires that the difference between male and female workers should understand within the framework of society.

With the significance of demographic factors for low-skilled worker's skill-improvement, the result of this study shows that effective learning activity for low-skilled workers is informal learning with a co-worker or self-learning through work. Therefore, for low-skilled worker's skill-improvement, it is necessary to establish an environment to directly self-learn through working activity and naturally learn with co-worker. Rather, learning activity for a low-skilled worker on organizational hierarchy can negatively influence the skill-improvement. Furthermore, the finding presents that institutionalized learning significantly influence low-skilled worker's skill-improvement, but the standard should be on learning activity with work-based continuity.

Overall, learning activity on a low-skilled worker's flat relationship and a worker's self direction through work can be effective to improve skill. The effectiveness of informal learning is effective, if learning activity is based on low-skilled worker's continuous working activity, and the learning activity can be effective to improve the skills. Therefore, for a low-skilled worker to improve, it is necessary for policymakers to consider informal learning on a flat relationship and self-learning through work with institutionalized support, and establish work-involved environment for low-skilled workers.

Finally, this study applied to data for not low-skilled workers but general workers. Therefore, post-research should consider the application of data for only low-skilled workers. Next, this study focuses on low-skilled workers' skill-improvement in manufacturing industry, because measuring each manufacturing worker's skill-improvement is easier than other industries such as financial and service business. Therefore, in order to generalize research, it is necessary to focus on low-skilled workers' skill-improvement in other industries such as financial and service business in the future. Third, gender and age issues for low-skilled worker's skill-improvement are very important, because the problems are deeply related to the framework of society. Therefore, post-research is necessary to explore the fundamental reasons of this situation. Fourth, this research can consider the possibility of omitted variables bias by the gap of time between the learning activity and skill-improvement, because the data is based on secondary data. Post-research is necessary to supplement such drawbacks for the purpose of a more precise result.

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Appendix A: HCCP questionnaire

QUESTIONNAIRE FOR "ON-SITE" WORKER EMPLOYED IN MANUFACTURE INDUSTRY

[Demographic Question]

1. When did you start to work in this company/workplace?
( ) Month, ( ) Year

2. This is a question about
(1) your position when you worked for this company /workplace and (2) your current position.
Check the appropriate position.

	Worker	Manager	Department Associate	Department Assistant	Department Manager	Director
(1)	1	2	3	4	5	6
(2)	1	2	3	4	5	6

3. When did you start to work for your current position? From ( ) Month, ( ) Year

4. Gender: ( ) Male, ( ) Female

5. Birthday: ( ) Month, ( ) Year

6. Education Level
( ) Below Middle-School
( ) Graduation of High-School
( ) Graduation of Vocational High-School
( ) Graduation of other Technical High-School except Vocational High-School
( ) Graduation of 2- or 3- year college
( ) Above Graduation of 4- year college

7. After working for this company/workplace how many different teams have you worked? ( )

[Education & Training Question]

This question is
(1) your participation and (2) its effectiveness about "On-site" HRD situation.
Check the appropriate position.

	participation		effectiveness for task-ability after "On-site" HRD program				
	Yes	No	Never	Little	Neutral	Fairly	Strongly
8. Informal Learning by Superiors	1	2	1	2	3	4	5
9. Informal Learning by Co-workers	1	2	1	2	3	4	5
10. Job Rotation	1	2	1	2	3	4	5
11. Self-Learning through Work	1	2	1	2	3	4	5
12.Mentoring or Coaching	1	2	1	2	3	4	5
13. Formal OJT Program	1	2	1	2	3	4	5
14. Task Force Team (TFT)	1	2	1	2	3	4	5
15. Quality Circle (OC)	1	2	1	2	3	4	5
16. Suggestion System	1	2	1	2	3	4	5
17. Knowledge Mileage System	1	2	1	2	3	4	5
18. 6-sigma	1	2	1	2	3	4	5

Note:
(1) If the "On-site" HRD program wasn't implemented in your workplace, check "No".
(2) The standard is based on when "On-site" HRD program was implemented in 2004.

This question is about
1) the skill level at the beginning of working for this company and 2) current skill level.

	Beginner	Apprentice ship	skilled worker 1	skilled worker 2	skilled worker 3	skilled worker 4	skilled worker 5
19. (1)	1	2	3	4	5	6	7
20. (2)	1	2	3	4	5	6	7

Note:
Skilled worker 1: Those who has just one skill
Skilled worker 2: Those who has more skilled level than skilled worker 1
Skilled worker 3: Those who has various skills
Skilled worker 4: Those who has more skilled level than skilled worker 3
Skilled worker 5: Those who has various skills and the skill-related theory, knowledge, and overall judgment ability